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Fact Sheet	
 The logo for the California Department of Health Services (dhs) features a green outline of the state of California. Inside the outline, there is a caduceus symbol (a staff with two snakes and wings) in orange and yellow. Below the state outline, the letters 'dhs' are written in a large, bold, black font. Underneath 'dhs', the words 'DEPARTMENT OF HEALTH SERVICES' are written in a smaller, black, sans-serif font.	<p style="text-align: center;">Hazard Evaluation System and Information Service</p> <p style="text-align: center;">850 Marina Bay Parkway Building P, 3rd Floor Richmond, CA 94804</p> <p style="text-align: center;">(866) 282-5516</p>

Workplace Pulmonary Function Testing

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Introduction

The main way in which workers are exposed to chemicals in the workplace is through breathing the substance into their lungs. Some chemicals can irritate the nose or throat; they can also cause discomfort or coughing when they are inhaled into the lungs. Some chemicals can cause more severe damage and serious lung disease.

Pulmonary (lung) function tests (PFTs) are tools used in the diagnosis of lung disease. These tests can often identify problems early in the course of disease, sometimes before physical examinations or chest X-rays. While PFTs by themselves cannot determine the cause of any

abnormality, they can be used in combination with other tests to help determine what *type* of lung disease a person has.

Studies of lung function range from relatively simple tests which can be done at the workplace to complex tests which are done in a medical laboratory. This fact sheet concentrates on spirometry, a type of lung function test which can be done at the workplace, and explains how it is done and what it shows.

How Your Lungs Work

The main job of your lungs is to bring oxygen into your body and get rid of carbon dioxide in your blood. When you breathe, the lungs and chest wall act as a bellows to bring in fresh air. The *upper airway* carries air to the lungs. The *lower airways* branch out like a tree. The branches end in tiny air sacs called *alveoli*, where oxygen passes into your blood while waste gases such as carbon dioxide are returned from your blood and breathed out.

The lung's defense mechanisms can become overloaded and worn out by too much exposure to dusts and fumes for too long a time. This can allow lung tissue to be damaged. Healthy lung tissue is elastic; it can expand and contract. Some lung diseases interfere with the lungs' elastic property and make the lungs "stiff." Stiff lungs often cause the lung volume to be reduced, which is called *lung restriction*. Other diseases can cause *airways obstruction*, a narrowing of the tubes of the lung. Airways obstruction reduces the rate at which air can pass through the airways. Both lung restriction and airways obstruction can be caused by overexposure to certain chemicals.

Spirometry

Spirometry testing is useful for determining: 1) if a person has lung disease; 2) what type it is; 3) whether a person is getting better or worse; and 4) how impaired a person's health is.

The basic test of mechanical lung function can be done with a spirometer. (A spirometer is an instrument used to measure the volume of air entering and leaving the lungs.) To do the test, a person inhales fully and then blows out the air in his or her lungs through a tube as hard, fast, and completely as possible. The test is repeated until at least two of the exhaled breaths are as good as possible. The spirometer measures the amount of air expelled and the speed at which the lungs can be emptied. These measurements are useful in evaluating respiratory disease. These measurements are called FVC and FEV1, and are described below.

Forced Vital Capacity (FVC) is the maximum volume of air that can be blown out at maximum speed after a full breath is taken. An FVC between 80% and 120% of the predicted level is considered normal. When lungs are stiff because of diseases of the lung tissue, such as pneumonia or lung scarring due to asbestos exposure, they often show reduced lung volume. When a disease causes this type of abnormality, it is called a *restrictive* lung disease. A normal

FVC means it is unlikely that a person has a *restrictive* lung disease. The FVC can be low for other reasons, such as chest pain, other types of illness, or lack of effort.

Forced Expiratory Volume in One Second (FEV1) is the maximum volume of air that can be exhaled during the first second of a complete, fast, forced expiration. An FEV1 between 80% and 120% of the predicted level is considered normal. FEV1 is useful in diagnosing *obstructive* lung disease. FEV1 is reduced when the airways (*bronchial tubes*) are narrowed or obstructed, as in asthma. It can also be reduced in restrictive lung disease.

Ratio of FEV1/FVC - The ratio of the two values is useful in determining the type of lung disease a person may have. A ratio of 0.7 or above is considered normal. The ratio of FEV1 to FVC may be reduced in the presence of airway obstruction, but the ratio is normal in restrictive lung disease.

How Are Tests Interpreted?

An individual's lung function test results are interpreted by comparing them to the results predicted for a person of the same sex, age, height, and race.

Who Should Get Lung Function Tests?

All workers who are exposed to dusts, metal fumes, chemical vapors, and gases which affect the lungs should be given regularly scheduled lung function tests. This simple exam is a valuable tool in a full program for detecting and preventing serious occupational lung disease. Under the law, workers exposed to certain health hazards, such as cotton dust or asbestos, must be given periodic PFTs.

Most lung diseases take many years of exposure to develop. Symptoms of lung disease such as shortness of breath, wheezing, and coughing usually develop gradually. Lung function tests and an awareness of pulmonary symptoms are useful in early detection of lung disease. PFTs can help detect illness at an early stage before symptoms are apparent to the worker.

Rights and Responsibilities

Under the law, employers are required to protect workers from overexposure to hazardous substances. If overexposures cannot be prevented by engineering or other controls, then personal protective equipment, such as a respirator, is required. In these cases, employers must develop and follow a respiratory protection plan which includes medical evaluation, fit testing, maintenance, and training.

You have the legal right to see and copy your lung function tests and other medical records, as

well as records of your exposure to toxic substances (California *GISO 3204*). These records are important in determining whether your health has been affected by your work. If your employer has such records, the records must be kept and made available to you for at least 30 years after the end of your employment.