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Buoyancy driven acceleration in a hospital operating room indoor environment[1] JAMES MCNEILL, JEAN HERTZBERG, JOHN ZHAI, University of Colorado, Boulder — In hospital operating rooms, centrally located non-isothermal ceiling jets provide sterile air for protecting the surgical site from infectious particles in the room air as well as room cooling. Modern operating rooms are requiring larger temperature differences to accommodate increasing cooling loads for heat gains from medical equipment. This trend may lead to significant changes in the room air distribution patterns that may sacrifice the sterile air field across the surgical table. Quantitative flow visualization experiments using laser sheet illumination and RANS modeling of the indoor environment were conducted to demonstrate the impact of the indoor environment thermal conditions on the room air distribution. The angle of the jet shear layer was studied as function of the area of the vena contracta of the jet, which is in turn dependent upon the Archimedes number of the jet. Increases in the buoyancy forces cause greater air velocities in the vicinity of the surgical site increasing the likelihood of deposition of contaminants in the flow field. The outcome of this study shows the Archimedes number should be used as the design parameter for hospital operating room air distribution in order to maintain a proper supply air jet for covering the sterile region.

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