NUMERICAL INVESTIGATION FOR CONTROL AND REDUCE THE DISPERSION OF GASEOUS CONTAMINANTS INSIDE CHEMICAL LABORATORY

By

Eng. Mo'men Beshary Taie Beshary

A Thesis Submitted to the Faculty of Engineering at Cairo University in Partial Fulfilment of the Requirements for the Degree of MASTER OF SCIENCE

In

MECHANICAL POWER ENGINEERING

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
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Title of Thesis : NUMERICAL INVESTIGATION FOR CONTROL AND REDUCE THE DISPERSION OF GASEOUS CONTAMINANTS INSIDE CHEMICAL LABORATORY

Key Words: Chemical Laboratory, Ventilation, Gaseous Contaminants, CFD, Indoor Air Quality

Summary :

Providing a comfortable and healthy indoor environment for chemical laboratories is the primary concern of HVAC and healthy ventilation engineers, so control and reduce the dispersion of gaseous contaminant inside chemical laboratory is very important point.This thesis covers ventilation requirements for enclosed chemical laboratory subjected to emitted gaseous contaminant and how to control and reduce the contaminant concentration by using ANSYS FLUENT 15.0 for chemical laboratory that has the following dimensions 4.8m*4.3m*2.73m. The CFD modelling techniques solved the continuity, momentum, energy, and species transport equations in addition to k-ε model equations for turbulence closure. The model was plot using DesignModeler producing 2100000 mesh volumes and comparing results with results of previous research for make sure of ANSY FLUENT 15.0 results and also allowed better and meaningful predictions of the flow regimes. The air supply locations affect the dispersion of contaminant in the space and also the exhaust grille locations can reduce the level of contaminant concentration inside the laboratory. Throughout the present work, lots of parametric cases are studied that implement changes in ACH, supply and exhaust locations with and without bench hood exhaust that exist above the source of contaminant to obtain the optimum design for ventilation and better work environment that control and reduce the dispersion of gaseous contaminant inside chemical laboratory to the lowest concentration level to ensure the occupants' safety and yield to energy savings. The results show the necessary to make the design of supply diffuser and exhaust grille before establish the chemical laboratory for better ventilation that also yield energy savings where the lowest ACH can be used

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