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Seasonal Readiness Guideline

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ABSTRACT

This report provides guidelines for the annual processes of seasonal readiness for fossil, gas and oil-fired power plants. These types of power plants differ significantly in their particular designs and operational details; however, they have many common themes, including the overall process to prepare for changing seasons. Seasonal readiness is a systematic, defined process that includes preparation, execution, restoration, and feedback mechanisms to ensure that lessons learned are captured to continually improve the overall process.

This report presents fundamentals concepts of winter and summer readiness, development of a seasonal readiness cycle for an operating fleet, development of technical content and activities for seasonal readiness, and several checklists and outlines that can be used in the winter and summer seasons.

Winter readiness activities are principally aimed at preventing problems caused by temperature fluctuations such as freezing and condensation formation. The principal activities for winterization are inspection and maintenance to ensure that heating provisions are functional and in the proper state of readiness.

Summer readiness involves preparing for elevated ambient temperatures and the prevalence of high levels of atmospheric moisture. Major activities for summer readiness involve cleaning heat exchanger surfaces to maximize heat transfer capability.

The scope of this report is limited to preparing generating plants for the annual changes of seasons. It does not cover standard maintenance or maintenance actions and preparations for severe acts of nature or natural disasters.

Keywords
Climate considerations
Seasonal readiness
Seasonal readiness procedures
Summer season
Winter season

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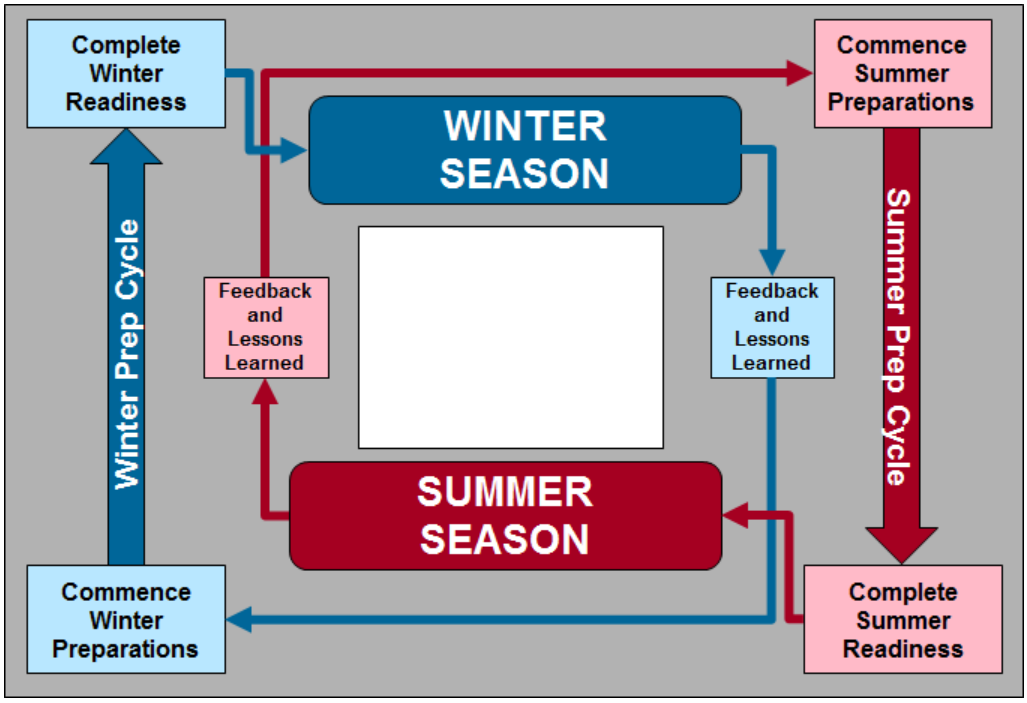
EXECUTIVE SUMMARY

This report provides a guideline to the annual processes of Seasonal Readiness for both the winter and summer seasons for fossil, gas and oil-fired power plants. These types of power plant differ significantly in their particular design and operational details, though there are many common themes that apply to both, including the overall systematic process to approach preparing for changing seasons.

Seasonal readiness is a systematic and defined process that is repeated on an annual cycle. This cycle includes preparations, execution, restoration and feedback mechanisms to ensure lessons learned are captured year after year to continue to improve the overall process. This overall cycle is shown below.



This report presents fundamentals concepts of winter and summer readiness, development of a seasonal readiness cycle for an operating fleet, development of technical content and activities for seasonal readiness as well as several checklists and outlines that may be utilized in the winter and summer seasons.

Winter Readiness activities are principally aimed at prevention of problems caused by temperature fluctuations such as freezing and condensation formation in systems and spaces where it can create problems. The principal activities then for winterization are inspection and maintenance to assure that heating provisions for spaces and equipment are functional and in the proper state of readiness. Even where designed and as-built measures are not provided, operating plants are well advised to maintain a number of portable heaters available for use.

A meteorological phenomenon that is experienced once or twice per decade is the breakout of a very cold polar air mass to more southerly latitudes than is typical. This phenomenon, which has been called the Polar Express or Polar Vortex, can introduce temperatures much lower than typical for the southern latitudes, with long duration (several days to one week). If this weather pattern is accompanied by high winds, freeze protection measures can be severely compromised. Recognition of the possibility of encountering this phenomenon has signaled the need to modify and add to plant winterization procedures, alter plant O&M culture in terms of awareness, and has also resulted in a number of retrofits of added protection in terms of protective heated housings for instruments, more complete insulation coverage, etc.

Summer Readiness involves preparation for elevated ambient temperatures and the prevalence of high levels of atmospheric moisture (depending on local climate). High humidity combined with elevated temperatures during the day can result in condensation forming at night in unwanted places. A major set of activities for summer readiness involves cleaning heat exchanger surfaces (both air and water cooled) to maximize heat transfer capability. Failure to do so can result in decreased generation capability or unexpected alarms and trips due to high lube oil temperatures, etc. Summer can also be a time of limitations on the ability to obtain adequate supplies of makeup water for plant operations. This is especially true in areas experiencing extended or severe periods of drought.

Challenges due to extremes in weather are coupled with decreasing margins in generation as plants are decommissioned. Further the separation of generation ownership from transmission ownership in many parts of the country may have resulted in lower margins. As the U.S. economy recovers from recent recessionary times, old plants are retired due to stricter emissions, new plants are difficult to build, and added non-continuous operating renewables are encouraged, system challenges under peak loads will continue to increase. These resulting low capacity margins create increased likelihood for blackouts under extreme weather conditions, and peak demand.

It is important to note that the scope of this report is limited to actions aimed at preparing generating plants for the annual changes of seasons. It does not cover normal and standard maintenance of power plant systems and equipment. Recommended maintenance procedures provided by the Original Equipment Manufacturers (OEM's) should be followed for all routine maintenance. In addition, though some other climate considerations are discussed (hurricanes, tornados, etc.), the scope of this report focuses on the winter and summer seasons. This report is not intended to cover maintenance actions and preparations for severe acts of nature or natural disasters.

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INTRODUCTION

Climate and weather considerations have a significant impact on power plant operation and maintenance. The annual cycle of seasonal readiness is one in which a systematic and repeatable approach allows for use of lessons learned and best practices. The seasonal readiness cycle typically contains actions in preparation for the following:

1. **Winter**: the most prevalent disruptive weather condition. Freezing conditions in the plant areas, with prolonged low temperatures that penetrate walls, insulation, ground depth, etc. In addition, winds that intensify the freezing process are also a consideration.
2. **Summer**: the next most impacting season with warm to hot conditions that challenge the reliability of many components. Here the challenge will be to maintain cooling of running equipment to within its design operating range. The exchange of heat between components and the ambient air and cooling water is significantly decreased, allowing heat to build to unacceptable levels. High temperatures result in shortened lives of equipment, degrading lubrication quality, electronic component failures, etc.
3. **Other seasonal considerations**: Spring and fall are sub-conditions of either winter or summer; however, short lived and intensive conditions may also need consideration. These may include and are not limited to the following:
   - Thunder storms
   - Hurricanes
   - Tornados
   - Flooding
   - Drought
   - Wind and sand storms

Winter Readiness

The onset of subfreezing temperatures, heralded by the historical timing of the first frost date at a given site, sets a very stern limit on the calendar for the activities involved in winter readiness. Recent weather trends in North America have added some urgency to the winter readiness task. The recent experience with the "Polar Vortex" in the U.S. has put an emphasis on potential impacts to the resiliency and reliability of the bulk generation system, increasing the importance of the winter readiness process. The Polar Vortex experience emphasized the following:

- Temperatures can fall up to 20F or more below historical values for any given location and date.
- The duration of these low temperatures can persist longer than average previous experiences.
- The combination of significant wind velocities coupled with the very low temperatures can overwhelm properly functioning heat tracing capabilities.
- Even minor damage or compromise to thermal insulation can expose piping, tubing, etc. to freezing during these types of below average or below design basis temperature excursions.

Based on this recent experience, the list of actionable items for winter readiness needs to be expanded with emphasis placed on more comprehensive checks of heat tracing, insulation, sealing of enclosures and buildings, the addition of heated enclosures for exposed items such as instruments, instrument air system dew point control, and many other actions detailed in the sections to follow.

Summer Readiness

Elevated summer temperatures have the potential to reduce output, degrade heat rate, and create operational challenges for plant staff. The appropriate subsections of this report provide discussion and simple checklists for summer readiness actions. Although there may be less urgency to the summer readiness process, the potential benefits are significant and these measures should be undertaken with the same comprehensive attention to detail as the winter readiness activities.

Summer readiness typically consists of cleaning and checking the condition of heat transfer equipment to assure peak performance during the summer months when temperatures are elevated. Examples of this type of activity include cleaning finned tube heat exchangers of accumulated dust/pollen/bugs to improve heat transfer, cleaning sumps and cooling tower fill of accumulated sludge and bio growth, etc. Temperatures of closed cycle cooling water and other closed fluid cooled by direct heat transfer (lube oil exiting from finned coolers) should be checked to determine if heat transfer is performing adequately. The real test will occur during the peak summer temperatures, but condition and performance during the transition can be an indicator of what lies ahead.

Other Seasonal Considerations

This report is specifically addressing the challenges of summer and winter readiness; however, this listing will outline some of the further challenges that may be considered in terms of seasonal preparations.

- Thunderstorm considerations;
  - Equipment grounding
  - Metal fencing grounding straps at gates and across openings
  - Items subject to become missiles under brief high wind conditions
  - Doors and hatches have secure attachments to maintain closed and avoid missile creation
  - Flash flooding potential due to plugged area drains
  - Redundant communications to system operator in the event of loss of normal communications coupled with transmission system interruptions
- Hurricanes
  - Doors and hatches have secure attachments to maintain closed and avoid missile creation, unsecured equipment that could become a missile
  - Sump pumps operable
  - Evacuation pathways identified
  - Sufficient warehouse supplies for making tie downs and pathway tie-off ropes
  - Indoor parking large enough for mobile equipment that may be needed post storm, i.e. fork trucks, mobile cranes, trucks and cars
- Tornados
  - Doors and hatches have secure attachments to maintain closed and avoid missile creation unsecured equipment that could become a missile
  - Evacuation pathways identified
  - Sufficient warehouse supplies for making tie downs for loose equipment that cannot be moved to storage, i.e. fire extinguishers
  - Fan housing for HVAC are secured with all fasteners. These have been often left off for convenience when performing maintenance.
- Flooding
  - Evacuation pathways identified
  - Sump pumps operable
  - Storm drains clear of blockage

  - Bung plugs available for in building isolation of floor drains in case of backup
  - Move portable equipment and mobile equipment to higher ground from potential historical flooding areas
  - Storm and area drains will need to be clear of debris to allow prompt runoff of excess water
- Drought
  - Deep wells are all operable
  - Intakes are open and dredged if needed to maintain intake head
  - Offsite water sources evaluated
  - Water cooled systems may need alternate air cooling capability
  - Transmission equipment may become contaminated due to dry salt deposits causing grounds when moisture returns to the area
- Wind and sand storms
  - Doors and hatches have secure attachments to maintain closed and avoid missile creation and keep dust/sand out of buildings
  - Sufficient warehouse supplies for making tie downs and pathway tie-off ropes
  - Indoor parking large enough for mobile equipment that may be needed post storm, i.e. fork trucks, mobile cranes, trucks and cars
  - Lubrication tanks, storage areas, etc. should be closed and have gaskets in good condition to avoid contamination

Best Practices and Lessons Learned

Seasonal issues should be well understood by plant operations and maintenance staff. But even a good understanding of normal weather patterns can leave a plant ill prepared when sustained below or above normal conditions plague a facility. Best practices that can be further developed into existing practices include:

- Updating Computerized Maintenance Management System (CMMS) to generate seasonal readiness tasks and track their completion
- Utilizing CMMS to give priority status to seasonal deficiencies entered as future jobs
- Treating lagging, heat trace and enclosures as required components for completion of other maintenance tasks (job is not complete until heat trace, insulation, doorways and access points are restored to operational condition)
- Verifying building penetrations are properly insulated and sealed from the elements
- Development of hot and cold operating plans that include actions in the casualty control procedures to reflect impact of the conditions
- Developing contingency plans or actions for weather effects and incorporate into the emergency action planning

- Reviewing material condition of plant equipment, enclosures and barriers to weather as necessary to the operation of the plant
- Updating training requirements for operations and maintenance staff to include seasonal awareness
- Adding work steps to existing job aids to prevent maintenance activities from defeating protective functions (e.g. heat trace de-energized during freezing conditions, insulation removed and left off for extended periods)

People and Culture Issues

Each facility will need to strengthen the understanding of operations and maintenance staff on the effects of their actions on freeze potential in plant systems. Prior to each winter season a review of winterization practices should be conducted with staff to refocus daily activities where the potential for freezing conditions are most likely to occur. Management must be proactive in developing the culture at each facility where all elements are considered while preparing systems for weather extremes. Facility teams should be proactive and anticipate specific weather demands on their plants. Discussions should focus on areas where other plants have had problems when operations and maintenance personnel lost focus on how weather affects plant operation, including:

- Leaving doors, windows and wall openings ajar
- Trenches flooded or open causing wetted lagging and exposing pipes
- Workers climbing on lagging, damaging jacket and insulation
- Lagging removed and freeze protection circuits pulled away to access equipment for maintenance and not returned
- Inadequate job planning to ensure insulation/freeze protection returned
- Lack of sensitivity to air dryers function and dew point of the instrument air
- Coordination between operations and maintenance staff to identify and rapidly correct winterization deficiencies

Summer readiness issues should also be reviewed with plant staff during summer readiness activities. The discussion of summer readiness should focus on plant and industry lessons learned with an emphasis on high ambient temperatures and how this affects plant operations. Also review operations and maintenance impacts personnel can have during typical peak demand seasons. Topics for discussion and training include:

- Assuring that air conditioned space doors and access points are not left open
- Arbitrary changing of thermostat setpoints in electrical spaces
- Developing awareness of electrical room temperature during rounds
- Coordination between operations and maintenance staff for urgently requested work when cooling systems are degraded
- Cleanliness of plant areas and debris that could potentially degrade finned cooler performance or be blown into open cooling water systems, obstructing cooling flow
- Training review for indications of clogged screens when inspecting open cooling water systems

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SUMMER AND WINTER SEASONAL FUNDAMENTALS

In preparation for the winter and summer seasons, there are some key fundamentals items that need to be embraced and understood across a site. Many of these concepts are intuitive to plant staff, however, clearly identifying these items as part of the approach to winter and summer readiness helps emphasize the importance of these items. The further sections will discuss development of guidance around many of the fundamental winter and summer readiness concepts below.

Winter Season Considerations

Insulation

Insulation is critical to maintaining temperatures within piping systems. Damaged, cracked or peeled insulation does not provide the intended function to reduce heat transfer and creates an environment that facilitates corrosion. Damaged insulation is commonly an indication of improper preservation of plant equipment or incomplete maintenance. Ensuring all necessary piping is properly insulated prior to entering the winter season and maintaining insulation integrity through the season is critical.

Heat Trace

Heat trace should be installed on all piping that has the potential to freeze in the winter months. Design of heat trace should include redundant circuits to ensure a single power failure will not put a system at risk. In addition, heat trace circuits should have test capabilities in order to operationally check each circuit through the winter season. Should heat trace circuits fail, temporary heat trace or heating blankets can be utilized on essential piping. Temperature guns can be used to check piping temperatures to understand the risk to freezing conditions. In some cases, provision of local enclosures with or without heating may be required to shield piping, equipment, instrumentation, etc. from winds that can increase heat transfer enough to negate the protective effects of heat tracing.

Instruments and Associated Lines

Instruments and associated lines are some of the highest risk components to freeze during the winter season. Many times this is due to lack of insulation, enclosures or heat sources coupled with low to no flow conditions and small diameter piping. This is further exacerbated due to the criticality of instruments in the control system. It is essential to identify all instruments that may lead to plant trip, derates or other automatic functions and understand how these components are maintained operable during the winter months.

Dampers and Louvers

Dampers and louvers are often forgotten when it comes to winter readiness yet they may put a unit at risk for many reasons. Many times, these types of equipment are automatically operated through some type of logic sequence yet do not provide response feedback to the control room operators. In the winter months, it is common for this equipment to get mechanically blocked open or closed unexpectedly, preventing air intake as needed or sending cold air where it is unexpected. In addition, high winds and/or snow drifts can block the intakes to this equipment preventing it from providing its proper function. It is essential to have plant staff walk down this equipment regularly, particularly when it is remotely operated.

Area Heating

Area heating, in the form of permanently installed HVAC systems, temporary space heaters or steam heating, is essential to protect both equipment and staff within the applicable areas. Keeping doors, windows, curtains and all other access points closed and properly sealed for each enclosure ensures the heating in the applicable area will be maintained. This is especially true for remote and unmanned areas where temporary heat sources may fail and remote indications of temperatures are not available. As temporary heaters are installed in various locations throughout the winter months, a log should be kept to track each heat source and power supply, as well as a routine check for proper operation.

Provision of space heating for indoor spaces to maintain temperatures above 40F or 45F as a minimum must be provided. Typically, unoccupied indoor spaces normally are heated to 55F or higher. Occupied spaces are typically heated to 65F to 70F most of the time, with set-back thermostats allowing temperatures to fall to 55F to 60F at night or on weekends. These measures are part of normal and typical design practices. The seasonal readiness aspect of this measure is to confirm that the building or space heating provisions are fully functional prior to the onset of cold weather.

Stored chemicals need to be maintained above freezing temperature for the chemical being stored. Barrels in transit or temporary locations will need to be maintained at appropriate temperatures.

Low or No Flow Piping

Low or no flow piping, isolated systems or other systems that are not normally operated during the winter season are especially vulnerable to freezing. In addition, many times these systems are not heat traced, insulated or adequately designed for extreme winter periods. Should temporary heat trace or blankets not be available, low or no flow systems may be able to be flushed, drained or put on a trickle discharge to prevent freezing.

Fire Protection

A review of fire protection systems should be conducted to ensure systems are properly heat traced. In wet systems where anti-freeze is used, the concentration of the glycol should be determined prior to the onset of freezing conditions.

Additionally, dry pipe systems must be inspected to ensure water is drained from piping low points. If water is allowed to accumulate, it could freeze and cause a break in that section. The resulting break would reduce system pressure and then activate the water supply to the piping. This could result in freezing water on plant equipment and in the normally dry pipe lines which could cause further damage and compound the effects to the plant.

Additionally, blockage is also a major concern in a dry pipe system. Since a dry pipe offers room for the frozen water to expand, freezing may simply cause a blockage or ice plug in the pipe, essentially defeating the fire protection system in the event of an actuation as the water may not reach its necessary destination. In effect, it would be like operating the system with a discharge valve shut.

Any changes made to fire protection systems need to be tracked, monitored and restored properly at the end of the season. Changes to fire protections systems need to be communicated to plant staff who are expected to use these systems.

Lube Oil Heaters

Oil systems are particularly vulnerable to moisture during cold weather seasons. Shutdown equipment eliminates the ability to self-heat and maintain oil temperatures as needed. Lube oil heaters must be in good operating condition and temporary heating may be required in some locations based on systems design. Additionally, colder temperatures change the viscosity of the oil which can cause problems. Particularly, since the oil flow is significantly hampered, overheating of equipment can occur due to insufficient lube oil flow if there is an immediate need for operation.

Motor Heaters

Motor heaters on equipment that is redundant in nature are critical to maintaining the integrity of plant motors. As equipment is swapped through the winter months, it is critical to ensure the motor heaters are functioning properly on idle equipment. Block heaters need to be verified in good operating condition for standby engines that may be required to start under extremely cold conditions.

Moisture in Air Systems

Even with this dry supply of air to these systems the potential for water accumulation can occur as the supply lines can be very long runs and potentially no water removal equipment downstream of the air receiver. An evaluation of a plant's air systems should be conducted to determine points in the system where water could accumulate, long level or improperly sloped section of piping and tubing. Water can still accumulate in remote sections of piping and cause

potential increases in dew point. This water could freeze on unprotected lines and accumulate over time causing erroneous readings or instrumentation/ control malfunction. Additionally, the expansion of air at remote valves and controls during cold weather conditions could induce freezing and plugging even with in-specification dry air.

It is critical to remove moisture from lines. Plant personnel should perform blowdowns at low points prior to the onset of freezing conditions to prevent damage to tubing lines. Lines should be inspected to ensure the proper slope so that any potential moisture accumulation will drain back to where it can be removed from the system.

Static Electricity in Oil Cooled Transformers

Preparation for Winter Readiness should include heightened awareness for the potential of oil cooled transformer failure due to static electrification. There have been numerous main generator trips, fires, and forced outages caused by both shell-form and core-form transformers manufactured by different suppliers. These transformer failures are significant because they result in unplanned plant transients and major outages.

In cold weather situations with high load, the cooling pumps can be "fooled" into a high flow rate situation, increasing the potential for damage from static electrification. All plant operators should be trained on how to recognize significant static electrification discharges in large transformers and what actions should be taken when such a condition occurs.

More detail can be found in EPRI Report EL-6081, "Static Electrification Control in Power Transformers".

Icing of Open Systems

Intake systems, circulating water systems, cooling towers and service water systems are all vulnerable to ice formation and blockage. Weather and system monitoring is essential to mitigate ice formation throughout the winter months. Many of these systems will have an alternate flowpath, recirculation lines or reverser flow capabilities as part of design to support the winter months. Ensure these portions of the system are kept operable and adequately tested prior to winter operation.

Closed Loop Water Systems

Contained cooling systems, such as those for diesel generators, typically contain antifreeze to prevent system freezing. Identification of the applicable systems and verifying the proper water chemistry for the anticipated temperature changes is critical to maintain equipment operable.

Abnormal System Lineups

As plant systems are realigned during the winter months, for maintenance, testing, normal plant operations or emergency conditions, it is critical to evaluate the system lineup for susceptibility to freezing and winter conditions. Stagnant piping, uninsulated lines and small diameter piping are particularly vulnerable to these conditions. Temporary alterations to normal plant equipment must be evaluated for seasonal readiness if it is expected to continue to support operation during the extreme season.

Air Cooled Condensers

If sections of the air cooled condenser are isolated during the winter months, draining the condensate water from the water side of the condenser will be required to prevent freezing. Verification of effective isolation is also needed to avoid in-leakage that can condense and freeze.

Leaks

Leaks across the site, in plant systems or piping have the potential to create hazards in cold weather conditions. Freezing of liquids and water vapors may cause slips, trips and fall hazards in many areas. In addition, leaks in elevated locations may cause the formation of icicles which create hazards to employees below. Preparations must be made to ensure the site has the proper equipment to deal with these hazards. Roping off areas that are identified to contain hazards through the winter season is essential to maintain a safe working environment.

Personnel Safety

Some of the key aspects to personnel safety in the winter months focus around skin protection, hazard awareness and slips, trips and falls. In severe weather, the concept of the buddy system or use of plant communication systems (radios, cell phones, etc.) are critical to ensuring all staff are routinely accounted for. At times commuting to and from work can put staff at risk due to road conditions. Contingency staffing plans and staging living supplies should be considered.

Contingency Plans

Contingency plans should be in place for several items during the winter months. Supplies such as heaters, blankets, power, scaffolding, insulation, fuel, and deicing chemicals, etc. should be readily available on site or easily accessible in the local area. Other contingency plans around communications, staffing, snow removal and emergency response should also be considered. Lastly, contingency work orders, operating procedures and critical spares for high risk items (failed heat trace, equipment leaks, critical equipment, system draining activities, etc. should be readily available. Contracts should be in place for specialized support or resource augmentation based on historical seasonal demands on the plant staff.

Other contingencies that may be considered are around low flow or minimum load modes of operation. Recirculation of many systems may be utilized to prevent freezing conditions such as ash conveying and fuel oil systesms. At times, delaying or rescheduling unit outages may also be an avenue that is considered based on extreme cold temperatures in local areas.

Fuel and Material Handling

Coal, limestone, and other solid materials that are delivered to the plant during extreme cold conditions can pose special challenges to plant equipment. Moisture that is present or is collected during transit freezes the materials in rail cars or trucks. Systems and equipment used to thaw heavily frozen shipping containers must be in good operating condition. Temporary heaters may

also be necessary, as well and delayed unloading (contingency inventory maintained on site that is not impacted by the extreme cold weather). Fuel oil tanks may require heating as some fuel oil has the potential to crystallize with extremely cold temperatures. Without intervention, this has the potential to plug fuel oil strainers.

Emergency Generators

Emergency generators are most likely called upon to support the plant in the most adverse conditions. Extra care is needed to assure full operational capability, including routine load testing and cold start. In some cases these generators are best protected by continuous operation. Care is needed to insure sufficient fuel supplies are maintained and that diesels are not run unloaded for extended lengths of time.

Auxiliary Boilers

Normally a significant quantity of high quality steam is available from the operating steam plant serving the site needs for auxiliary steam, such as building heating. This is especially true for multiunit sites where auxiliary steam can be drawn from any of the operating units. For these reasons auxiliary boilers are often one of the most overlooked systems in the operating power plant. However during winter seasons the need for auxiliary steam can be critical to the protection of the site equipment. Routine PM activities should be conducted well ahead of seasonal demand. These PMs should include a test operation that creates sufficient demand for steam such that the boiler is tested at loaded conditions. The plant should either maintain a qualified maintenance staff and associate parts or have effective contractor support to check and maintain the auxiliary boiler. Ensure the operating staff have sufficient knowledge and experience to be able to startup, monitor, and troubleshoot the auxiliary boiler. Procedures should be available to support critical operational activities. Proper operating chemistry as well as layup of the idle boiler is also essential for reliable operation. Maintain a quality fuel inventory, especially if fuel oil is used. Moisture, biological growth, and dirt/corrosion are all detriments to fuel oil that has been stored in stagnant tanks. Periodic flushing and sampling can be used to confirm oil quality.

Air Flow Passageways

Normal air flow passageways remain important for cooling of equipment even during adverse cold weather. Air flow can be impacted by build-up of snow and ice on filters, finned tubes, and other narrowly spaced areas in air flow passages. Outdoor exciter air coolers are an example of one such area. Enclosed fan room intakes can quickly become frosted over creating building vacuum capable of collapsing intake ducts or other structures.

Rodent and Pest Control

During seasonal changes certain pests can emerge from dormancy and spread through the plant. Some creatures may seek warmth in winter. These pests can damage electrical wiring and components as they find openings in conduit and cabinets looking for nesting spots. Inspections should be conducted to check electrical conduit openings and electrical entries for proper sealing to prevent pests from invading enclosures and small areas (conduit). Reputable pest control companies should be contacted to further evaluate the plant for baits, traps and barriers to prevent wildlife from entering areas where they can cause damage. Rodents will nest in electrical packages and eat insulation and rubber insulators.

Summer Season

Operating Limits

The summer months typically challenge the plant to operate at the high end of many of its design and operating limits with little margin for error or failure. Regular equipment monitoring, using both plant staff and monitoring centers as applicable, is critical to ensuring plant limits are not violated and equipment is not damaged. Of particular concern are those that may be associated with regulatory requirements (discharge temperatures, temperature gradients, etc.).

Cooling Water Sources

Cooling water systems face two key challenges in the summer months; elevated temperatures and reduced quantity. Additional cooling capabilities can supplement issues with cooling water systems including items such as temporary coolers, additional fans and ventilation systems.

Heat Exchangers

In addition to the elevated temperatures that reduce the efficiency of heat exchanges in the summer months, bio-fouling, dirt, dust, pollen, etc., all challenge the heat transfer capability of heat exchangers throughout the plant. Backflushing, chemical treatment, mechanical cleaning of surfaces (ball cleaning systems) and supplemental cooling systems provide various means to maintain the integrity of cooling capacity through the summer months. Ensuring heat transfer surfaces are optimized prior to entering the summer months can help minimize intrusive work through the summer. However, as some work may be unavoidable, having work orders, operating procedures, tools, parts and staff prepared to complete anticipated tasks will minimize impact on summer operations.

Ventilation and Air Conditioning

Ventilation systems must be kept clean and free of debris. Air conditioners should be checked for proper operation going into the summer months. This is especially important for remote areas with electronic equipment that is sensitive to elevated temperatures (computer rooms, battery rooms, etc.). Temporary air conditioning units and fans can be utilized to aid in cooling at specific locations. Filters need to be checked for clogging and tearing.

Motors

Ambient temperatures in the area of air cooled motors should be monitored on a regular basis. Motor temperatures will provide an indication of sufficient cooling and should be part of operator rounds. Air intake screens and filters need to be checked more frequently for debris and fouling.

Air Systems

During the summer, the moisture content of ambient air commonly increase. This added moisture could potentially overload the air drying system and carry over into the air receivers. Increased frequency of inspections of water removal systems (blowdowns and traps) should be conducted and documented to show if water accumulation is observed. Prior to summer operations any required maintenance on the air drying systems should be performed. Checks of low point drains for indications of water should also be performed.

Transformers

Transformers are typically non-redundant and critical to the operation of the plant. It is essential to ensure cooling surfaces are not fouled and are ready for summer. The support systems, such as fans, cooling pumps and oil analysis systems, should be checked frequently through the summer months. Many of the alarms associated with transformer temperatures are time sensitive with regard to operator action. Entering the summer months, just in time training involving this equipment and proper load drop response relating to transformer temperature alarms is prudent.

Personnel Safety

Some of the key aspects to personnel safety in the summer months focus around heat exhaustion and dehydration. Staging areas around the plant with water and electrolyte fluids can help prevent dehydration events. In addition, many areas in the plant will be at elevated temperatures. Stay times may need to be invoked at different times of the summer or times of day. A buddy system in these circumstances can help ensure staff are accounted for. The use of cool suits and ice vests may be considered to support extended stays in elevated temperature areas that cannot be avoided.

Contingency Plans

Similar to winter weather considerations, contingency plans should be in place for several items during the summer months. Supplies such as temporary cooling, fans and hydration supplies should be readily available on site or easily accessible in the local area. Other contingency plans around communications, staffing and emergency response should also be considered. Lastly, contingency work orders, operating procedures and critical spares for high risk items (fans and cooling equipment, transformers, etc.) should be readily available. Contracts should be in place for specialized support or resource augmentation based on historical seasonal demands on the plant staff.

Mold and Mildew

Certain spaces in each plant may promote the growth of mold and mildew. Spaces that are not normally occupied (warehouses and outbuildings) should be inspected for water intrusion and poor drainage. This accumulation of water or damp areas that don't dry thoroughly will eventually exhibit signs of mold or mildew. In some climates this may be caused by high humidity levels that always exist. In each scenario the water or dampness condition must be controlled. Drains that are not working properly need to be corrected, building seals and leaks need to be repaired and spaces with high humidity should be equipped with dehumidification (temporary dry type desiccant or more permanent dehumidification units). Mold and mildew collection in drain lines from the basin pans of air conditioning units can occur. Overflow due to a blocked drain line can result in damage to finishes, structures, and especially electrical components.

Biofouling

Fouling of systems and equipment is especially prevalent during hot summer conditions. Biological growth in open systems is often controlled by agents injected into open water systems, such as service water and circulating water. Many plants also experience seasonal challenges during "blooming" events, such as May-flies or jelly fish, that must be considered and mitigated. Other biological intrusion such as zebra mussels, and microbiological initiated corrosion, MIC, should also be considered at the appropriate season or plant condition.

4
SEASONAL READINESS PROGRAM

The approach to Seasonal Readiness across an operating fleet or at an individual unit should be a ***thorough, repeatable and defined process*** that is executed on an ***annual basis*** and ***incorporates learnings and best practices*** on a regular cycle. This section will provide information on what a typical seasonal readiness cycle encompasses.

The overall seasonal readiness program is typically an annual cycle that is governed by a procedure that incorporates all aspects of the program including timeframes, preparation activities, execution activities, restoration and lessons learned. This procedure will be the governing document for all activities related to seasonal readiness. Section 5 below will present guidance on building the technical content for a seasonal readiness program and the governing document with regard to preparation, execution and restoration of seasonal readiness items.

Annual Seasonal Preparedness Cycle

The Annual Seasonal Preparedness Program should be defined, documented and executed on a continual basis. The overall seasonal readiness program contains five (5) key steps as outlined and further discussed below:

1. Identification of Winter/Summer Readiness Issues
2. Winter/Summer Work-down List and Tracking
3. Site/Corporate Seasonal Readiness Board
4. Winter/Summer Season Execution
5. Restoration and Lessons Learned

As shown in Figure X below, the seasonal readiness process is essentially two individual cycles; one for the winter season and one for the summer season.

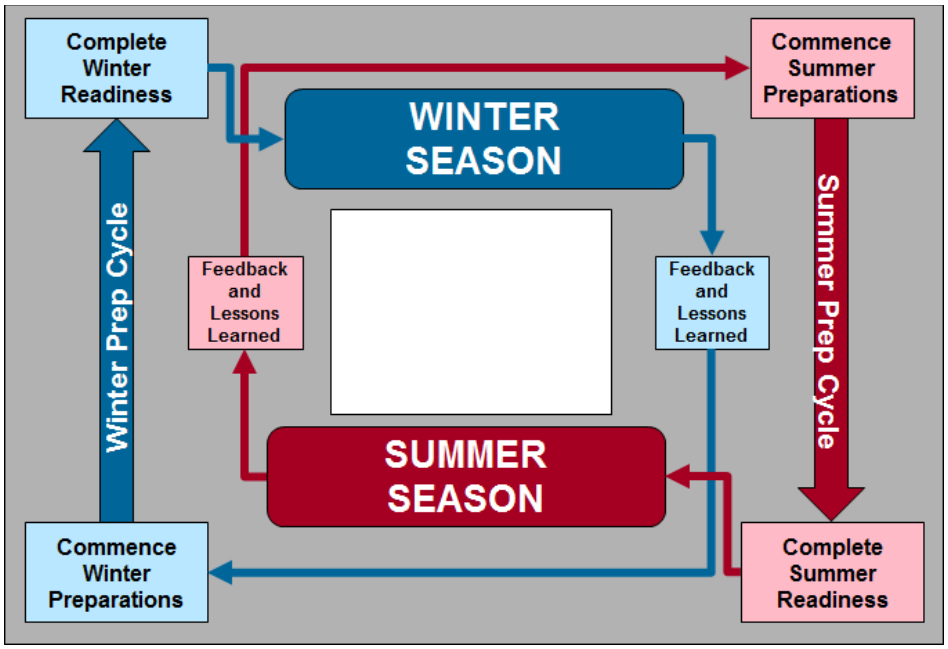


Figure 4-1
Annual Seasonal Readiness Cycle

Based on local climates and regional weather patterns, some facilities may choose the level of detail and rigor that needs to go into the winter and summer season program individually. However, incorporation of many of the elements described within this report can help transition a reactionary Seasonal Readiness Program to one that anticipates and mitigates risk effectively. The remainder of this section will outline the five key elements to a seasonal readiness program. An effective Seasonal Readiness Program should have sufficient procedural guidance to ensure the requisite elements described below can be effectively conducted by the station staff in a reliable manner.

Identification of Winter/Summer Readiness Issues

Identification of current winter and summer readiness issues going into the applicable season is critical to preparations. Individual sites should have a list of systems that are typically considered sensitive to winter and summer seasonal risk. The following items should be utilized to identify the current equipment issues and risks that may need to be addressed during the seasonal readiness period:

- Backlog Review
- System Walkdowns
- Past Operational Experience
- Previous Year Lessons Learned

A list of typical systems of concern can be found in Appendix B, Systems in Scope for Seasonal Readiness.

Winter/Summer Work-Down List and Tracking

From the identification of each winter/summer readiness issue above, a winter/summer work-down list should be developed. Each item on the list should be documented and tracked within the individual site's work management process or CMMS. This work should be done significantly before entering the winter and summer months at each location. For example, if the winter months for a site are identified to be December 1 through March 1, the winter work-down list should be developed in the June timeframe, to allow adequate time for issues identification, maintenance planning, part allocation and execution.

In addition to the overall list development and tracking, a Seasonal Readiness Team, made up of cross-functional plant staff should track the workdown list on a regular basis going into the applicable season. These meetings should ramp up as the season gets closer to ensure all work-down items are tracked and completed properly. Creating a seasonal readiness implementation schedule, similar to what would be done during an outage can be a tool to commit resources and track work execution.

A sample workdown and tracking checklist can be found in Appendix D, Sample Workdown Tracking List.

Site/Corporate Seasonal Readiness Board

A site and/or corporate seasonal readiness board should be conducted to provide an independent and objective look at the site's overall preparation for the upcoming season. Typically, the board may be made up of senior plant management or corporate support staff and led by the Site Director or Plant Manager. Having members from other sites or corporate often add objectivity to the board. Many times, it is the Site Director or Plant Manager's responsibility to validate the plant/site is prepared for entering the summer/winter season. The types of items that would be included in the seasonal readiness board are as follows:

- Backlog and Deficiencies
- Contingency Plans
- Trending
- Maintenance and Operations Plans
- Use of Lessons Learned

A list of challenge questions that may be useful for this type of review board can be found in Appendix E, Sample Seasonal Readiness Board Questions.

Winter/Summer Season Execution

Once all of the preparations for the upcoming season have been completed, execution of the established plan and immediate identification of potential issues is critical. Each site should have a checklist and verification of items that are required on some frequent basis to ensure all systems are operating as expected. Emergent work items should be rolled into the established work management process which should account for criticality of some items based on seasonal conditions.

Typically, execution will consist of a few key items for both the winter and summer. An example of execution items is presented below:

Winter	Summer
• Monitoring equipment for impacts due to the winter season • Verification of heating sources to buildings and equipment • Maintaining site and personnel safety through keeping walkways cleared, parking lots cleaned, etc. • Executing contingency and emergent work items as needed	• Monitoring equipment for impacts due to the summer season • Verification of proper cooling to key equipment and buildings • Executing contingency and emergent work items as needed

A large percentage of the items in the execution phase of seasonal readiness are around monitoring and verifying the summer and winter support systems are properly operating, maintaining site safety and responding to emergent needs. The more thorough and rigorous the preparation phase is for both these seasons, the less demanding the execution phase should be.

Restoration and Lessons Learned

At the conclusion of the summer/winter season, each system needs to be restored to its normal condition. This would include things such as system realignments, removal of temporary heating or cooling systems, running auxiliary power, etc. In addition, lessons learned, additional contingencies and mitigating actions should be documented and incorporated in the seasonal readiness plan for the following year.

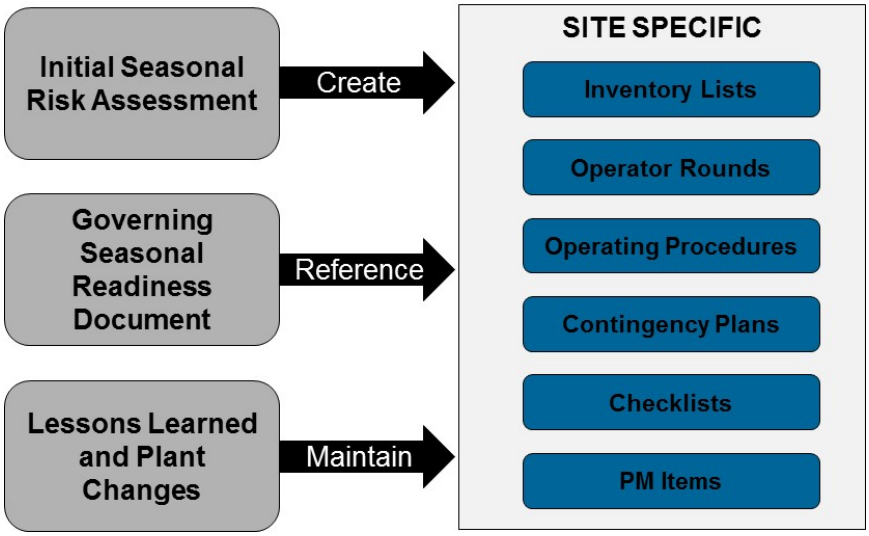
5
SEASONAL READINESS PROGRAM CONTENT DEVELOPMENT

The annual seasonal readiness program provides a systematic and repeatable process as described above in Section 4. However, this process is built upon technical content, procedures and tasks that need to be identified and executed in order to maintain a rigorous program.

This Section will present an approach to develop all the necessary technical content for a seasonal readiness program. There are three key pieces to develop and maintain the technical content of a Seasonal Readiness Program:

1. Governing Seasonal Readiness Document (Fleetwide or Site Document)
2. Initial Assessment of Seasonal Risks (Site Specific)
3. Incorporation of Lessons Learned and Plant Changes (Fleetwide and Site Specific)

Understanding how the pieces above tie together is critical to the development of the seasonal readiness program. As shown below in Figure X, the three different items that are further discussed below; Initial Seasonal Risk Assessment, Governing Seasonal Readiness Document, and Incorporation of Lessons Learned and Plant Changes all play a different role in an overall seasonal readiness program.



The Initial Assessment of Seasonal Risk will develop the site specific documentation and actions necessary to support execution of a seasonal readiness program. Annual review of lessons learned and plant changes will maintain the site specific documentation current. The governing seasonal readiness document will reference the identified/developed material at each site to provide the specific actions and tasks of the seasonal readiness program.

This section will provide further detail on all three pieces to the seasonal readiness program, starting with the governing seasonal readiness document.

Appendix A, G and H present a sample of a governing seasonal readiness document as well as some specific considerations for preparation, execution, restoration and contingencies when developing the site specific seasonal readiness tasks and activities.

Seasonal Readiness Program Governing Document

The seasonal readiness governing document establishes the overall plan for winter and summer readiness across a fleet or at an individual site. The governing document will provide guidance on the following items:

- Purpose and scope of the seasonal readiness program
- Roles and responsibilities
- Definition of winter and summer periods
- Identification of all items that need to be completed prior to and during the summer and winter seasons

Appendix A presents a sample of a governing seasonal readiness document.

Purpose and Scope

The purpose of the seasonal readiness procedure is to describe the process used to prepare the fleet and/or individual station(s) for safe and reliable operation during the summer and winter periods. The seasonal readiness procedure should be used in conjunction with site-specific procedures, maintenance tasks and policies to create a complete and thorough seasonal readiness program.

Roles and Responsibilities

In development of a seasonal readiness procedure, identifying roles and responsibilities defines who is involved in seasonal readiness preparations across a fleet and at an individual site. This will vary across the industry based on the structure and resources of each company. It is critical that roles and responsibilities are identified for a fleet/site/unit and that expectations are clearly set.

Generally, roles and responsibilities should cover positions such as Senior Management, Station Management, Plant Staff and in this case the Seasonal Readiness Coordinator and Team. Responsibilities shall be defined based on each company's seasonal readiness expectations and commonly include items such as executing the seasonal readiness procedure, general expectations around safety, seasonal readiness boards, training and implementation of lessons learned.

Winter and Summer Definitions

In development of a seasonal readiness governing document, it is integral to understand the weather patterns of concern and local climate at designated plant locations in order to define the official winter and summer period. For example, some locations may have a winter period set from January 1 to April 1, while other locations located in a colder climate may designate the winter period from November 1 to May 1. These periods are based on regional locations and are specific to each operating plant. It is imperative to clearly define the start and end dates of the winter and summer seasons in order to effectively schedule and implement the seasonal readiness cycle.

For some general information about the U.S. Climate, reference Appendix B, U.S. Climate Considerations.

Procedure Content

Generally, the seasonal readiness document will have high level guidance, typically around the fundamentals discussed in Section 3. The document will then reference existing procedures, policies, practices and work items that will be used to execute specific seasonal readiness items. These additional checklists, procedures and maintenance tasks specific to seasonal readiness requirements of individual units should be maintained separately but utilized complementary to the governing document. For example, the governing document may require additional operator rounds on heat-traced equipment. Specific operator rounds checklists or tracking documents would be developed that are site specific with regard to the heat-traced circuits at a specific location. The following information in this section will provide guidance on how to develop the content for the seasonal readiness document. Attempting to implement seasonal readiness based on ‘tribal knowledge’ presents an error-likely situation to potentially miss critical equipment protection, cause forced outages, and increase risk to the health and safety of the plant staff. Further, electrical system stability and reliability may be challenged. It is critical to systematically approach the development of the content for each site’s seasonal readiness.

Initial Assessment of Seasonal Risk

The purpose of the initial assessment of seasonal risk is to build the starting point for a robust seasonal readiness program. This assessment will be the basis and lay the foundation for development of tools that can be used in the annual seasonal readiness process. The outcome of the assessment will likely include the following:

- Development of and/or identification of Preventive Maintenance Items related to the winter or summer season
- Development of and/or identification of Operating Procedures related to or needed for the winter or summer season

- Development of and/or identification of rounds, inspections and testing that must be performed on a regular basis throughout the summer or winter season
- Development of communication and contingency planning for facilities, equipment, tools, etc.
- Development of training material and/or briefing material for plant staff going into the summer and winter seasons.

The governing seasonal readiness document introduced above will provide the overall steps to a seasonal readiness program. However, the site specific procedures and processes will be the actual specific implementation tools. These tools will guide each site through seasonal preparations and execution on an annual cycle.

The initial seasonal risk assessment can be broken into two overall areas:

- Initial Assessment of Seasonal Risk for Components, Equipment and Systems
- Initial Assessment of Risk for Site and Personnel Safety

Initial Assessment of Seasonal Risk for Components, Equipment and Systems

In order to perform an initial seasonal risk assessment for components, equipment and systems, it is critical to identify the assets that can potentially be impacted in the various seasons, i.e. winter and summer months and identify the weather conditions and extremes that are typical for the area. This will typically be done through review of prints and design information, system walkdowns, operations and maintenance procedure reviews and discussions of seasonal preparations with experienced plant staff.

Design Review

An initial assessment of risk should first consider the unit design relative to the expected weather conditions experienced over the past years (100 years for example), including the impact on systems, equipment, components and the overall site. Where possible, locate the original design specifications for the station. These should specify the seasonal conditions and survival parameters for the facility.

For example, it may be an outdoor structure with all the balance of plant and turbine equipment exposed in an open structure. The equipment may be supplied with freeze protection circuits and insulation to protect in one of the following circumstances: 10 degrees F for 12 hours, 20 degrees F for 24 hours, or 25 degrees F indefinitely. Understanding what equipment was designed to handle will allow for evaluation of needed tasks and actions in the winter and summer seasons.

Since weather conditions can never be fully determined or predicted with accuracy, the facility should be overly protecting sensitive equipment to ensure survivability. This becomes the margin of acceptable performance.

Historical weather patterns with specific attention to the extremes and extreme durations should be investigated. This is most important for relatively new plants that may not have experienced decades of local weather patterns.

Part of the initial design review should also include a review of plant operating and maintenance history to identify any past seasonal lessons learned and near misses that can be incorporated into the seasonal readiness program.

Interviews

The initial seasonal risk assessment should include interviews with employees who have long standing experience at the site and in the community to access their collective knowledge of past personal experiences. Prior plant experience is critical to the success of a winter and summer readiness program.

Some of the key items that should be discussed during these interviews include the following:

- What failures has the plant experienced in the winter and summer season?
  - Were the failures avoidable?
  - How?
- What temporary items have been put in place in the past to prepare for or during the winter and summer months?
- What type of design changes would help the plant better perform in the winter and summer months?
- What safety issues become apparent during the winter and summer months?
- Who else can provide insight and information on preparing the station for the summer and winter months.
- How is plant operation challenged or altered during the winter and summer season?
- What inspections become more important during the summer and winter season?
- What weather patterns create what challenges, such as wind direction and velocity, snow accumulation, extent of drought experienced and what water sources may be compromised?

System Walkdowns

System Walkdowns are one of the best ways to get a thorough evaluation of all equipment, components and systems on site that may be impacted by the winter and summer seasons. These walkdowns should be completed by knowledgeable plant staff, normally an engineer, experienced operator, and experienced maintenance staff who understand the system design, function, current condition and operation.

The following outline can be utilized during System Walkdowns to help identify all relevant seasonal risks.

1. Building and Structures
    a. Identify all outdoor enclosures important to the reliability of the unit:
        i. Remote buildings
        ii. Switchgear
        iii. Local control panels
    b. For each outdoor enclosure, identify the following;
        i. Heat source (portable heaters, HVAC system, auxiliary steam heating, none, etc.)
        ii. Access Points (doors, curtained areas)
        iii. Sumps and sump pumps
        iv. Wall insulation
        v. Unprotected openings
    c. If no heat source is identified for enclosures, perform the following;
        i. Evaluate the need for a temporary heater
        ii. Evaluate available power supplies
    d. Identify all outdoor containments and identify the following;
        i. Drainage path
2. Outdoor Tanks
    a. Identify all outdoor tanks and identify the following for each;
        i. Heating installed
        ii. Insulated
        iii. Recirculated
        iv. Containment and drain path
3. Outdoor Valves, Actuators and Piping
    a. Identify all outdoor valves, actuators and piping.
    b. Identify the following for each
        i. Heat trace installed
            1. Number of heat trace circuits
            2. Power supplies for each heat trace circuit

   ii. Lagging installed
   iii. Drain paths
      1. Manual
      2. Automatic
   iv. Flushing requirements
4. Instruments and Instrument Lines
   a. Identify all instruments and transmitters
      i. Level transmitters
      ii. Pressure transmitters
      iii. Flow transmitters
      iv. Other transmitters and instruments
   b. Identify the following for each transmitter and associated instrument line
      i. Heat traced or blanketed
      ii. Lagging installed
   c. Instrument air lines sloped correctly with blowdown valves
5. Dampers and Louvres
   a. Identify all dampers and louvres
      i. Automatic
      ii. Manual
   b. Mechanical blockages or staged equipment areas that may prevent operation
6. Safety Systems
   a. Identify all safety equipment including the following;
      i. Fire Protection hoses and piping
      ii. Eye Wash stations

Document Review

The current operating and maintenance practices at a site will typically support many of the needs for seasonal readiness. The critical documents that should be reviewed for specific applicability for seasonal readiness include operator rounds, operating procedures and Preventive and predictive maintenance items.

Operator Rounds

Operator rounds are a crucial piece to a successful seasonal readiness program in both preparing for upcoming seasons and identifying system information and trending throughout the seasonal periods. A review of current operator rounds will identify any items that may be needed to be completed on a more frequent basis during the summer and winter months. In addition, identification of items that may not typically be part of rounds in off months or items that need additional logging sheets will be a critical part of this task.

Some of the common items that may be included in operator rounds in the winter and summer season are displayed in Table 5-1 below.

Table 5-1
Additional Rounds for Plant Operations Staff

Winter	Summer
• Heat Trace Panels Energized • Walkways Cleared • Temporary Heaters Functioning • Area Temperatures • Insulation Damaged • Insulation Blankets installed • Containments drained • Outdoor Tanks recirculating/heated • Leaks of liquids or steam	• Frequent monitoring of intake and cooling water systems • Frequent monitoring of heat exchanger differential pressures • Areas Temperatures • Air Conditioning Units properly functioning • Filters clean and free of debris • Transformer and switchgear fans properly operating • Cleanliness of air cooled components/devices

Appendix F, Sample Heat Trace Log, contains a sample heat trace panel log for additional operator rounds.

Maintenance Tasks

Both predictive and Preventive maintenance tasks are critical in the preparation and execution of plant operations in the summer and winter months. Reviewing all currently performed tasks to identify those that will prepare equipment for seasonal operation and identifying gaps of additional items that need to be completed is critical. Each task should be properly flagged for and scheduled prior to entering the applicable season.

Contingency maintenance items should also be identified and developed should a critical piece of equipment fail or become degraded. Examples of contingent work that should be prepared include repair of heat trace circuits for the winter season and heat exchanger cleaning during the summer season.

Table 5-2
Contingency Work Orders

Winter	Summer
• Heat Trace Repair • Insulation Repair • Door Seal Repair	• Heat Exchanger Cleaning • Temporary Cooling Systems • Filter Replacements

Initial Assessment of Risk for Site and Personnel Safety

In order to perform an initial risk assessment for site and personnel safety, it is critical to evaluate all the tools and resources the staff may need, identify communication plans, contracts and other key resources that are required to support seasonal readiness.

The following outline can be utilized while assessing seasonal risk for the site and personnel safety to help identify all relevant items.

1. Contingency Supplies and Personnel Protective Equipment
    a. Electrical Equipment
        i. Extension Cords
        ii. Portable Generators and fuel supply
        iii. Temporary Lighting
    b. Heating and Cooling Equipment
        i. Temporary Heaters
        ii. Tarps
        iii. Temperature Guns
        iv. Insulation Blankets
        v. Temporary insulation
        vi. Portable Heaters
        vii. Temporary Enclosures
        viii. Portable Air Conditioning Units
    c. Scaffolding Equipment
    d. Personnel Protective Equipment
        i. Gloves
        ii. Shoe spikes
        iii. Hard Hat Liners
        iv. Sunglass Safety Glasses

v. Hand warmers
vi. Face shields/warmers
vii. Danger, caution, safety tape and signs
viii. Barrier tape and signs

2. Communication Plans
   a. Plant Event Reporting (trips, fuel supply issues, derates, safety, etc.)
   b. Fleetwide Event Sharing of Seasonal Event
   c. Site evacuation, shutdown, staffing changes
3. Training
   a. Just in Time Training for Seasonal Periods
   b. Briefs of Lessons Learned from past seasonal events
   c. Review of operating procedures, rounds and season specific actions
4. Staffing
   a. Manning changes due to severe weather and staff not being able to get to site
   b. Contingency workforce for severe weather events
   c. Items required for continuous manning
      i. Food/water supply
      ii. Sleeping facilities, cots, blankets, etc.
      iii. Toiletry and shower facilities
   d. Chain of command for reporting site events through plant and corporate leadership
   e. Use of 'buddy' system during extreme weather for plant staff
5. Walkways and Traversed Areas
   a. Identification of all areas that are used for day-to-day plant operations and alarm response
   b. Roofs, ladders and intake areas
   c. Staged shovels and ice-melt/salt in applicable areas
   d. Rope off areas where icicles historically form
6. Site Vehicles and Parking Lots
   a. Identification of all site vehicles and fuel supplies
   b. Development of parking lot snow removal plans and coordination activities
7. Contracts and Support Workers
   a. Review of contracts for fuel, snow removal, contingent workers, scaffold builders, etc.
   b. Availability of support workers such as snow removal, intake cleaning, etc.

Incorporation of Lessons Learned and Plant Changes

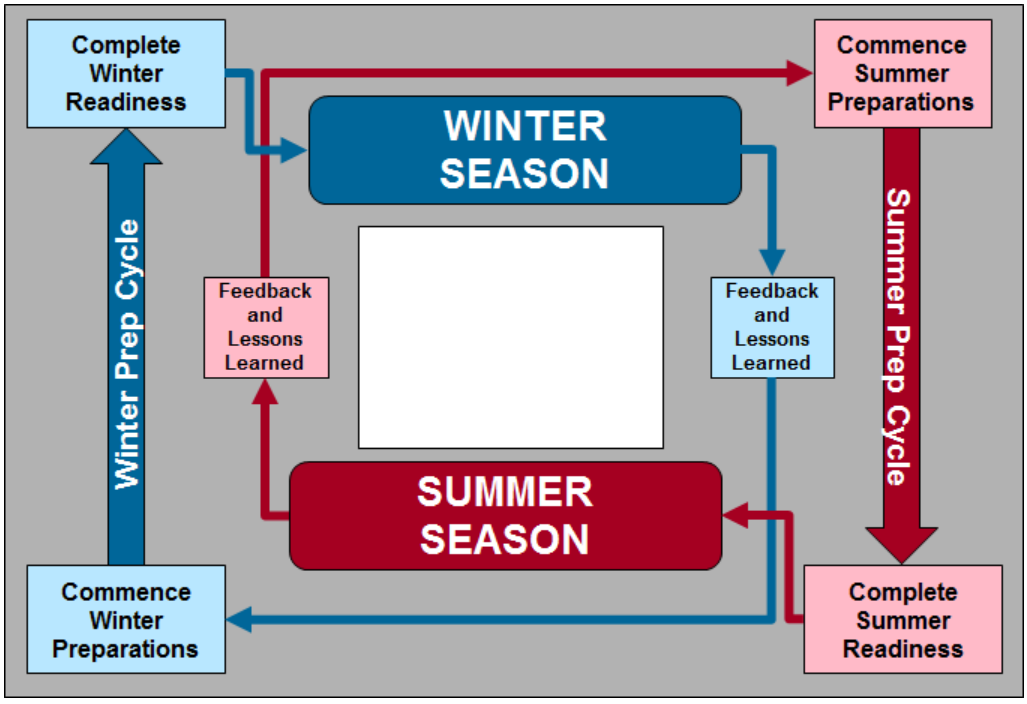
The last piece of a robust Seasonal Readiness Program is the feedback mechanism and continuous learning of the program. At the end of each season, review boards should be held at each unit to identify key lessons learned that need to be incorporated into the initial risk assessments. These reviews should be in alignment with the organization corrective action program, documented and recorded. Action items should be developed and tracked to ensure the corrective actions and lessons learned are properly incorporated into the seasonal readiness program.

In addition, as new equipment, components and systems are installed or modified, they need to be evaluated for potential risk and impacts during the summer and winter months. This should take place as part of an organization's management of change program.

Reference EPRI Report, *Guidelines for Obtaining and Using Operating Experience at Fossil Power Plants*, 1012783, for more information on lessons learned and operating experience.

6
CONCLUSIONS

Seasonal readiness is a systematic and defined process that is repeated on an annual cycle. This cycle includes preparations, execution, restoration and feedback mechanisms to ensure lessons learned are captured year after year to continue to improve the overall process. This overall cycle is shown below.



Effective seasonal readiness can be achieved on a consistent basis by starting with a comprehensive initial assessment that will provide the basis and supporting documentation for an annual cycle. Implementation, including sufficient contingency, will create a reliable generation resource to the grid, while minimizing hazards to personnel. Capturing lessons learned will ensure that the seasonal readiness program is a "learning program' that continuously improves. Further the programmatic element assures that it not only continues to improve, but repeatedly supports reliable plant operations.

7
RECOMMENDATIONS FOR FURTHER DEVELOPMENT

Future development of the Seasonal Guidelines Report and underlying practices is expected to occur along the following lines:

Identification of the most critical systems and operational processes for each type of plant should be established. These systems and processes can be addressed in expanded detail in subsequent versions of this report. Mission critical systems, wherein a component failure can result in plant trip or damage are expected to comprise systems in this category. Critical operational processes will be identified and developed along the same line or reasoning.

Preventive Maintenance (PM) and Predictive Maintenance (PdM) processes can be developed and described or summarized in generic terms in a future report. These items can be incorporated into the Preventive Maintenance Database through template creation.

Establish recommendations for specific design bases for cold weather protection for each type of plant. This topic can include the following:

- Description of different types of freeze protection.
- Establishment of design parameters for 25 year (frequency of occurrence) limiting conditions of low ambient temperature plus coincident prevailing wind.
- Guidelines for wind breaks
- Guidelines for insulation types and typical installation details to avoid thermal short

A
EXAMPLE GOVERNING SEASONAL READINESS DOCUMENT

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1. Purpose and Scope

The purpose of the seasonal readiness procedure is to describe the process used to prepare the fleet and/or individual stations for safe and reliable operation during the summer and winter periods. The seasonal readiness procedure should be used in conjunction with site-specific procedures, maintenance tasks and policies to create a complete and thorough seasonal readiness program.

2. Roles and Responsibilities

2.1. Senior Management

2.1.1. Sets expectations for safety, reliability and compliance.

2.1.2. Ensures that a seasonal preparation process exists for each operating location

2.1.3. Challenges individual sites in the annual seasonal preparation cycle

2.1.4. Supports with the needed resources for preparation, training and execution of seasonal readiness

2.1.5. Encourages sharing of best practices and lessons learned across the fleet and through industry associations

2.2. Plant Management

2.2.1. Ensure site focus is on the implementation of seasonal readiness actions

2.2.2. Ensure site has developed a seasonal readiness procedure and available supporting documentations (procedures, maintenance items, etc.)

2.2.3. Develop contingency and communication plans for the winter and summer seasons.

2.2.4. Conduct a plant readiness review prior to the summer and winter months

2.2.5. Encourage plant staff to identify potential issues that may impact safety or reliability during the winter and summer seasons.

2.2.6. Ensure adequate resources are applied to execute the Seasonal Readiness scheduled items.

2.2.7. Ensure lessons learned and best practices after each season are discussed and incorporated into the seasonal readiness documentation.

2.3. Seasonal Readiness Coordinator

2.3.1. Responsible for facilitating seasonal readiness activities at a plant site/location.

2.3.2. Responsible for communication to plant management the status of seasonal readiness preparations and any associated support required.

2.3.3. Leads the site seasonal readiness team and facilitates team meetings

2.3.4. Facilitates the lessons learned and best practice review meetings and ensures all items are captured in plant documentation.

2.4. Site Seasonal Readiness Teams

2.4.1. Consists of representatives from Operations, Maintenance, Engineering and Support Organizations as applicable.

2.4.2. Lead various departments through the execution of seasonal readiness preparations. This may include system reviews, critical spare inventories, current equipment issues, work down curves, contingency plans, site operating experience, emergent activities, and upcoming milestones.

2.4.3. Provide information to site senior management during seasonal readiness challenge meetings.

2.4.4. Tracks resolution of any and all issues related to seasonal readiness.

2.4.5. Responsible to oversee Seasonal Readiness packages preparation and implementation.

2.5. Site Staff

2.5.1. Perform seasonal readiness preparations and execute seasonal readiness activities as directed by site procedures, policies and management.

2.5.2. Identify potential issues that may impact safety or reliability during the winter and summer seasons.

2.5.3. Feedback results from execution of readiness program, such as identifying insufficient heating or insulation, requirements to add heaters, or employ added cooling not considered part of the existing readiness program.

3. Definitions

3.1. Winter Season

The winter season shall be defined from November 1 to April 1.

3.2. Summer Season

The summer season shall be defined from June 1 to September 1.

4. Winter Season Program

4.1. Winter Readiness Coordinator and Team

4.1.1. Identify a winter readiness coordinator

4.1.2. Identify a winter readiness cross functional team with a member from Operations, Maintenance, and Engineering.

4.1.3. Develop a regular meeting schedule for the winter readiness team

4.1.4. During the winter readiness team meetings review the following:

4.1.4.1. Winter Readiness Workdown Log and Schedule

4.1.4.2. Winter Readiness Contingency Plans

4.1.4.3. Winter Readiness

4.1.5. At the conclusion of the winter season, schedule a debrief to review lessons learned

4.2. Preparation Activities

4.2.1. Develop a site-specific workdown list to prepare the site for winter operation and use to track applicable winter readiness activities

4.2.2. Perform winter readiness system walkdowns to identify any deficiencies and issues that will need repair.

4.2.2.1. Capture all issues within CMMS and flag for winter readiness

4.2.3. Review CMMS to identify any deficiencies and issues that will require repair prior to the winter months.

4.2.3.1. Ensure all items are properly flagged/coded for winter readiness and tracked

4.2.3.2. Schedule all winter readiness items within the normal work management process for completion by October 15.

4.2.3.3. Develop contingent work orders for items

4.2.4. Conduct winter readiness training and crew briefings in preparation for the winter months.

4.2.5. Develop contingency work orders for the winter season.

4.2.6. Develop communication plans for site shutdown, staffing changes and emergent events

4.2.7. Verify inventory of all supplies, PPE and material needed for the winter season.

4.2.8. Perform a site challenge review to ensure the site is prepared for the winter season.

4.3. Execution Activities

4.3.1. Initiate additional operator rounds for the winter months.

4.3.2. Review new issue reports daily and identify any items applicable to winter readiness.

4.3.3. Perform maintenance on winter readiness items in a timely fashion.

4.4. Restoration and Lessons Learned

4.4.1. Restore all winter readiness items to normal lineups.

4.4.2. Secure winter related operator rounds.

4.4.3. Conduct a critique of winter performance.

4.4.3.1. Use the corrective action program to capture lessons learned.

4.4.3.2. Incorporate lessons learned into procedures, work order, training, etc.

5. Summer Season Program

5.1. Summer Readiness Coordinator and Team

5.1.1. Identify a summer readiness coordinator

5.1.2. Identify a summer readiness cross functional team with a member from Operations, Maintenance, and Engineering.

5.1.3. Develop a regular meeting schedule for the summer readiness team

5.1.4. During the summer readiness team meetings review the following:

5.1.4.1. Summer Readiness Workdown Log and Schedule

5.1.4.2. Summer Readiness Contingency Plans

5.1.4.3. Summer Readiness

5.1.5. At the conclusion of the summer season, schedule a debrief to review lessons learned

5.2. Preparation Activities

5.2.1. Develop a site-specific workdown list to prepare the site for summer operation and use to track applicable summer readiness activities

5.2.2. Perform summer readiness system walkdowns to identify any deficiencies and issues that will need repair.

5.2.2.1. Capture all issues within CMMS and flag for summer readiness

5.2.3. Review CMMS to identify any deficiencies and issues that will require repair prior to the summer months.

5.2.3.1. Ensure all items are properly flagged/coded for summer readiness and tracked

5.2.3.2. Schedule all summer readiness items within the normal work management process for completion by May 15.

5.2.3.3. Develop contingent work orders for items

5.2.4. Conduct summer readiness training and crew briefings in preparation for the summer months.

5.2.5. Contact switchyard operator to ensure summer activities related to the switchyard have been completed.

5.2.6. Develop contingency work orders for the summer season.

5.2.7. Develop communication plans for emergent events.

5.2.8. Verify inventory of all supplies, PPE and material needed for the summer season.

5.2.9. Perform a site challenge review to ensure the site is prepared for the summer season.

5.3. Execution Activities

5.3.1. Initiate additional operator rounds for the summer months.

5.3.2. Review new issue reports daily and identify any items applicable to summer readiness.

5.3.3. Perform maintenance on summer readiness items in a timely fashion.

5.4. Restoration and Lessons Learned

5.4.1. Restore all summer readiness items to normal lineups.

5.4.2. Secure summer related operator rounds.

5.4.3. Conduct a critique of summer performance.

5.4.3.1. Use the corrective action program to capture lessons learned.

5.4.3.2. Incorporate lessons learned into procedures, work order, training, etc.

B
U.S. CLIMATE CONSIDERATIONS

The principal weather parameters of concern are ambient temperature and the presence of moisture in its various forms. Dry cold conditions represent one kind of challenge to equipment, but severe cold accompanied by moisture in the form of snow, sleet and freezing rain pose a different type of challenge. Hot and dry conditions impose one kind of challenge to power plant equipment, but warm/hot and moist conditions, extended over periods of one week or more, can lead to growths of mold, mildew, and other undesirable biological matter.

Within the continental United States, although average or normal minimum and maximum seasonal temperatures vary considerably from one location to another, extreme record temperatures, particularly maximum values, tend to show some consistency. Looking at temperature extremes and averages on a state by state basis does not adequately capture the data needed by an individual power plant. Site elevation and proximity to large bodies of water are very influential in determining the average and extreme highs and lows for any given plant.

The graphic in Figure 7-1 below illustrates the five regions into which the continental U.S. is divided by the U.S. Energy Information Administration as part of the Residential Energy Consumption Survey. The graphic broadly illustrates the diversity of temperature and moisture conditions across the continental U.S.

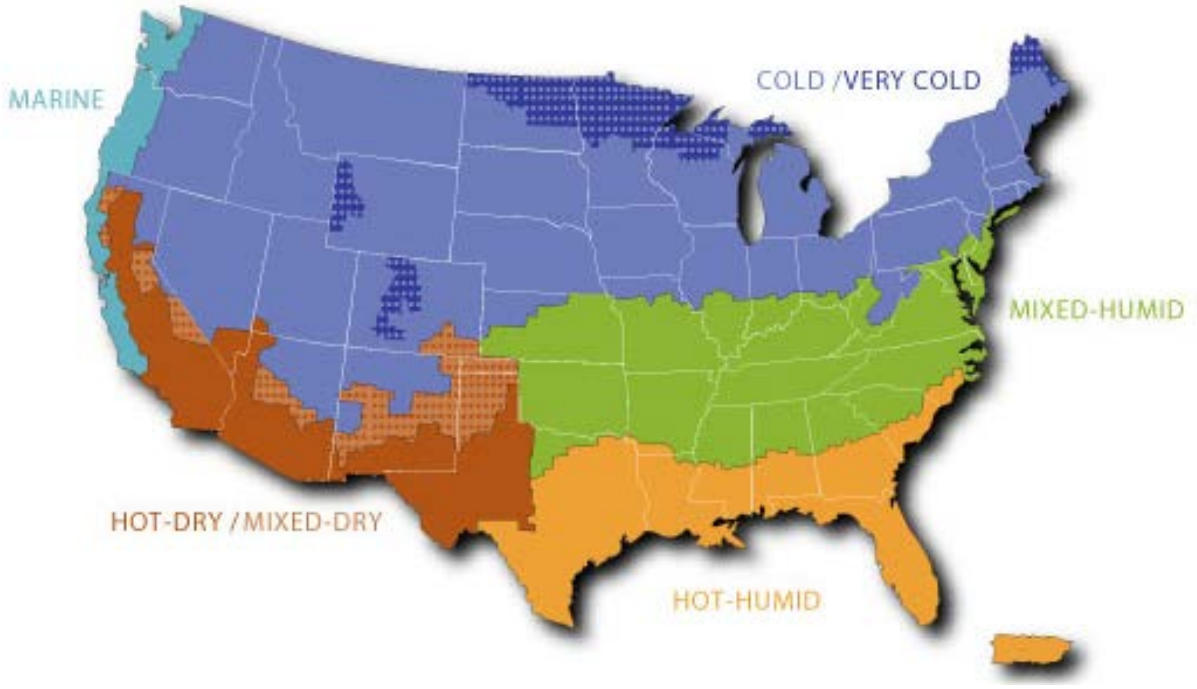

Figure 7-1
Regional Map of U.S. Showing Varying Climate Conditions

Similarly, the U.S. Department of Agriculture provides a map, Figure 7-2 below, that shows the boundaries of geographical zones with selected minimum temperatures. This map provides guidance on where freezing temperatures are likely to prevail, thereby requiring the provision of buildings or enclosures that are provided with space heating, or for items left out of doors, where heat tracing and insulation will be required.

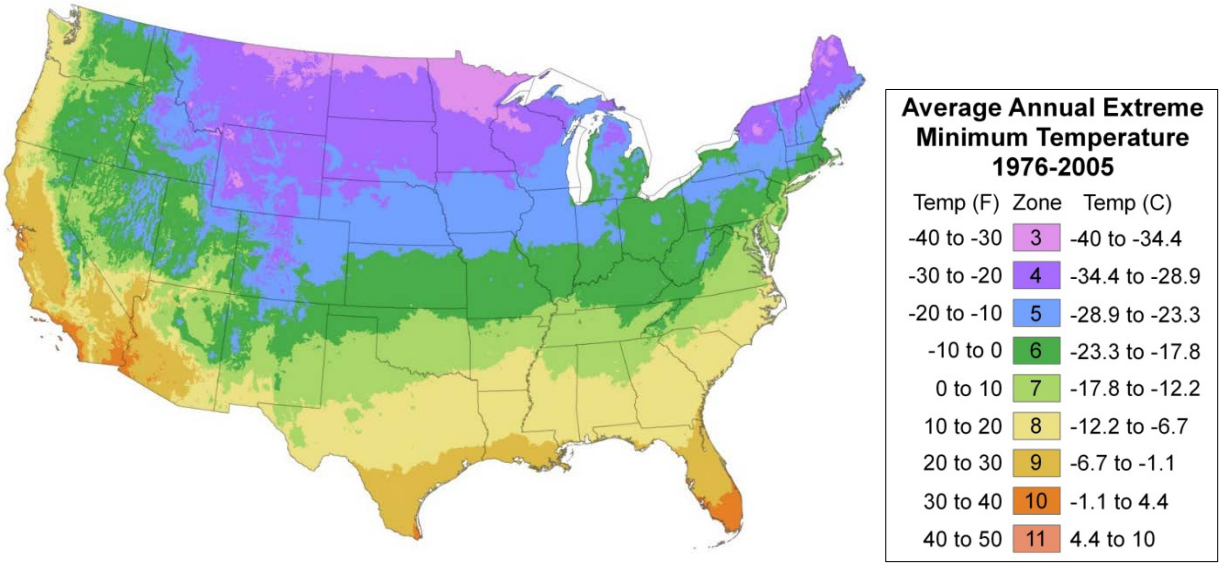

Figure 7-2
Plant Hardiness Zone Map from U.S. Dept. of Agriculture

When making preparations for seasonal readiness, the specific location of an individual site and the understanding of its own microclimate are paramount. Each facility must seek out and plan for its own specific weather expectations in terms of ambient temperature and moisture conditions (humidity, rain, snow, ice, etc.). The effects of microclimate on the local environment, particularly bio growth, insects, pollen, etc. are also important considerations for keeping a power plant running at design conditions. Humid and wet areas will promote the growth of biofilms and other bio growth that can impact component performance, especially at design or beyond design conditions.

Considerations for Humid Climate Zones

In many places humid conditions prevail during summer months. These conditions can facilitate growth of biofilms or biomass in wetted equipment such as cooling tower basins, heat exchanger tubes, etc. In general, measures to control this growth should be implemented to assure proper operation of affected equipment. This can range from chemical treatment of cooling tower circulating water systems to making sure that condensate drains from air conditioning and chilling equipment are free-flowing, and that mold and mildew are promptly treated. Dry climate zones may not see as much bio growth on a regular basis, but average annual peak temperatures may consistently be several degrees higher than in the humid zone regions. This puts more of a premium on maintaining heat transfer surfaces and capability in peak condition.

C
SYSTEMS IN SCOPE FOR SEASONAL READINESS

Activated Carbon Injection System	Emergency Generators
Batteries and DCS	Fabric Filters and Bag House
Boiler (Exhaust / Gas side)	Feed and Condensate Systems
Boiler Pressure Parts (Steam)	Fire protection systems
Bottom Ash Sluicing Systems (Wet System)	Fuel Oil Storage
Catalyst Systems	Generator Exciter
Closed Cycle Cooling Water System	HRSG Systems
Coal Handling Systems	Instrumentation and Controls
Combustion Turbine Electrical Starting System	Lube Oil
Combustion Turbine Fuel Supply System	Main Steam Surface Condenser
Combustion Turbines	Raw water supply system
Cooling Tower	Service and Instrument Air System
Demineralized Water Treatment Systems	Service Water
Draft Fans	Spray Dry Absorber and FGD System
Dry Ash Transport System (Bottom Ash, etc.)	Steam Turbine
Dry Sorbent Injection System	Switchyard
Electrical Generator	Transformers
Electrical Switchgear	Waste Water Systems

D
SAMPLE WORKDOWN TRACKING LIST

Item #	Unit	System	Issue	Work Request ID	Comments and Basis for Seasonal Readiness	Disposition
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						

E
SAMPLE SEASONAL READINESS BOARD QUESTIONS

Backlog and Deficiencies

- How did you determine the list of open backlog items?
- How did you determine the condition of degraded components?
- Did you perform a walk down of each deficiency?
- Did you perform a complete system walk down?
  - If not, why?
- What deficiencies were identified as a result of the walk down?
- What are the system material condition issues?
- What critical spare parts are **not** available?
- What modifications are pending for the system?
- Have there been any unexpected system failures during the last year?

Contingency Plans

- Has a review been performed for required contingencies for components whose failure would result in the unit being derated?
- Has a communication plan been put in place should the site be shutdown, weather prevents staff coming/going?
- Is there a current emergency contact list in place?

Trending

- Have you reviewed all available trending sources?
  - All available computer points
  - Vibration monitoring
  - Thermography
  - Motor Analysis
  - Oil analysis
  - Operator rounds
  - Monitoring and diagnostic center data

- What trending issues were identified?
- What was the time interval used for your trending review? Is it adequate?
- When is the component projected to fail? What is the certainty?
  - What is the worst thing that could happen if it failed?
  - What type of contingency would be needed to mitigate?

Maintenance and Operations Plans

- Have all open PM items been reviewed?
- Are the PM's being performed?
- Are there any PM's that have been deferred that could affect winter/summer operation?
- How have we verified vulnerable equipment has been identified, inspected, cleaned and maintained properly?
- How have we ensured equipment that has been adjusted for summer/winter operation is returned for winter/summer operation?
- What methods do we use to monitor heat exchanger performance?
  - What instrumentation is available, such as flow, pressure, and temperature on heat exchangers that can be used to provide early warning of degradation?
- Are there any procedure changes pending that would affect operation?
- Is there any necessary staff training that needs to take place?

Use of Lessons Learned

- What did your review of site lessons learned identify?
- What has been incorporated from last year's summer/winter season?
- Were any contingencies needed during the last summer/winter season?

What is the potential aggregate effect of all items discussed above?
What is the largest risk?
How do we mitigate it?
What help do you need?

F
SAMPLE HEAT TRACE LOG

Heat Trace Panel ID				
Panel Energized		**Date/Time**	**Alarms**	
Yes	**No***		**Yes***	**No**
* Comments Required. Issue Report written. Supervisor informed.				

G
WINTER READINESS ITEMS FOR CONSIDERATION

Item	Preparation Activities *(items which need to be completed prior to entering the designated Season)*	Execution Activities *(items to be completed during the designated Season)*	Restoration Activities *(items to be completed after the designated Season has ended)*	Contingency Items *(items that should be ready for execution during the designated Season as needed)*
Backlog and Open Work Orders	• Review the backlog and all open work orders and designate those associated with winter/summer readiness • Schedule all winter/summer readiness items within the normal work management process • Ensure the proper resources are placed on each item	• Finalize any open work orders that may impact readiness for winter/summer operation. Prioritize new work orders properly consistent with potential impact to operations under expected weather conditions.	• Write work orders as needed to remove any temporary seasonal equipment, portable heaters, extra cooling units, temporary power supplies, etc.	• Prepare open work orders and resources to make anticipated repairs due to seasonal challenges, based on experience and current status of plant systems and equipment.
System Walkdowns	•	•	•	•
Lessons Learned and Operating Experience	• Review all seasonal related events and work orders from past season. Confirm that corrective actions developed form lessons learned, event reviews, and work order history are identified and scheduled to be resolved for the upcoming seasonal readiness	• Capture events and work orders that provide lessons learned for future seasonal readiness efforts.	• Investigate events and work orders for appropriate root causes and identify needed corrective actions	• N/A
Insulation	• Inspect insulation and identify issues • Repair damaged insulation	• Identify damaged insulation	• Not applicable	• Temporary insulations • Portable heaters
Heat Trace	• Check heat trace circuits • Walkdown and inspect heat trace • Identify heat trace deficiencies	• Frequent operational check of heat trace circuits • Identify heat trace failures	• Secure heat trace circuits • Repair damaged heat trace	• Heat trace repair work orders and parts • Heating blankets • Temperature guns

Item	Preparation Activities *(items which need to be completed prior to entering the designated Season)*	Execution Activities *(items to be completed during the designated Season)*	Restoration Activities *(items to be completed after the designated Season has ended)*	Contingency Items *(items that should be ready for execution during the designated Season as needed)*
Instruments and Associated Lines	• Inspect insulation and identify needed repairs • Identify critical components	• Monitor instrument for faulty readings	• Not applicable	• Heating supplies • temporary instrumentation
Dampers and Louvers	• Walkdown areas and identify issues, obstructions	• Visually inspect automatically operated equipment	• N/A	• Repair as needed, thaw frozen obstructions
Area Heating	• Walkdown to assess proper operation, check auto controls or thermostats • Be aware of stored chemicals and the required storage temperature	• Increase rounds and inspections in heated areas	• N/A	• Have portable heating available. Verify power and fuel supplies
Low or No Flow Piping	• Develop list for all expected operating conditions. Confirm heat trace and insulation is in good condition. Drain if not protected.	• Include routine walkdown of piping to verify heat trace and insulation condition.	• N/A	• Establish alternate operating mode to keep flow in pipe
Fire Protection	• Confirm all dry pipes are fully drained and void of water, stagnant wet piping should be insulated and heat traced, confirm proper condition and operation, confirm all hoses are drained	• Include monitoring of fire water piping on routine observations/rounds	• N/A	• Store contingency hoses to back up inoperable installed systems
Lube Oil Heaters	• Verify heaters are in proper operating condition, including control devices	• Monitor oil temperature and heater operation	• Remove any external heaters that have been used.	• Add blankets or external heaters if needed to maintain oil temperature, increase sampling for moisture if temperatures are not maintained

Item	Preparation Activities *(items which need to be completed prior to entering the designated Season)*	Execution Activities *(items to be completed during the designated Season)*	Restoration Activities *(items to be completed after the designated Season has ended)*	Contingency Items *(items that should be ready for execution during the designated Season as needed)*
Motor Heaters	• Confirm proper operation	• Check idle motors to confirm heaters are warming motor	• N/A	• Provide external hot dry air to keep motor warm and dry
Moisture in Air Systems	• Confirm proper operation of air dryer systems	• Verify proper operation of air dryer systems, increase blowdown frequency of long piping runs	• Return to normal line blowdown frequency	• Provide temporary source of dry air. Ensure connections and power supplies are available
Icing of Open Systems	• Confirm proper operation of systems to prevent ice buildup and intrusion. Test operating components and systems such as circulating water recirculation valves, intake trash rakes, wash down systems, etc. Identify improperly working components and include in seasonal readiness work order scheduled work.	• Increase monitoring of areas that tend to ice up during extreme cold weather. Modify operator rounds accordingly to add systems and components used to prevent operational impacts due to icing of open water systems.	• Return to normal rounds.	• Provide standby and back up deicing capability for areas that are subject to freeze. Insure sufficient staff are available to manage the potential increase work load.
Treatment of Closed Loop Water Systems	• Confirm proper levels of antifreeze treatment exist in closed systems. • Verify external cooling is functioning at design prior to entering summer periods. Identify any needed heat exchanger cleaning.	• Increase monitoring of temperature sensitive areas.	• Return to normal operations and monitoring	• Backup cooling systems or alternate connections to existing systems may be needed to support operation. Prepare procedures and conditions that would require such implementation.

Item	Preparation Activities *(items which need to be completed prior to entering the designated Season)*	Execution Activities *(items to be completed during the designated Season)*	Restoration Activities *(items to be completed after the designated Season has ended)*	Contingency Items *(items that should be ready for execution during the designated Season as needed)*
Abnormal System Lineups	• Review all temporary systems lineups, jumpers and lifted leads to identify those that impact seasonal readiness. Return to normal operation, or develop plans to manage through the season with temporary condition in place.	• Be prepared to develop needed temporary changes to the plant to protect plant equipment for seasonal issues. • Incorporate temporary conditions into operator rounds, data collection efforts, and other operational procedures as needed.	• Return equipment to normal operating conditions. Return rounds and inspections to normal.	• If temporary lineups are needed to continue through the season, make sure needed parts are available to keep the temporary equipment in operation.
Air Cooled Condensers	• If segments of the heat exchanger are expected to be removed from service during winter, confirm that isolation valves and system drains work properly. Ensure procedures are in place to support expected operational conditions.	• Clean with care not to damage finned tubing as needed to achieve expected performance. • Implement sectional isolation per plant procedures.	• Return to normal operating conditions	• N/A
Leaks	• Correct deficiencies that cause leaks to prevent icing conditions.	• Promptly correct new leaks that occur that can cause ice buildup, slick walking areas and icicles. Monitor plant for buildup of icicles and slick walks and ladders. • Promptly correct leaks that impact cooling system performance or create personnel hazards.	• N/A	• Have plans to eliminate dangerous icicles. Be prepared to correct iced walks and ladders.

Item	Preparation Activities *(items which need to be completed prior to entering the designated Season)*	Execution Activities *(items to be completed during the designated Season)*	Restoration Activities *(items to be completed after the designated Season has ended)*	Contingency Items *(items that should be ready for execution during the designated Season as needed)*
Personnel Safety	• Conduct staff safety meetings to heighten awareness to upcoming conditions. Organize routine ongoing safety briefs and crew sessions in anticipation of upcoming season. • Inventory and store needed items for seasonal personnel safety.	• Continue routine safety meetings. Ensure crew briefs deal effectively with seasonal challenges and adequate warnings to staff. • Monitor staff performance to ensure proper safety conduct is in place	• Return to normal safety monitoring and briefing. Capture any lessons learned for future seasonal preparations.	• Have extra staff as needed to reduce extreme environmental impact on normal staff. Have contract in place to provide specialized seasonal services to allow plant staff to focus on operational needs of plant, while others take care of seasonal emergencies.
Contingency Plans	• Organize contingency plans so that proper equipment, materials, are staged. • Develop checklists to monitor status of all contingencies.	• Regularly confirm status of contingent equipment and material.	• Evaluate effectiveness of contingency plans, note items that require adjustment, correction. Also note unused/expensive contingencies to determine if they should continue to be implemented in future years	• N/A
Air Flow Pathways	• Include rounds or other inspection plans to maintain air flow paths needed for proper equipment clear of snow, ice, etc.	• Monitor routine air flow paths for obstructions. Buildup of snow can result in heating due to the insulating properties if air flow is blocked	• Return to normal rounds	• Have snow and ice removal equipment readily available to open blocked air flow passages

Item	Preparation Activities *(items which need to be completed prior to entering the designated Season)*	Execution Activities *(items to be completed during the designated Season)*	Restoration Activities *(items to be completed after the designated Season has ended)*	Contingency Items *(items that should be ready for execution during the designated Season as needed)*
Emergency Generators	• Confirm cooling systems are protected via heating or antifreeze. • Develop increase rounds or operating periods to maintain operational integrity	• Monitor equipment more frequently with special attention being paid to impact of cold weather. • Conduct increased test operations	• Return to normal rounds and testing	• Be prepared to run emergency generators through extreme cold weather to provide back-up capability. Have access to off-site back-up generators and connection capability.
Fuel and Material Handling	• Review solid fuel handling system to confirm ability to manage frozen coal • Review capability to manage other solid materials, such as limestone, gypsum, etc. under extreme cold conditions. • Evaluate the use of deicing chemical treatment of systems and equipment. • Narrow shuts should be heated and insulated if moist solids can flow through them. • Evaluate the use of strainers that may become iced/plugged.	• Routinely monitor heating systems that support operation of these systems • Implement deicing chemicals as determined appropriate.	• Return to normal monitoring • Curtail use of deicing chemicals.	• Have backup heaters available.

H
SUMMER READINESS ITEMS FOR CONSIDERATION

Summer Readiness Items for Consideration

Item	Preparation Activities *(items which need to be completed prior to entering the designated Season)*	Execution Activities *(items to be completed during the designated Season)*	Restoration Activities *(items to be completed after the designated Season has ended)*	Contingency Items *(items that should be ready for execution during the designated Season as needed)*
Backlog and Open Work Orders	• Review the backlog and all open work orders and designate those associated with summer readiness • Schedule all summer readiness items within the normal work management process • Ensure the proper resources are placed on each item	• Finalize any open work orders that may impact readiness for summer operation. • Prioritize new work orders properly consistent with potential impact to operations under expected weather conditions.	• Write work orders as needed to remove any temporary seasonal equipment, portable heaters, extra cooling units, temporary power supplies, etc.	• Prepare open work orders and resources to make anticipated repairs due to seasonal challenges, based on experience and current status of plant systems and equipment.
System Walkdowns	•	•	•	•
Lessons Learned and Operating Experience	• Review all summer related events and work orders from past season. • Confirm that corrective actions developed form lessons learned, event reviews, and work order history are identified and scheduled to be resolved for the upcoming seasonal readiness	• Capture events and work orders that provide lessons learned for future seasonal readiness efforts.	• Investigate events and work orders for appropriate root causes and identify needed corrective actions	• N/A
Dampers and Louvers	• Walkdown areas and identify issues, obstructions	• Visually inspect automatically operated equipment	• N/A	• Repair as needed, thaw frozen obstructions
Motor Heaters	• Confirm proper operation	• Check idle motors to confirm heaters are warming motor	• N/A	• Provide external hot dry air to keep motor warm and dry
Moisture in Air Systems	• Confirm proper operation of air dryer systems	• Verify proper operation of air dryer systems, increase blowdown frequency of long piping runs	• Return to normal line blowdown frequency	• Provide temporary source of dry air. Ensure connections and power supplies are available

Item	Preparation Activities *(items which need to be completed prior to entering the designated Season)*	Execution Activities *(items to be completed during the designated Season)*	Restoration Activities *(items to be completed after the designated Season has ended)*	Contingency Items *(items that should be ready for execution during the designated Season as needed)*
Abnormal System Lineups	• Review all temporary systems lineups, jumpers and lifted leads to identify those that impact seasonal readiness. Return to normal operation, or develop plans to manage through the season with temporary condition in place.	• Be prepared to develop needed temporary changes to the plant to protect plant equipment for seasonal issues. • Incorporate temporary conditions into operator rounds, data collection efforts, and other operational procedures as needed.	• Return equipment to normal operating conditions. Return rounds and inspections to normal.	• If temporary lineups are needed to continue through the season, make sure needed parts are available to keep the temporary equipment in operation.
Air Cooled Condensers	• Summer. Plan to clean coils as necessary based on inspections and performance.	• Clean with care not to damage finned tubing as needed to achieve expected performance. • Implement sectional isolation per plant procedures.	• Return to normal operating conditions	• N/A
Leaks	• Correct leaks that can impact cooling performance on cooling systems.	• Promptly correct leaks that impact cooling system performance or create personnel hazards.	• N/A	• N/A

Item	Preparation Activities *(items which need to be completed prior to entering the designated Season)*	Execution Activities *(items to be completed during the designated Season)*	Restoration Activities *(items to be completed after the designated Season has ended)*	Contingency Items *(items that should be ready for execution during the designated Season as needed)*
Personnel Safety	• Conduct staff safety meetings to heighten awareness to upcoming conditions. Organize routine ongoing safety briefs and crew sessions in anticipation of upcoming season. • Inventory and store needed items for seasonal personnel safety.	• Continue routine safety meetings. Ensure crew briefs deal effectively with seasonal challenges and adequate warnings to staff. • Monitor staff performance to ensure proper safety conduct is in place	• Return to normal safety monitoring and briefing. • Capture any lessons learned for future seasonal preparations.	• Have extra staff as needed to reduce extreme environmental impact on normal staff. • Have contract in place to provide specialized seasonal services to allow plant staff to focus on operational needs of plant, while others take care of seasonal emergencies.
Contingency Plans	• Organize contingency plans so that proper equipment, materials, are staged. Develop checklists to monitor status of all contingency	• Regularly confirm status of contingent equipment and material.	• Evaluate effectiveness of contingency plans, note items that require adjustment, correction. Also note unused/expensive contingencies to determine if they should continue to be implemented in future years	• N/A
Mold and Mildew	• Identify likely areas and causes of mold and mildew. Develop mitigation strategy. Obtain appropriate solutions and processes to remove mold and mildew that may develop.	• Implement mitigation strategy, avoid leaks, and moisture buildup. Add ventilation as needed to prevent mold and mildew. Correct any buildup promptly.	• Return to normal ventilation.	• Have contract in place for supplemental resources to correct problems if they develop.

Item	Preparation Activities *(items which need to be completed prior to entering the designated Season)*	Execution Activities *(items to be completed during the designated Season)*	Restoration Activities *(items to be completed after the designated Season has ended)*	Contingency Items *(items that should be ready for execution during the designated Season as needed)*
Biofouling	• Ensure proper operation of bio agents that prevent fouling. System should be tested for proper operation ahead of summer season.	• Monitor heat exchangers to identify potential biofouling conditions. Add data to rounds to monitor more closely. Promptly correct biofouling conditions as they develop.	• Return to normal water treatment of non-seasonal conditions.	• Have work orders planned to clean heat exchangers that traditionally have experienced biofouling.

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