# Airborne Hydrocarbon Exposure and Lung Function Decline in Petrol Filling Station Employees

Nagaraja B G, Research Scholar, Malwanchal University, Indore

Prof.Dr. Pradeep VS, Research Supervisor, Malwanchal University, Indore

## Abstract

Petrol filling station employees are continuously exposed to airborne hydrocarbons and volatile organic compounds released during fuel dispensing and storage. These pollutants, particularly benzene, toluene, ethylbenzene, and xylene, represent significant occupational health hazards. Long-term inhalation exposure to petroleum vapors can impair respiratory function and lead to chronic pulmonary disorders. Several studies have reported reduced pulmonary function parameters among petrol pump workers compared with unexposed populations. Declines in forced vital capacity (FVC), forced expiratory volume in one second ($FEV_1$), and peak expiratory flow rate (PEFR) indicate both obstructive and restrictive respiratory patterns. The present article reviews the sources of airborne hydrocarbon exposure, pathophysiological effects on the respiratory system, and evidence of lung function decline among petrol filling station employees. Preventive strategies including occupational safety training, use of personal protective equipment, and routine pulmonary screening are also discussed. Protecting petrol station workers from hydrocarbon exposure is essential for preventing long-term respiratory complications and promoting occupational health.

**Keywords:** Petrol pump workers, hydrocarbons, occupational exposure, pulmonary function, respiratory impairment

## Introduction

Petrol filling stations are important sources of environmental and occupational exposure to volatile organic compounds (VOCs). Workers at these stations are repeatedly exposed to gasoline vapors released during fuel transfer and vehicle refueling. These vapors contain toxic hydrocarbons such as benzene, toluene, ethylbenzene, and xylene, collectively known as BTEX compounds (Uzma et al., 2008).

Occupational exposure to these hydrocarbons has been associated with several adverse health outcomes including respiratory disorders, neurological symptoms, and hematological abnormalities (WHO, 2021). Petrol pump workers are particularly vulnerable because they remain in close proximity to fuel pumps for prolonged periods. Continuous inhalation of petroleum vapors can irritate the respiratory tract and impair lung function over time.

In many developing countries, petrol pump attendants work in open environments without adequate ventilation systems or protective equipment. As a result, their exposure to airborne pollutants is significantly higher than that of the general population (Solanki et al., 2015). Studies have reported that petrol pump workers frequently experience respiratory symptoms such as cough, wheezing, breathlessness, and throat irritation (Thomas et al., 2020).

Urban petrol stations present an additional risk because workers are exposed not only to fuel vapors but also to vehicular exhaust emissions containing particulate matter and nitrogen oxides. Combined exposure to these pollutants can accelerate respiratory damage and increase the risk of chronic pulmonary disease (Moghadam et al., 2019).

Considering the growing number of petrol stations and workers employed in this sector, evaluating the respiratory health effects of hydrocarbon exposure is crucial. This article examines the relationship between airborne hydrocarbon exposure and lung function decline among petrol filling station employees.

## Occupational Exposure to Hydrocarbon Vapors

Petrol is composed of a complex mixture of hydrocarbons that readily evaporate at ambient temperatures. During refueling operations, a portion of the fuel vaporizes and enters the surrounding air. Workers stationed near fuel dispensers inhale these vapors repeatedly throughout the day.

Among the hydrocarbons present in petrol, benzene is considered particularly hazardous due to its toxic and carcinogenic properties (WHO, 2021). Studies have shown that petrol pump attendants may experience significant benzene exposure during fuel dispensing activities (Solanki et al., 2015).

Other hydrocarbons such as toluene and xylene can also cause respiratory irritation and systemic toxicity when inhaled in high concentrations (Uzma et al., 2008). These chemicals can enter the body through inhalation and are absorbed into the bloodstream through the lungs.

Petrol pump attendants typically work shifts ranging from eight to ten hours per day. During this time they may perform hundreds of refueling operations, increasing their cumulative exposure to fuel vapors (Thomas et al., 2020). Repeated exposure over several years may lead to chronic respiratory damage.

Poor workplace safety practices further contribute to hydrocarbon exposure. Many petrol pump workers do not use personal protective equipment such as

masks or respirators. Inadequate ventilation and prolonged working hours also increase exposure levels (Solanki et al., 2015).

## Pathophysiological Effects of Hydrocarbon Inhalation

Hydrocarbon vapors can affect the respiratory system through several biological mechanisms. When inhaled, these compounds irritate the epithelial lining of the respiratory tract, triggering inflammatory responses. Chronic inflammation can lead to airway narrowing and reduced lung elasticity.

Hydrocarbons also induce oxidative stress by generating reactive oxygen species within pulmonary tissues. These reactive molecules damage cellular structures and impair normal respiratory function (Uzma et al., 2008).

Another important mechanism involves the deposition of hydrocarbon metabolites in lung tissues. Benzene metabolites, for example, can disrupt cellular repair mechanisms and increase susceptibility to respiratory infections (WHO, 2021).

Prolonged exposure may therefore lead to structural changes in lung tissue, including airway obstruction and reduced lung capacity. These pathological changes can be detected through pulmonary function tests.

## Effects on Pulmonary Function

Pulmonary function tests provide objective measurements of lung capacity and airflow. Several studies have demonstrated significant reductions in lung function parameters among petrol pump workers.

Singhal et al. (2007) conducted a comparative study evaluating pulmonary function among petrol pump workers and healthy individuals. The study found that workers exposed to petrol vapors had significantly lower FVC and $FEV_1$ values compared with controls.

Similarly, Solanki et al. (2015) reported decreased pulmonary function parameters among petrol station workers exposed to fuel vapors for extended periods. The study indicated that chronic hydrocarbon exposure can impair lung function and reduce respiratory efficiency.

A meta-analysis conducted by Moghadam et al. (2019) further confirmed that occupational exposure to petrol fumes is associated with significant reductions in several pulmonary parameters, including FVC, $FEV_1$, and peak expiratory flow rate.

These findings suggest that petrol pump workers are at increased risk of both obstructive and restrictive respiratory disorders due to occupational exposure to hydrocarbons.

**Respiratory Symptoms Among Petrol Pump Workers**

In addition to measurable lung function decline, petrol pump workers frequently report respiratory symptoms related to hydrocarbon exposure.

Common symptoms include chronic cough, shortness of breath, wheezing, and throat irritation (Thomas et al., 2020). These symptoms are often more pronounced among workers with longer occupational exposure.

Uzma et al. (2008) reported that petrol pump workers exposed to fuel vapors exhibited significantly higher rates of respiratory morbidity compared with

unexposed individuals. The study also observed increased prevalence of headaches, dizziness, and fatigue among workers.

Persistent respiratory symptoms may eventually lead to chronic respiratory diseases such as bronchitis or chronic obstructive pulmonary disease if exposure continues over long periods.

## Environmental and Occupational Risk Factors

Several factors influence the severity of respiratory impairment among petrol pump workers.

**Duration of exposure:** Workers with longer employment history tend to show greater reductions in lung function (Solanki et al., 2015).

**Urban air pollution:** Petrol stations located near heavy traffic areas expose workers to additional pollutants such as particulate matter and nitrogen oxides (Moghadam et al., 2019).

**Smoking habits:** Smoking can exacerbate the harmful effects of hydrocarbon exposure by increasing airway inflammation and oxidative stress.

**Lack of protective equipment:** Failure to use masks or respirators increases inhalation exposure to petrol vapors (Thomas et al., 2020).

## Preventive Measures

Reducing occupational exposure to hydrocarbons requires several preventive strategies.

Proper ventilation systems can reduce hydrocarbon concentrations in petrol stations. Installation of vapor recovery systems can capture fuel vapors released during refueling.

Use of personal protective equipment such as respirators can also help reduce inhalation exposure. Workers should be educated about occupational hazards and safe work practices.

Regular medical examinations, including spirometry tests, are essential for early detection of respiratory impairment (WHO, 2021).

Government regulations and workplace safety policies should also ensure that petrol station operators maintain safe working conditions for employees.

## Implications for Occupational Health Nursing

Occupational health nurses play an important role in protecting the health of petrol pump workers. They can conduct regular health screenings, monitor respiratory symptoms, and provide education regarding occupational safety.

Nurses can also promote health awareness among workers and encourage adoption of protective measures such as mask use and smoking cessation.

Through workplace health programs and surveillance systems, occupational health nurses can help identify early signs of respiratory impairment and prevent long-term complications.

## Conclusion

Airborne hydrocarbon exposure is a significant occupational hazard for petrol filling station employees. Prolonged inhalation of petrol vapors containing toxic hydrocarbons can lead to progressive lung function decline and increased respiratory morbidity.

Studies consistently demonstrate reduced pulmonary function parameters among petrol pump workers compared with unexposed individuals. Factors such as duration of exposure, urban air pollution, smoking, and lack of protective equipment further increase the risk of respiratory impairment.

Effective occupational health interventions including ventilation systems, personal protective equipment, health education, and regular medical screening are essential to protect workers from hydrocarbon exposure.

Ensuring safe working environments for petrol pump employees is critical for improving occupational health outcomes and preventing chronic respiratory diseases.

**References**

Moghadam, S. R., et al. (2019). Occupational exposure to petrol fumes and pulmonary function decline: A systematic review and meta-analysis. *Journal of Occupational Health.*

Singhal, M., Khaliq, F., Singhal, S., & Tandon, O. P. (2007). Pulmonary functions in petrol pump workers. *Indian Journal of Physiology and Pharmacology.*

Solanki, R., Bhise, A., & Sheth, N. (2015). Effect of petrol fumes on pulmonary function tests in petrol pump workers. *Lung India.*

Thomas, J. S., et al. (2020). Awareness and prevalence of respiratory morbidity among petrol pump workers. *Journal of Family Medicine and Primary Care.*

Uzma, N., Kumar, B. S., Hazari, M. A., & Kishore, B. K. (2008). Exposure to benzene and respiratory health effects among petrol pump workers. *Environmental Toxicology and Pharmacology.*

World Health Organization. (2021). *Benzene exposure and health effects.*