

**EVALUATION OF OCCUPATIONAL EXPOSURE TO  
ETHYLENE OXIDE (ETO<sub>x</sub>) AND ITS EFFECTS  
ON WORKERS IN THE FIELD OF MEDICAL  
PRODUCTS STERILIZATION**

**By**

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## **Abstract**

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Ethylene oxide gas (EtO) represents an important hazardous industrial gas for the contact workers during the sterilization of the medical products. More recent work has focused on aspect of its harmful effects on exposed persons. Thus, the studying of the immunological parameters in exposed blood persons may help to predict the bad effects and these parameters like: immunoglobulin G (IgG) concentration and the clusters of differentiation subsets (CDs). Also, studying the hematological changes can give a good mirror of the general health of these contact persons; these parameters like: hemoglobin concentration (Hb), platelets count (PLT) and total leukocyte count (TLC). Finally, the hazardous effects of gas exposure may be clarified in studying the cancer incidence probability; studying of the p53 gene mutations is considered one of the further steps to know how to control these bad effects.

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### **List of Abbreviations**

<b>Btu</b>	British Thermal Unit.
<b>CA</b>	Chromosomal aberrations.
<b>CAD</b>	Coronary Artery Diseases
<b>CDs</b>	Clusters of differentiation subsets.
<b>CEA</b>	Carcino embryonic antigen.
<b>CNS</b>	Central nervous system.
<b>DNA</b>	Deoxy ribonucleic acid.
<b>ECH</b>	Ethylene Chlorohydrins.
<b>EDTA</b>	Ethylene di-amine tetra acetic acid.
<b>EG</b>	Ethylene Glycol.
<b>ELISA</b>	Enzyme Linked Immunosorbent-Assay.
<b>EtO</b>	Ethylene oxide gas.
<b>EPA</b>	Environmental Protection Agency.
<b>Fc</b>	Fab fragments.
<b>FCS</b>	Flow cytometry system.
<b>FSC</b>	Forward angle scatter.
<b>GC-MS</b>	Gas chromatography- Mass spectrometry.
<b>GST</b>	Glutathione-s-transferase enzyme.
<b>G-6-PD</b>	Glucose-6- phosphate dehydrogenase enzyme.
<b>HAS</b>	Human Albumin Serum.
<b>Hb</b>	Hemoglobin concentration.
<b>HE Val</b>	Hemoglobin adducts N- (2- hydroxy ethyl) valine.
<b>IFN</b>	Inter-feron.
<b>IgA</b>	Immunoglobulin –A.
<b>IgD</b>	Immunoglobulin-D.

<b>IgE</b>	Immunoglobulin-E.
<b>IgG</b>	Immunoglobulin-G.
<b>IgM</b>	Immunoglobulin-M.
<b>LD50</b>	Lethal Dose 50.
<b>NER</b>	Nucleotide Excision Repair.
<b>NLB</b>	Nuclei lysis buffer.
<b>OSHA</b>	Occupational Safety And Health Agency.
<b>ppm</b>	Part per million.
<b>PCV</b>	Packed cell volume (hematocrite value).
<b>PEL</b>	Permissible exposure limit.
<b>PK</b>	Proteinase –K.
<b>PLT</b>	Platelets count.
<b>RBC</b>	Red blood cells.
<b>RIA</b>	Radio Immune Assay.
<b>SCE</b>	Sister- Chromatid exchanges.
<b>S.D.</b>	Standard Deviation.
<b>SPSS</b>	Statistical Package of Social sciences.
<b>SSC</b>	Side angle light scaler.
<b>SSCP</b>	Single Stranded Conformational Polymorphism.
<b>STS</b>	Soft Tissues Sarcoma.
<b>TLC</b>	Total Leukocyte count.
<b>TWA</b>	Time Weighted Average.
<b>UDS</b>	Unscheduled Deoxy ribonucleic acid synthesis.
<b>WFI</b>	Water For Injection.



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## **Introduction**

Ethylene Oxide gas (EtO) is an important volatile industrial chemical. Its major importance in the heat -sensitive materials and products sterilization (***Nakata et al ., 2004***).

Although, EtO gas is a well-known sterilizing agent such as sterilizing bandages, sutures, surgical implements, oxygenators and tubing applied to heart surgery, the residual levels of EtO gas and ethylene glycol (EG), may be hazardous to the patients. Therefore, it must be removed by the aeration process (***Jordy et al., 2000 and Dias et al., 2009***).

The Ethylene oxide (EtO) gas is toxic to humans due to its epoxide forms hydroxyethyl adducts with macromolecules such as hemoglobin and DNA, so the gas is mutagenic in vivo and in vitro and carcinogenic in experimental animals (***Marczynski et al., 2006***). Also in human , due to its capability of increasing the incidence of leukemia and/or lymphoma in the exposed persons ( ***Vincent et al ., 2007***).

Concurrently, EtO gas may cause reproductive failure if exposed personals were exposed in large quantities (***Mendes et al., 2007 and Nancy et al., 2007***).