



LIFE SCAN

Wellness

The Life Scan Wellness Centers program focuses on early detection and prevention for public safety officers. All services provided by Life Scan are carefully selected to maintain uniformed personnel's overall health status including physical and mental capabilities. The selection of services is based on the National Fire Protection Agency (NFPA) and the Fire Service Joint Labor Management Wellness-Fitness Initiative (WFI); these are the governing organizations that establish the health and wellness guidelines to which public safety officers comply. The Life Scan program described in this book is up to date with the current NFPA 1582 and 1583 editions as well as the WFI 4th edition. To assure an effective wellness program, all Life Scan specialists thoroughly understand the essential job tasks of uniformed personnel and the program is tailored to meet the specific needs of this population.

Life Scan's background in the area of professional medical services and prevention-based health, wellness, and fitness programs spans over fifteen successful years in development and implementation of programs for state municipalities and counties to fit their specific needs. Life Scan's unique formula generates a healthier and more productive work force resulting in reduced absenteeism, better interventional care, and substantial healthcare cost savings to the employer with the potential to save the lives of America's heroes.



For more information, visit the NFPA website at www.nfpa.org

WE PROTECT THOSE WHO PROTECT US

Exclusively designed to meet the unique needs of public safety officers, Life Scan offers an annual occupational health, wellness, and fitness evaluation that focuses on early detection and prevention. We will assist your department in complying with OSHA and state guidelines as well as NFPA medical standards, meeting your health and wellness initiatives and going beyond.

WE TACKLE THE BIG ISSUES: CANCER, HEART DISEASE AND BEHAVIORAL HEALTH

Cancer is on everyone's radar early detection saves lives. It is a fact: And first responders' risk and rates of cancer is a national crisis. The bottom line is that a standard physical cannot find cancer until it is too late. And with first responders the cause of cancer is so often from exposure and the resulting cancer is often extremely aggressive and spreads quickly.

Cardiovascular Disease is still the leading cause of first responders' deaths today and now claims its victims younger and younger every year. Enlarged hearts as well as aortic valve damage are best measured by ultrasound and not identified by just listening with a stethoscope.

Behavioral Health: First responders are exposed to scenes and situations that are beyond comprehension. Life Scan incorporated a behavioral health/trauma screening into our physical exam.

NFPA and OSHA Compliant:

The Life Scan public safety physical is an integrated medical approach to occupational exams that combines NFPA 1582 physicals, NFPA 1583/Wellness Fitness Initiative fitness evaluations, and OSHA 1910.134 Respirator Medical Clearance and Mask Fit Testing with advanced medical assessments for the early detection of the major diseases such as heart disease, stroke, cancer, diabetes, and aneurysms before they reach a catastrophic level. It provides your employees with a thorough assessment of their health as well as recommendations for achieving and maintaining long term health and managing medical risks.

Improved Fitness

Life Scan's WFI- Compliant Firefighter Fitness Analysis ensures firefighters are in top physical condition for better on-the-job performance and overall wellbeing. Our integrated fitness initiative includes diet and nutritional analysis, a state-of-the-art fitness evaluation, and a personalized wellness plan to create an ongoing customized fitness plan for each individual officer and firefighter.

Cost Containments

Our successful early detection rates reduce health care costs and workers compensation costs because many health issues are identified before they reach catastrophic levels.

HEALTH, WELLNESS, & FITNESS PROGRAM OVERVIEW

Comprehensive Public Safety Physical (NFPA 1582 compliant)

- Hands-on Physical Exam
- Medical & Occupational/Environmental History Questionnaire
- Back Health Assessment
- Breast Exam
- Vision Exam (Titmus) Ishihara, color, binocular, and depth perception
- Audiology
- Skin Cancer Assessment
- Personal Consultation with review of testing results

Behavioral Health Assessments

- Behavioral Health Resource Toolkit
- National Recognized Board of Behavioral Health Experts
- Evidenced-Based Assessment and Screenings
- Sleep Disturbance and Mental Health Questionnaires

Blood Analysis and Laboratory Tests

- Colon Cancer Screening (Hemoccult Test)
- Urinalysis Dip
- Lipid Panel (Cholesterol, Ratio, and Blood Glucose)
- Diabetes Tests (Hemoglobin A1C and Glucose)
- Comprehensive Metabolic Panel (Renal and Liver Functions)
- Thyroid Panel
- PSA (men)
- CA-125 (women)

Cancer, Heart, Vascular, and Disease Screenings

- Echocardiogram (Heart Ultrasound)
- Aorta and Aortic Valve Ultrasounds
- Carotid Arteries Ultrasound with CIMT Calculation
- Thyroid Ultrasound
- Liver, Gall Bladder, Spleen, & Kidney Ultrasounds
- Bladder Ultrasound
- Pelvic Ultrasounds for Women (Ovaries and Uterus)
- Prostate and Testicular Ultrasounds for Men

Cardiopulmonary Assessment

- Resting EKG
- Cardiac Treadmill Stress Test with EKG (Bruce Protocol)
- Pulmonary Function Test (Spirometry)

Fitness Evaluation (NFPA 1583-WFI Guidelines)

- Muscular Strength and Endurance Evaluation
- Aerobic Endurance Evaluation (VO2 Max Calc)
- Nutrition and Diet Recommendations
- Personal Fitness Recommendations and Exercise Prescription
- Body Weight and Composition (Body fat, Calipers)

Medical Clearances

- Firefighter Medical Clearances NFPA 1582

WHAT TO EXPECT DURING EACH PORTION OF YOUR EXAM

Physical Examination

The Life Scan Mid-Level Practitioner is responsible for providing an annual comprehensive medical assessment for uniformed personnel. The medical examination provides invaluable health status assessments of both the individual and department wide. The medical evaluation is intended to identify whether an individual is physically and mentally able to perform essential job duties without undue risk of harm to self or others, monitor acute and long-term effects of the working environment of uniformed personnel, detect patterns of disease in the workforce that might indicate underlying work-related health concerns, provide quantifiable medical information on the entire workplace, and inform uniformed personnel of their occupational hazards and health status. This medical evaluation complies with federal, state, provincial and local health and safety requirements. The Mid-Level Practitioner has a thorough understanding of the public service officer positions including essential job tasks, physical demands, psychosocial stressors, various environmental exposures and the effects of medical conditions on essential job tasks. The following outlines the medical evaluation provided by the Mid-Level Practitioner:

Health History Questionnaire

A medical history questionnaire is completed by each patient prior to the physical examination. This questionnaire is essential for establishing a medical baseline and annual questionnaires provide follow-up information to aid in identifying changes in health status.

Vital Signs

The Mid-Level Practitioner, in addition to the other specialists at Life Scan Wellness Centers, checks each patient's most basic body functions including:

- *Body Temperature* – measured orally.
- *Pulse Rate* – measured and recorded by the Clinical Exercise Specialist through the use of an electrocardiogram (EKG) and measured manually by the Mid-Level Practitioner.
- *Blood Pressure* – measured and recorded by the Clinical Exercise Specialist both at rest and during the (EKG) stress test.
- *Respiratory Rate* – manually assessed.

Head, Eyes, Ears, Nose and Throat (HEENT) Exam

The hands-on physical examination includes the assessment of the head, eyes, ears, nose and throat (HEENT) with the inclusion of occupational hearing and vision examinations. The HEENT includes a thorough evaluation of:

- *Head* – searching for shape abnormalities or evidence of previous trauma that may interfere with the use of SCBA or other Personal Protective Equipment (PPE).
- *Eyes* – searching for inadequate eye function or diseases that can potentially impair essential job tasks such as driving capabilities as well as the ability to accurately read placards and street signs. The eye exam consists of tests for visual acuity, pupil function, and extra ocular muscle motility as well as external examination of the eyes.

- *Ears* – the physical assessment of the ears includes an evaluation of the auditory canal and tympanic membrane. Public safety officers should have adequate hearing in order to hear and understand the spoken voice under conditions of high background noise, or hear, recognize and directionally locate cries or audible alarms.
- *Nose* – inspected for deformities or diseases which could potentially affect the ability to properly secure facial personal protective equipment (PPE) or to detect harmful toxins and chemical fumes.
- *Mouth/Throat* – evaluation of the oropharyngeal cavity, gums, teeth/dental structures, palate, tongue, tonsils and posterior pharyngeal wall is conducted to detect pre-cancerous changes due to environmental exposure.
- *Neck* – evaluation of major vessels, lymph nodes, salivary and thyroid glands, physiologic functioning (e.g. swallowing, saliva production), and an assessment for abnormal masses, gland enlargement, or suspicious skin lesions. Range of motion of the cervical spine is also assessed and noted. Any neck or throat abnormalities can impair the safety and performance of one or more of the essential job tasks.

Occupational Vision and Hearing

The assessment of vision includes evaluation of distance, near, peripheral, and color vision; more in depth, the visual evaluation comprises visual acuity screening for both far vision acuity and near vision acuity with the eyes tested separately, vision testing to determine both uncorrected and corrected visual acuity, color vision testing using color plates, and a peripheral vision evaluation. This screening is used to detect presbyopia, or near visual loss, which is common in adults and escalates in prevalence with increasing age. Other common visual disorders that may be identified are cataracts, macular degeneration, glaucoma, and diabetic retinopathy.

A hearing examination, which is done in accordance with 29 CFR 1910.95, “Occupational Noise Exposure,” is conducted at the following frequencies: 500 Hz, 1000 Hz, 2000 Hz, 3000 Hz, 4000 Hz, 6000 Hz and 8000 Hz. The testing is done in an ANSI-approved soundproof booth with pure tones presented at various intensities until a threshold is established. This test is important for uniformed personnel because by nature of their occupation, they are at an increased risk for noise-induced hearing impairment at an earlier age.

Cardiovascular and Pulmonary Function

The Mid-Level Practitioner manually evaluates cardiovascular and pulmonary function in addition to the electrocardiogram (EKG) and echocardiogram provided by the other Life Scan specialists. This portion of the examination includes auscultation of the heart (identifying heart sounds, extra sounds, clicks and murmurs) and major arteries. Inquiring about changes in a patient’s aerobic capacity as well as identifying and explaining modifiable and non-modifiable cardiac risk factors is part of this portion of the examination as it could indicate pulmonary or cardiac disease. The respiratory exam includes an inspection for respiratory rate and effort, presence of coughing, sneezing or other signs indicative of respiratory diseases, and auscultation for breath sounds and any abnormal sounds. Spirometry is an effective screening and surveillance exam for pulmonary disease and is included as part of Life Scan’s examining process; however, this screening is

conducted by the Exercise Physiologist who further discusses the results ([see page 8](#)). Additionally, OSHA Respiratory Clearance is provided to any departments that require it.

Gastrointestinal Examination

The gastrointestinal exam includes inspection, palpation, percussion and auscultation.

Generally, the right upper quadrant is palpated for evidence of liver, colon or gall bladder disease; the left upper quadrant is palpated for spleen or colon pathology; palpating the right and left lower quadrants is helpful for evaluation of colon disease. This exam aids in the detection of masses such as tumors, hernias or lymph node enlargement.

Genitourinary Examination

The genitourinary examination for men includes testicular, penis and inguinal hernia evaluations. This part of the examination allows the Mid-Level Practitioner the opportunity to discuss testicular and prostate cancer screenings as well as techniques for self-examination of the testicles. This exam may be deferred if the patient prefers to obtain these exams from his own primary care physician. The genitourinary examination for women includes a clinical breast exam and an evaluation of the gynecologic Pap smear and mammography. This part of the examination allows the Mid-Level Practitioner to discuss breast and cervical cancer screenings and techniques for self-examinations of the breasts. This exam may be deferred if the patient prefers to obtain these exams from her own primary care physician.

The rectal screening scans for rectal masses and mucosal abnormalities such as hemorrhoids, anal fissures, and cancerous lesions; it also detects prostate abnormalities in men. These assessments are critical to safely performing a majority of the essential job tasks such as crawling, lifting and carrying heavy objects, wearing protective gear, and operating from heights or uneven surfaces.

Neurological Evaluation

The neurological examination for uniformed personnel includes a general assessment of mental status, cranial nerve function, cerebellar function/coordination, motor system, sensory system, balance and gait, and the reflexes. Significant neurological abnormalities can greatly affect a public service officer's ability to perform the essential job duties. This population's exposure to heat, stress, activity and variable shift work has the capacity of taking a toll on the neurological system.

Behavioral Health Evaluation

First responders are exposed to scenes and situations that are beyond the comprehension and coping capabilities of the average person; they see, hear, and smell what no human being should ever have to experience. Life Scan incorporated behavioral health/trauma screening into our physical exam.

Consultation with Review of Results and a Personalized Health Plan

Upon completion of the physical examination the Mid-Level Practitioner reviews the results obtained by all the Life Scan specialists, the patient's lab work (completed prior to the patient's

visit to Life Scan), and the results of any other scans or tests (e.g., MRI's, chest/lumbar x-rays, mammograms and CTA of heart). In reviewing the results, the examiner takes the time to focus on patient education and the incorporation of a personalized health and wellness plan.

This health and wellness plan includes an exercise prescription as well as diet and nutritional recommendations; these recommendations are based on the patient's laboratory analysis and the findings and recommendations from the Clinical Exercise Physiologist. The Mid-Level Practitioner also refers patients to appropriate interdisciplinary health practitioners for follow up care (e.g., cardiology, endocrinology, primary care physician, etc.) in the event of significant abnormal findings. The Mid-Level Practitioner works closely with the Ultrasound Technician and Clinical Exercise Specialist to provide detailed and beneficial recommendations that are tailored to each patient's specific needs based on the results of all examinations conducted by each specialist.

Hemoccult Test

This test is used to detect the presence of fecal occult blood (FOB), which is blood in the feces that cannot be seen, through the collection of a small sample of the patient's stool. This test is most often used to help detect colorectal cancer; however, other positive results may include: gastroesophageal cancer, GI bleeds, diverticulae, hemorrhoids, anal fissures, colon polyps, ulcerative colitis, Crohn's disease, celiac disease, GERD, esophagitis, peptic ulcers, gastritis, inflammatory bowel disease, vascular ectasias, portal hypertensive gastropathy, aortoenteric fistulas, hemobilia, endometriosis, and trauma. This simple test is necessary for public service officers because research has shown that firefighters have a 21% increased risk of developing colorectal cancer.

Lymph Node Inspection

The Mid-Level Practitioner palpates and inspects various areas of the body to detect abnormalities. An examination of the lymph nodes for enlargement, tenderness, and mobility in the cervical (neck), supraclavicular (above the clavicle), inguinal (groin) and the axillary (upper limb and breasts) regions is conducted.

Musculoskeletal Evaluation

In the musculoskeletal exam, the Mid-Level Practitioner inspects and palpates for structural asymmetries, active range of motion of all major joints, the sensation of pain with any of the above and a complete joint specific examination. Limitations or abnormalities are noteworthy in order to provide timely provision of physical therapy and to record those injuries that may be relevant to future worker's compensation, pension or disability claims.

Skin Cancer Screening

The examiner inspects the skin for color, vascularity, lesions, and edema. Examination of the skin for moles or other suspicious lesions is critical because these sites could be cancerous; in fact, firefighters face approximately a 39% increased risk for skin cancer. The examiner closely inspects areas of the skin that are often overlooked, such as between the fingers and toes, because these sites are where dangerous carcinogens like melanoma can be found.

Inspection of the skin may also aid in determining if an individual is at increased risk for burn damage and infection.

Ultrasound Studies

The ultrasound technician conducts a thorough evaluation of each patient's internal organs and provides the patient with copies of still images (sonograms) that may be passed on to the patient's primary physician for further evaluation and/or diagnostic purposes.

Ultrasound scanning is a noninvasive, safe and painless method that uses sound waves to create real time images of the inside of the body. Performing ultrasound scans and searching for abnormalities in the major internal organs assures that the public service officers can adequately perform essential job tasks with as little risk as possible. It also aids to track the yearly effects of the environmental exposure the job entails such as exposure to toxic fumes, irritants, particulates, biological and nonbiological hazards, and/or heated gases. The following provides a comprehensive list and description of each scan conducted by the ultrasound technician at Life Scan Wellness Centers:

Echocardiogram Heart Scan

An echocardiogram is a test that uses sound waves to create a moving picture of the heart. The echoes of the sound waves are picked up by transducers and transmitted as electrical impulses, thus converting these impulses into moving pictures of the heart. This noninvasive scan allows the technician to see the heart beating as well as the heart valves and chambers of the heart. The echocardiogram allows physicians to diagnose, evaluate and monitor: abnormal heart valves, atrial fibrillation (a fast and irregular heart rhythm), congenital heart disease, damage to the heart muscle, heart murmurs, pericarditis (infection in the sac around the heart), infectious endocarditis (infection on or around the heart valves), pulmonary hypertension (abnormally high blood pressure in the arteries of the lungs), the pumping function of the heart (especially for those with heart failure), and the source(s) of blood clots. Ultimately, an echocardiogram heart scan can detect abnormalities ranging from those that are very minor and do not pose serious risks to those that indicate signs of severe heart disease requiring further evaluation by a cardiologist.

Carotid Artery Scan

The carotid artery duplex scan assesses the blood flow of the arteries that supply blood from the heart through the neck to the brain. This noninvasive procedure uses two modes of ultrasound (Doppler and B-mode) to obtain both an image of the carotid arteries as well as an evaluation of the velocity and direction of blood flow in the vessel. This particular scan is used to assess blockage or narrowing of the carotid arteries of the neck and/or branches of the carotid artery caused by plaque, blood clots or other substances in the blood stream. Blockages detected by this scan may serve as an early warning sign of a possible stroke. This scan may also aid in evaluating previously performed procedures to restore blood flow to the area (i.e., angioplasty or bypass surgery), locating a hematoma (a collection of clotted blood that may slow and eventually stop blood flow)

and detecting dissection of the carotid artery that may lead to obstruction of blood flow or weakening of the wall of the artery.

Aortic Aneurysm Scan

An abdominal aortic aneurysm (AAA) is the 13th leading cause of death in the United States. The lethality of a ruptured AAA is devastating; the mortality rate after rupture approaches 90%. Therefore, it is essential to perform this preventative exam or to recognize AAA promptly. Abdominal palpation correctly diagnoses AAA only 68% of the time, whereas ultrasound is an ideal method for detecting AAA's due to its near 100% accuracy.

An AAA occurs when a bulging, weakened area develops in the side of the aorta. The aorta is the body's major artery and is crucial in delivering oxygen and nutrients to all parts of the body. Abdominal aortic aneurysms, if left untreated, can grow and may rupture or tear, which may cause life-threatening internal bleeding. The aortic aneurysm scan analyzes the circumference of the aorta; an AAA is diagnosed when the diameter exceeds 3.0 cm.

Liver, Pancreas, Gall Bladder, Kidneys and Spleen (Abdominal Organ Scan)

An ultrasound of the upper abdomen consists of examining the liver, pancreas, gall bladder, kidneys and spleen; this examination requires that the patient fasts for approximately six hours before the scan. An abdominal organ scan can detect various abnormalities including but not limited to hernias, tumors and cancer, ascites (excess fluid in the space between the tissues lining the abdomen and abdominal organs), abdominal organ swelling and stones in the gall bladder or kidney. It can also aid in determining the cause of various symptoms including abdominal pain and swelling, kidney infections, fevers as well as the cause of abnormal blood tests such as liver function tests or kidney tests.

Ovaries/Uterus Scan (Female Only)

For women, a pelvic ultrasound uses sound waves to take a picture of the organs and structures in the lower belly, specifically the ovaries and uterus. This specific exam looks at the size and shape of the uterus and ovaries as well as the thickness of the uterine lining. The procedure may ultimately detect lumps, cysts, uterine fibroids or pelvic inflammatory disease and can determine the cause of vaginal bleeding and/or pelvic pain.

A normal pelvic ultrasound for women is defined by the ovaries, cervix and uterus being normal in shape, size and location as well as being absent of growths, tumors, fluid or other problems. Small cysts in the ovaries may be normal in certain women. An abnormal pelvic ultrasound is present in women who present with the following conditions: a large or abnormally shaped uterus, the presence of cysts or tumors, a thicker than normal endometrial stripe (lining of the uterus) which may indicate an increased risk for endometrial cancer, an abnormal amount of fluid in the pelvis, or the presence of pelvic inflammatory disease or abscesses.

Testicular/Prostate Scan (Male Only)

For men, a pelvic ultrasound uses sound waves to look at the seminal vesicles and the prostate gland, check for prostate cancer, and determine if urinary problems are caused by an enlarged prostate. A normal pelvic ultrasound in men is one which the prostate gland and seminal vesicles are normal in size and shape and no growths, tumors or other problems are present. One of the most common abnormal findings in this exam is an enlarged prostate gland (also known as benign prostatic hypertrophy). Other findings that result in an abnormal testicular/prostate scan include an abscess, tumor or abnormal amount of fluid in the pelvis.

According to a study by the University of Cincinnati, firefighters face a 102% increased risk of developing testicular cancer and 28% increased risk of prostate cancer, emphasizing the importance of this screening.

Bladder Scan

The bladder scan portion of the abdominal ultrasound scan is conducted on both men and women to determine whether the bladder empties completely during urination by viewing the bladder both before and after urination and to find the cause of urinary problems or urine in the blood. For the test it is required that the bladder is full to obtain the best results; therefore, patients are advised to drink 4-6 glasses of water within the hour of the scan.

A normal bladder scan will show a bladder that is an appropriate size and shape with no stones or abnormal growths. The scan should confirm that the bladder empties completely before and after urination and that urine flows normally from the ureters into the bladder. If the bladder has an abnormal shape or thick wall, a growth or stone is seen within, or the bladder does not completely empty after urination then further evaluation may be suggested.

Thyroid Scan

A thyroid ultrasound is an imaging method used to see the thyroid, a gland in the neck that regulates metabolism. This scan checks the thyroid for normal size, shape and position; the ultrasound can determine the difference between a sac containing fluid (cyst) and abnormal tissue that may or may not be cancerous (tumor). Abnormalities of the thyroid may be due to cysts, goiter (enlargement of the thyroid gland) or thyroid nodules (raised bumps that are wider than 0.5 cm). This scan can ultimately lead to the detection of one of several types of cancers that may be present in or around the thyroid gland.

Urinalysis

The ultrasound technician performs a comprehensive urinalysis exam which serves various purposes. It is required as a drug test as part of the pre-employment process and for employees the urinalysis is utilized for screening purposes. The technician searches for urinary tract infections as well as proteins, ketones, and glucose in the urine.

Employees may be required to submit to drug testing as well; this is verified in departments' individual contracts.

Cardio-Pulmonary/ Fitness Evaluations

Life Scan's unique 8-level fitness analysis conducted by a Clinical Exercise Physiologist makes certain that public safety officers are in top physical condition to ensure better on-the-job performance and overall wellbeing. An integrated fitness initiative includes diet and nutritional analysis, a state-of-the-art fitness evaluation, and a personalized wellness plan to create an ongoing customized fitness program for each officer and firefighter. Life Scan's cardio-pulmonary and fitness evaluation protocols are specifically chosen to meet the 2013 NFPA 1582 and 1583 standards as well as OSHA standards. The following provides a comprehensive list and description of the fitness assessments conducted at Life Scan Wellness Centers, including references to specific NFPA standards as well as the 13 essential job tasks as described by the NFPA which necessitate the conduction of these assessments:

Electrocardiogram (EKG)

The resting electrocardiogram (EKG) is a noninvasive procedure that records the electrical activity of the heart over a period of time. The EKG is used to measure the rate and regularity of heart beats, as well as the size and position of the chambers, the presence of any damage to the heart, and the effects of drugs or devices used to regulate the heart. An EKG is a way to measure and diagnose abnormal rhythms of the heart, particularly abnormal rhythms caused by damage to the conductive tissue that carries electrical signals, or abnormal rhythms caused by electrolyte imbalances or oxygen deficiencies.

The Clinical Exercise Physiologist at Life Scan Wellness Centers performs baseline (resting) assessments including a resting EKG and blood pressure to search for signs of heart disease and hypertension (high blood pressure) prior to beginning a stress test.

Cardiac Treadmill Stress Test with EKG

Once a resting EKG is conducted and baseline values are established, the Clinical Exercise Physiologist may begin the stress test with the patient if resting values are conducive to testing. The term exercise stress test refers to stressing the body by putting an exercise load on it and measuring the response; this type of testing is considered the "Gold Standard" academically and medically for heart disease screening. The stress test conducted at Life Scan is a sub-maximal stress test, which means the patient works until a pre-determined heart rate is achieved; this pre-determined heart rate is 85% of the predicted maximum heart rate. The protocol used for the treadmill stress test is the Bruce Protocol, which is the most widely used for a treadmill test; this is a multistage protocol consisting of several stages of progressively greater workloads (the treadmill's incline becomes steeper and its speed becomes faster with the advancement of each stage) until the target heart rate is attained. Overall, the EKG stress test allows the exercise specialist to determine maximal exercise capacity (VO₂max) while also detecting early signs of coronary artery disease.

Overall, stress testing is an important tool in assessing public service officers because it aids in:

- Determining whether an individual is physically fit to perform essential job duties without undue risk of harm to self or others.
- Monitoring the effects of exposure to specific biological, physical, or chemical agents that may be related to hazardous working conditions.
- Detecting any patterns of disease in the workforce that might indicate underlying work-related problems.
- Providing the safety officer with information about his/her current health.
- Providing a cost-effective investment in the early detection, disease prevention, and health promotion of the fire fighter.
- Developing recommendations for exercise prescription and rehabilitation.
- Complying with federal, state, provincial, and local requirements.

An exercise stress test is just one diagnostic test that may be used in the determination of an individual's fitness for duty. The determination of fitness for duty must not be made on the basis of a single test, but rather on a comprehensive evaluation of the individual that includes diagnostic testing, personal medical history, and other indicators of health status. For example, another assessment built into the Life Scan format to compliment the stress test is the echocardiogram which is part of Life Scan's ultrasound studies; the Exercise Physiologist will often refer to results from the Ultrasound Technician or vice versa to reinforce certain findings. The NFPA suggests the importance of the stress test to ensure that the public service officer is capable of withstanding unpredictable emergency requirements for prolonged periods of extreme physical exertion without benefit of warm-up, scheduled rest periods, meals, access to medication(s), or hydration (NFPA 6.9.1).

Pulmonary Function Test (Spirometry)

The pulmonary function test (PFT) is a method of assessing the function of the lungs; PFT's are a way of detecting and quantifying abnormal lung function in a noninvasive manner and are one of the most common diagnostic tests for measuring lung function. Spirometry measures how quickly air can be expelled from the lung and is performed by having an individual blow into a device called a spirometer. This machine measures the volume of air that is exhaled as a function of time. Spirometry does not measure the amount of air in the lungs, just the amount of air entering or leaving the lungs; therefore, it is most useful for measuring diseases that cause obstruction to air flow (i.e., asthma, COPD, chronic bronchitis, emphysema).

Although many measurements can be made from a PFT, the Life Scan Exercise Physiologist focuses special attention on the Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 second (FEV 1), and the ratio of FEV 1 to FVC (FEV 1/ FVC). Stated simply, FVC is the volume of air (liters) that can forcibly be blown out after full inspiration and FEV 1 is the volume of air that can forcibly be blown out in one second. The ratio FEV1 / FVC can suggest the presence of the following pulmonary diseases: obstructive lung disease if the FEV 1 / FVC ratio is less than 75% of predicted; mixed pattern disease if the FEV 1 / FVC ratio is between 75-85% of predicted AND both FEV 1 and FVC are reduced; or restrictive lung disease if the FEV 1/ FVC ratio is greater than 85% of predicted and both FEV1 and FVC are reduced.

As indicated by the NFPA, public service officers may be exposed to toxic fumes, irritants, particulates, biological (infectious) hazards, nonbiological hazards and/or heated gases despite the use of personal protective ensembles and SCBA (NFPA 6.8; 7.7.4); the unique nature of these individuals' work environment necessitates spirometry. It is recommended because it may reflect early changes in the lungs, prior to the onset of symptoms; this allows for earlier intervention and treatment of a potential medical problem. The Wellness/ Fitness Initiative does not recommend the use of spirometry to automatically exclude a fire fighter or public safety officer from work but rather, to monitor changes over time and to treat abnormalities before they become clinically significant. Additionally, an FVC or FEV 1 less than 70% of predicted prevents the safe use of SCBA due to increased minute ventilation requirements leading to earlier than expected depletion of air in the SCBA cylinder.

Metabolic Analysis with Body Fat

The Clinical Exercise Physiologist performs a body fat assessment using skinfold measurements; this method of assessing body fat involves the use of calipers to pinch the skin in distinct areas to determine the thickness of the skin. Skinfold measurements are one of the most practical and accurate ways of determining body fat percentage. The accuracy of predicting percent fat from skinfolds is approximately $\pm 3.5\%$; whereas most other methods of determining body fat percentage, including the popularly referenced Body Mass Index (BMI), have greater than $\pm 5.0\%$ error. Skinfold measurements produce more accurate results because they distinguish fat from muscle mass and bone; unlike methods such as BMI, which merely attempt to predict body composition solely upon one's height and weight. Life Scan uses a 3-site method for assessing body fat using skinfold calipers; for men, the three sites are the chest/pectoral, abdominal and thigh; for women, the three sites include the triceps, suprailiac (above the hip bone), and thigh. These sites are specific to the 2013 NFPA 1582 Annex C.2.1.2.

By assessing the patient's height, weight, age, body fat percentage, resting heart rate, aerobic capacity as well as other biometric variables, the Clinical Exercise Physiologist may then conduct a metabolic analysis to estimate daily caloric expenditure and needs of the patient.

Understanding body fat percentage and the health risks associated with being overweight and obese is imperative for a public service officer due to the physical demands of the position. The Life Scan Exercise Physiologist assists patients in understanding their current body fat classification and how to maintain or develop lower risk stratification.

Strength, Endurance and Flexibility Assessments

Physical fitness is important for all public safety officers based on the high demands of their job duties. This is exemplified by the fact that while wearing personal protective ensembles and SCBA, safety officers must search, find, and rescue-drag or carry victims ranging from newborns to adults weighing over 200 pounds to safety despite hazardous conditions and low visibility (NFPA 8.2.2.2). Public safety officers must also be able to climb six or more flights of stairs while wearing protective ensemble, including SCBA, weighing at least 50 pounds, or a duty belt, and carrying equipment/tools weighing an additional 20 to 40 pounds (NFPA 8.2.2.4). The following

describes the fitness assessments conducted by the Clinical Exercise Physiologist which encompasses all aspects of muscular strength, endurance and flexibility:

Muscular Strength

Muscular strength is assessed by a Jamar Hydraulic Hand Dynamometer (used for grip strength) as specified in the 2013 NFPA 1582 Annex C.2.1.5. Bilateral grip strength measurements serve to detect muscle imbalances and nerve impingements in the arms, shoulders and neck. According to the WFI, adequate grip strength is crucial in numerous emergency tasks such as lifting and carrying equipment, moving patients, holding and operating hose lines, raising extension ladders and removing victims.

Muscular Endurance

To assess muscular endurance, Life Scan utilizes the push-up test as well as the static plank evaluation. The push-up test spans over 2 minutes and the patient is instructed to stay on cue with a metronome set to 80 bpm. An object is placed 5 inches in height under the patient's chin and a push-up is counted only if the chin touches the object. Additionally, the Exercise Physiologist will have the patient perform the static plank evaluation which is an indicator of core endurance. This is a timed test that involves the patient lying prone while supporting the body on forearms and toes and maintaining a neutral position by keeping the back flat. Any deviations from appropriate posture warrant two verbal warnings and a third infraction is cause for termination of the test. The test is also terminated if the knees touch the ground, or if the patient achieves the NFPA optimal time of 4 minutes. These assessments are specific to the 2013 NFPA 1582 Annex C.2.1.9 and C.2.1.11.

Flexibility

Life Scan implements the YMCA sit-and-reach protocol which uses a sit-and-reach box or a tape measure to assess lower body flexibility; this test is NFPA's 2013 specified protocol and is indicative of flexibility in the low back, hamstrings, and shoulders (Annex C.2.1.12). According to the WFI, the leading type of line of duty injury within the fire service is sprains and strains.

Furthermore, the most prevalent line of duty injury that leads to premature departure is back injuries. Back health and flexibility are critical to the health and safety of uniformed personnel, which makes assessing this component of fitness imperative.

Diet and Nutritional Recommendations/ Personal Exercise Prescription

Based upon the results of the previous assessments the Clinical Exercise Physiologist at Life Scan consults with the patient regarding a personalized exercise prescription and the establishment of realistic goals for enhanced health and wellness. The Exercise Physiologist provides tips and strategies for achieving these goals including, but not limited to, educational handouts, tips on useful phone applications and web pages, as well as personalized diet and nutritional recommendations.