Article Abstract

Title:	2D study of wind forces around multiple cooling towers using computational fluid dynamics
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Abstract:	A comprehensive numerical study for the determination of wind pressure coefficients on multiple cooling towers by simulating turbulence using Reynolds Averaged Navier-Stokes Equations (RANS) models of Computational Fluid Dynamics techniques (CFD) such as, Standard $k-\varepsilon$, RNG $k-\varepsilon$, Realizable $k-\varepsilon$ and Reynolds stress method were done. The main objective of this study is to explore an effective and reliable approach for evaluation of wind force on cooling towers (in interference) using the above turbulence models. The computed results on isolated and in single interference configurations of cooling towers were compared with the wind-tunnel tests data from Indian Institute of Technology, Kanpur, India for Krishnapatnam thermal power plant in Andhra Pradesh, India, so as to ascertain the accuracy of the available turbulence model. It was found through comparison that the pressure coefficients obtained using RNG $k-\varepsilon$ turbulence model is in good agreement on the windward face of the cooling tower and has the advantage of providing rapid solutions. These results were also corroborated using recommendations of Bureau of Indian Standards Code IS: 11504-1985and IS 4998: Part 1: 1992. After validating the numerical results with the wind-tunnel data above, a pure numerical study were done on three and five cooling towers (in interference) of same geometric configuration placed staggerly at different wind incidence angle. It was found that the property of approaching wind flow mainly influences the mean pressure coefficients on the cooling towers and the incident turbulence intensity profile has a significant effect on the fluctuating wind forces. Therefore, it is necessary to correctly simulate both the incident wind velocity and turbulence intensity in CFD to accurately predict the wind force. The recommended turbulence modeling techniques and associated numerical treatments provide an effective way for the designer to access wind effects on cooling towers.
Keywords:	Natural Drought Cooling Towers(NDCT), CFD, Krishnapatnam thermal power plant, Wind-tunnel