



Water Atlas Extension







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- Thermoelectric power generation is threatened by disruption to water supply (quantity and quality).
- Threat assessments attempt to project how this threat is evolving with changing climate, technology, and resource demand.
- Current assessments lack access to potentially important plant-level data:
 - Unique modes of impact due to drought, flood, and water quality; and
 - Local mitigation measures employed.



Conduct plant-level interviews to determine:

Objective

- Specific modes through which extreme conditions impact power plant operations, and
- Specific measures implemented by owners/operators to mitigate water-related threats.



Questionnaire

- Contacted power plant operators.
- Semi-structure interview process conducted by phone.
- Approximately 30 questions.
- Limited to coal-fired generation.



Coal-Fired Plants Operating in U.S.

Water-Related Threat Questions

	Owner				
	Plant Name				
в	Fuel	Coal	Coal	Coal	Coal
dat	Number of Units				
eta	Generation Capacity (MW)	Medium	Large	Large	
Σ	Location (lat/lon; state)		-		
	Water Source (type, %)	Surface water (100%)	Surface water (100%)	Surface water (100%)	Surface water (100%)
	Water Source (name)				
	Annual Water Withdrawal (MGD)				
	Water Permitting Requirements (State-	State Water Departing (Lice)	Chake Maker Departing (Use)	Choke Maker Departing (Lice)	State Mater Reporting (11co)
	level, municipality, other provider?)	state water Reporting (Ose)	state water Reporting (Ose)	state water Reporting (ose)	state water Reporting (Ose)
Availability	Drought-related Constraints? (env flow, river operations, other users, power plant efficiency; gw: drawdowns) Frequency?	FERC-regulated reservoir. Plant owns reservoir and hydro station. Low flow contingency plans exist due to permit. Drought every 10-15 years (2007-2008). Rarely derated because it already has a low capacity factor.	Not a FERC-regulated reservoir but plant owns and controls the reservoir. Also installed an intake on adjacent river to account for drought issues. Installed because of FGD water intake increases. More of a contingency/motivated by recent drought.	FERC-regulated reservoir. Plant owns reservoir and hydro station. Low flow contingency plans exist due to permit. Drought every 10-15 years. Rarely derated because it's intake is at a lower elevation than downstream reservoir.	It's on a lake they created so no withdrawal constraints.
	Flood-related constraints? Frequency?	No b/c of reservoir upstream	No b/c of reservoir upstream	No b/c of reservoir upstream	No b/c of reservoir upstream
	Water quality-related Constraints?		No issues present		
	(thermal, biological, salinity, etc.)	None		None	None
	Peaking vs constant load considerations?	Peaking plant	Baseload plant	Baseload plant	Peaking plant
	Mitigation Strategies	Reservoir operations protocols manage water supply and coordinate withdrawals between neighboring power plants (coordinated with water supply extremes)	Added supplemental water supply with intake on adjacent river	Reservoir operations protocols manage water supply and coordinate withdrawals between neighboring power plants (coordinated with water supply extremes)	N/A
	Cooling Technology	Once-through	Once-through	Once-through	Recirculating tower with induced draft coo
	Any Storage/Cooling Ponds on-site?	No	No	No	No
	Discharge Permitting Requirements (State- level; temps, etc.)	State NPDES (NC has been more aggressive in terms of	State NPDES (State has been more aggressive in terms of water regulations: so putting treatment technologies on all coal plants.)	State NPDES (State has been more aggressive in terms of water regulations: so putting treatment technologies on all coal plants.)	State NPDES (State has been more aggressive in terms of water regulations: so putting treatment technologies on all coal plants.)
ischarge	Drought-related Constraints? (env flow, river operations, other users, power plant efficiency; gw: drawdowns)? Frequency of issues?	N/A	N/A	N/A	N/A
	Flood-related constraints? Frequency?	N/A	N/A	N/A	N/A
	Water quality-related Constraints? (thermal, biological, salinity, etc.) Frequency of issues?	Thermal limits exists but has not caused any problems.	Was a problem in the 1980s (standards issues) - discharge of coal pond goes to one river while discharge of cooling intake to another. Can adjust discharges as needed to account for low flows.	Summer, there's always a competition for cool water - for both thermal limits and fisheries. Group looks at that balancing specifically. Most of the time they make it work. Rarely derate.	Thermal pollution happens rarely. Even though plant created the lake, they still have to maintain standards for water quality discharge. Have to put in extensive treatment to meet the limits
	Peaking vs constant load considerations?	N/A	N/A	N/A	N/A
	Mitigation Strategies	N/A	N/A	Monitor thermal conditions and coordinate discharge with neighboring plants.	Derate
laneous	How does coal ash management influence water operations at the site?	Bottom ash (recycled water). Everything else in dry. Inactive ash pond.	Bottom ash (recycled water). Everything else in dry. Inactive ash pond. Planned retirement in 2035. In the	Bottom ash (recycled water). Everything else in dry. Inactive ash pond.	Everything's dry.
Miscel	Other	All units set to retire in 2025.	process of installing natural gas burners so that the plant can operate 50% with coal.	None	Planned retirement in 2029.
10	Metadata				1
ces	Metadata Availability				
ources	Metadata Availability Discharge				
Sources	Metadata Availability Discharge Miscellaneous				

• Identification of plant-level contacts was difficult successful for only 40% of plants (based on capacity)

	Total	Interviewed	Interviewed (% of Total)
Utilities	220	32	14.5
Plants	353	69	19.6
States with Coal Plants	46	23	50.0
Plant Capacity (GW)	279.5	91.9	33.0

 Covered broad range of geographies, plant characteristics, water sources, and water discharge practices.



Results: Water Supply

Institutional Controls on Water Supply by Region



Modes of Impact that Drought has on Water Supply and Discharge



- 49 plants reported drought related threats
- 5 modes of impact on supply
- 2 modes of impact on discharge



Mitigation Measures taken to Manage the Impact of Drought on Water Supply and Discharge



- In only 7 cases was no action taken
- 13 measures taken to manage supply
- Discharge-related drought impacts are usually not managed



Results: Flood

Modes of Impact that Flood has on Water Supply and Discharge



 32 plants reported flood related threats

- 10 modes of impact on supply
- 4 modes of impact on discharge



Mitigation Measures taken to Manage the Impact of Flood on Water Supply and Discharge



- In 13 cases no action was taken
- 10 measures taken to manage supply
- 5 measures taken to manage discharge



Modes of Impact that Water Quality has on Water Supply and Discharge



 32 plants reported water quality related threats

- 4 modes of impact on supply
- 2 modes of impact on discharge



Mitigation Measures taken to Manage the Impact of Water Quality on Water Supply and Discharge



- In 17 cases no action was taken
- 4 measures taken to manage supply
- 4 measures taken to manage discharge



- Key information missing from the open literature:
 - Unique threats posed to plants due to their location and design (25 unique modes), and
 - Physical and managerial measures taken to mitigate threats (115 measures across 69 plants).
- Each plant is largely unique; however, some broad trends exist relating threats and actions taken.
- Such information provides improved classification of a plant's availability for dispatch supporting:
 - System reliability assessments, and
 - Capacity expansion planning.