

Heat Impacts on Infrastructure & Personnel: An OKC Case Study

Final Report

Resilient Analytics

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Executive Summary

Oklahoma City Utilities Department (OKC) will experience several vulnerabilities due to future increases in extreme heat events as a result of projected changes in climate. Resilient Analytics (RA) is using a climate stressor methodology to analyze the impact of such extreme temperature events on critical OKC physical infrastructure assets and personnel. The methodology focuses on examining the effects of extreme temperatures on personnel and facilities in the years 2030, 2050 and 2070 compared to a baseline period of 1990 to 2009. In total 32 models and two representative concentration pathways (RCPs) were used in this analysis (RCP 4.5 and RCP 8.5). The RCP 4.5 is a stabilization scenario and assumes that climate policies are invoked to achieve the goal of limiting emissions, concentrations, and radiative forcing. The RCP 8.5 is a business as usual scenario with a continuous rise in global carbon emissions. Note that projected costs do not account for inflation.

Increases in daily heat index and daily maximum temperatures will put additional stress on the outdoor workers. This could lead to additional workplace accidents resulting in additional costs for OKC.

- By 2030, it is projected that the OKC service area will see an additional four weeks of temperatures over 95°F, and five days of temperatures over 105°F each year.
- By 2070, it is projected that the OKC service area will see an additional seven weeks of temperatures over 105°F, two weeks of temperatures over 110°F, and three days of temperatures over 110°F each year.
- If OKC does nothing, the risk of workplace accidents and injuries is estimated to increase by 4% by 2030 for RCP 4.5 and by as much as 9% by 2070 for RCP 8.5.
- The number of High Heat Index days is estimated to increase from 16 days to 26 days by 2030, and to 48 days by 2070. Historically almost zero Extreme Heat Index days occur. By 2070 two to six days of Extreme Heat Index days are projected. These days will present extreme risk to outdoor worker safety.
- A national heat stress standard could be put into place, which would require OKC to follow a regulated work/rest cycle. Implementing a standard work/rest cycle will help to avoid additional worker accidents and fatalities from increased heat.
- To offset losses in productivity associated with increases in work/rest cycles, OKC should implement scheduling related adaptation strategies to reduce exposure to mid-day heat. One example would be to flex outdoor worker schedules to earlier in the morning. Under this scenario, OKC would see savings from increased productivity. Annual savings range from \$88,000 to \$222,000 in 2030 and \$241,000 to \$994,000 in 2070 under the moderate and strict heat standard, respectively.

The facilities and assets owned and operated by OKC will also experience additional stress due to increases in temperature.

- By 2030, the lifespan for all roofing systems is projected to decrease by 2.9 to 4.9 years with little difference between the RCP 4.5 and RCP 8.5 scenario.
- By 2070 the roof lifespan under the average RCP 4.5 scenario is expected to decrease by 4.4 to 6.8 years. By 2070 the roof lifespan under the average RCP 8.5 scenario is expected to decrease by 5.9 to 8.7 years.

- Over the 60-years from 2021 to 2080 the reduction in lifespan for the roofing system at the Draper Water Treatment plant is projected to cost \$125,000 and \$152,000 under the RCP 4.5 and RCP 8.5 scenarios.
- At the Hefner Water Treatment Plant, the cost is projected to be \$87,000 and \$105,000 under the RCP 4.5 and RCP 8.5 scenarios.
- In the short term, the cost to retrofit the current roofing systems into cool roof alternatives is projected to outweigh the financial benefits of offsetting the reduction in roof lifespan.
- We recommend that the roofing systems be upgraded to a cooler alternative when the roof needs to be replaced. The cost to upgrade the roofing system upon roof replacement is significantly lower and could lead to long term savings.