



## DEPARTMENT OF MECHANICAL ENGINEERING Purdue School of Engineering and Technology

### SPRING 2005 SEMINAR SERIES

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Date: **Thursday, February 24, 2005**

Time: **11:00 am - 12:00 pm**

Room: **SL 165**

**Reception at 10:45 am (cookies and refreshments served)  
Everyone is invited**

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### **CFD Simulation of Flow and Mass Transfer in Pharmaceutical Isolators** **Dr. Nishant Nayan**

*Research Associate, Department of Mechanical Engineering, IUPUI*

**Abstract.** Isolator technology is gaining increasing popularity in the pharmaceutical industry as a standard for sterility testing and is also widely used for aseptic filling of products. For decontamination in isolators, vaporized phase hydrogen peroxide (VPHP) has been widely used for last ten years. The key advantages in using this chemical are its known ability to accomplish the decontamination faster, minimal material degradation and effectiveness against most microorganisms.

Though VPHP has been widely used, many factors which affect the 'kill rates' of microorganisms are still not very well understood. In order to generate production at a higher rate industrially, a growing need for validations and experiments to reduce the sterilization time has emerged. Therefore, a study concerning prototype geometry of a transfer isolator was undertaken using Computational Fluid Dynamics (CFD). In this preliminary investigation, the velocity profiles and the time needed for the overall distribution of VPHP were studied.

The scenarios investigated using CFD included the modeling of airflow at volumetric flow rates typically encountered in industry. The inclusion of fans was also studied. The velocity profiles and visualizations were obtained at sections inside the isolator in order to investigate areas of reduced or no flow. The results will be discussed with an introduction to using FLUENT commercial code to analyze general fluid flow problems.

**About the Speaker.** Dr. Nishant Nayan joined IUPUI in March 2004 as a Research Associate. His primary interest is in Computational Fluid Dynamics (CFD) and his research involves analyzing pharmaceutical isolators using CFD. He received his B.Eng. in Chemical Engineering from UMIST (Manchester, UK) in 1999 and his PhD in 2003 in CFD analysis of bioreactors at Birmingham University (UK) where he carried out research on the flow visualization and mixing of Newtonian and non-Newtonian fluids in stirred reactors. The key questions addressed were the velocity and shear in a bioreactor and their effect on the fluid mixing.

His research interests lie in airflow simulation, reaction modeling, Particle Image Velocimetry (PIV), Laser Doppler Velocimetry (LDV) and fluid dynamics in general.