MEDICAL SCREENING PROTOCOL
FOR THE FORMER WORKER MEDICAL SCREENING PROGRAM
U.S. DEPARTMENT OF ENERGY

General Principles:

1. The purpose of the medical evaluation component of the U.S. Department of Energy (DOE) Former Worker Medical Screening Program (FWP) is to provide interested former workers with targeted testing to screen for selected adverse health effects potentially related to their work in DOE operations. The program does not test for all potentially work-related conditions; for example, screening for work-related musculoskeletal conditions is not included in the medical evaluation.

2. The following table is intended to identify work-related health outcomes of relevance to DOE workers for which there are screening tests that are reasonably likely to be effective and beneficial to program participants. The table is not intended to represent a comprehensive list of all occupational diseases that are associated with the listed hazards or a comprehensive list of all occupational diseases for which DOE workers are at elevated risk.

3. The selection of specific medical evaluations is based on the collection of a detailed occupational history for each worker.

4. This protocol is intended to ensure consistency of approach in the medical evaluation of participants.

5. This protocol is not intended to dictate the clinical practice of medicine.

6. This protocol is not intended to substitute for periodic health maintenance/disease screening examinations by a former worker's personal physician. However, as a secondary goal the examination may include assessments that contribute to general health.

7. Follow-up medical evaluation and treatment are not within the scope of the FWP.

8. This protocol was developed by consensus of the cooperative agreement awardees and the DOE officials associated with the FWP.

9. The medical evaluation protocol may be changed only by or with the approval of DOE.

10. The protocol will be reviewed and updated at least every two years by the Medical Task Group established by DOE and the FWP.

11. Individual FWPs are permitted to add COVID-19 related testing to their examination protocol if able, if warranted by local public health conditions, and if test(s) of sufficient quality are available. The rationale is that COVID-19 represents a substantial threat to an older population with a high burden of chronic medical conditions, some of which were caused, aggravated by or contributed to by prior occupational exposures experienced during DOE employment.

Recommended Medical Screening Protocol for Selected Occupational Health Conditions of DOE Workers for Which Screening and/or Early Detection is Reasonably Likely to be Effective and Beneficial

Hazard(s)	Target Organ(s)	Health Outcome(s)	Medical Evaluation	Re-screening through FWP
Asbestos	Lung	• Asbestosis • Other non-malignant respiratory disease	• Chest radiograph with B-reading • Spirometry • Physical examination	No more frequently than every 3 years
		Lung cancer	Low-dose chest CT scan for eligible participants, where offered[Appendix A]	Re-screening offered at 3 or 6 months after baseline scan for indeterminate (non-calcified) nodules as per current professional recommendations; repeat CT scan offered on an annual basis after initial baseline scan
Beryllium	Lung	• Sensitization • Chronic Beryllium Disease (CBD)	• Chest radiograph with B-reading (if symptomatic) • Physical examination • Beryllium Lymphocyte Proliferation Test (BeLPT), with repeat testing for other than normal results	• No more frequently than every 3 years if asymptomatic[1] • If new symptoms develop or worker is very concerned in interim, BeLPT can be performed
		Lung cancer	Low-dose chest CT scan for eligible participants, where offered[Appendix A]	Re-screening offered at 3 or 6 months after baseline scan for indeterminate (non-calcified) nodules as per current professional recommendations; repeat CT scan offered on an annual basis after initial baseline scan
Plutonium, Lung Deposition of	Lung	Pulmonary Fibrosis	Chest radiograph	No more frequently than every 3 years
		Lung cancer	Low-dose chest CT scan for eligible participants, where offered[Appendix A]	Re-screening offered at 3 or 6 months after baseline scan for indeterminate (non-calcified) nodules as per current professional recommendations; repeat CT scan offered on an annual basis after initial baseline scan

Hazard(s)	Target Organ(s)	Health Outcome(s)	Medical Evaluation	Re-screening through FWP
Silica	Lung	Silicosis	See Asbestos above	No more frequently than every 3 years
		Lung cancer	Low-dose chest CT scan for eligible participants, where offered[Appendix A]	Re-screening offered at 3 or 6 months after baseline scan for indeterminate (non-calcified) nodules as per current professional recommendations; repeat CT scan offered on an annual basis after initial baseline scan
• Epoxy resins • Methylene-dianiline • Other known bladder carcinogen	Bladder	Carcinoma	Urine cytology. Protocol should be tailored to specific exposure and approved by the DOE review process.[2]	No more frequently than every 3 years
• Ionizing radiation • Chemicals (e.g., benzene, formalde-hyde)	Hematopoietic	Leukemia or non-malignant conditions	Complete blood count (CBC) with differential[3]	No more frequently than every 3 years
• Asbestos • Ionizing radiation	Gastrointestinal system	Colorectal carcinoma	Stool for occult blood[4]	No more frequently than every 3 years[4]
Diesel Exhaust	Lung	Chronic obstructive lung disease	• Respiratory symptoms questionnaire • Spirometry	No more frequently than every 3 years
		Lung cancer	Low-dose chest CT scan for eligible participants, where offered[Appendix A]	Re-screening offered at 3 or 6 months after baseline scan for indeterminate (non-calcified) nodules as per current professional recommendations; repeat CT scan offered on an annual basis after initial baseline
Welding	Lung	• Asthma • Chronic obstructive lung disease	• Respiratory symptoms questionnaire • Spirometry	No more frequently than every 3 years for COPD

Hazard(s)	Target Organ(s)	Health Outcome(s)	Medical Evaluation	Re-screening through FWP
Chromium	Lung	Asthma	Respiratory symptoms questionnaire, plus spirometry, as indicated	No
		Lung cancer	Low-dose chest CT scan for eligible participants, where offered[Appendix A]	Re-screening offered at 3 or 6 months after baseline scan for indeterminate (non-calcified) nodules as per current professional recommendations; repeat CT scan offered on an annual basis after initial baseline scan
Formaldehyde	Lung	Asthma	Respiratory symptoms questionnaire, plus spirometry, as indicated	No
Metal Working Fluids	Lung	Asthma	Respiratory symptoms questionnaire, plus spirometry, as indicated	No
Nickel	Lung	Asthma	Respiratory symptoms questionnaire, plus spirometry, as indicated	No
		Lung cancer	Low-dose chest CT scan for eligible participants, where offered	Re-screening offered at 3 or 6 months after baseline scan for indeterminate (non-calcified) nodules as per current professional recommendations; repeat CT scan offered on an annual basis after initial baseline scan
Respiratory irritants	Lung	Chronic obstructive lung disease	Respiratory symptoms questionnaire, plus spirometry, as indicated	No more frequently than every 3 years
• Radioactive iodine • External ionizing radiation	Thyroid	Hypothyroidism and thyroid cancer	• Physical examination (i.e., palpation of the thyroid) • Thyroid-stimulating hormone (TSH)	No more frequently than every 3 years
• Solvents • Lead • Mercury	Central Nervous System	Chronic neurologic disease	Primary care level clinical evaluation	No

Hazard(s)	Target Organ(s)	Health Outcome(s)	Medical Evaluation	Re-screening through FWP
• Toluene • Styrene • Xylene • Trichloroethylene • Methyl Ethyl Ketone • Methyl Isobutyl Ketone • Ethyl Benzene	Ears	Sensorineural hearing loss	Audiometry	No more frequently than every 3 years
Ionizing radiation	Female Breast	Cancer	Recommend mammography by personal physician for women 50 to 74 years of age[5]	Recommend mammography by personal physician for women 50 to 74 years of age[5]
Carbon tetrachloride and other chlorinated solvents	Liver	Hepatocellular injury and insufficiency	• Bilirubin • Transaminases	No
Hydrazine	Liver	Hepatocellular injury	Transaminases	No
• Chromium • Lead	Kidneys	Chronic renal insufficiency	Serum creatinine	No
• Nickel • Chromium • Formaldehyde	Skin	• Dermatitis • Skin cancer • Cancer of the nasal mucosa	Physical examination of the skin and nasal mucosa[6]	No more frequently than every 3 years[6]
Ionizing or ultraviolet radiation	Skin	Skin cancer	Physical examination of the skin[6]	No more frequently than every 3 years[6]
Noise	Ears	Hearing Impairment	Audiometry	No more frequently than every 3 years

[1]The inclusion of a BeLPT on the re-screening examination may vary among DOE sites and depends on the known prevalence of abnormal BeLPTs on initial and re-screening examinations at a particular DOE site, the use of beryllium at the DOE site, and the medical history and occupational risk information of the individual who will undergo the re-screening examination. The determination about whether to offer the BeLPT on re-screening to individuals is made by the FWP active at the DOE site.

[2]Additional bladder cancer biomarker tests will be considered, if demonstrated to be effective. When screening for bladder cancer is included, the participant should also receive recommendations for periodic screening. Initial screening will be supported by the FWP.

[3]DOE FWP recognizes that the complete blood count (CBC) is not an effective screening test for the early detection of leukemia. The CBC may detect white blood depression or anemia that may be associated with pre-malignant conditions caused by occupational agents.

[4]Recommend in letter that individual discuss colonoscopy with PMD, per USPSTF and/or ACS guidelines.

[5]Communication to participant should recommend biennial screening for women 50 to 74 years of age. For women between the ages of 40 and 49, mammography is recommended following a discussion with their personal physician regarding risks and benefits (USPSTF and ACS).

[6]Communication to participant should recommend annual screening with PMD for anyone at high risk for skin cancer.

[7]In June 2022, it was decided to delete screening for laser- associated eye injury from the FWP Medical Protocol, because the screening tests currently utilized are not specific for identifying prior laser-associated eye injury. Clinically significant laser-

[7]

associated eye injury requires diagnostic evaluation at the time of injury that is beyond the scope of a former worker screening program.

Appendix A (Medical Screening Protocol, DOE FWP)

DOE FWP recommends the use of low dose chest CT scan for early lung cancer detection for DOE workers who are at elevated lung cancer risk. This recommendation is based on the scientific demonstration of reduced lung cancer mortality and prolonged survival for individuals who have undergone low-dose CT scanning on an annual basis (National Lung Screening Trial Research Team, N Engl J Med. 2011; 365(5):395-409; de Koning, HJ, van der Aalst, CM, de Jong, PA, et al. Reduced Lung-Cancer Mortality with Volume CT Screening in a Randomized Trial. N Engl J Med. 2020, 382, 503-513; International Early Lung Cancer Action Program Investigators, Henschke CI, Yankelevitz DF, et al. Survival of patients with stage I lung cancer detected on CT screening. N Engl J Med 2006;355:1763-71.)

FWP acknowledges the initial and updated recommendations of the USPSTF (Moyer VA, U.S. Preventive Services Task Force. Screening for lung cancer: U.S. Preventive Services Task Force recommendation statement. Ann Intern Med 2014;160:330-8; Krist AH, US Preventive Services Task Force. Screening for Lung Cancer: US Preventive Services Task Force Recommendation Statement. JAMA. 2021 Mar 9;325(10):962-970.) and the guidelines of the National Comprehensive Cancer Network (National Comprehensive Cancer Network Clinical Practice Guidelines. Lung Cancer Screening Version 1.2012 (2012) and Version 1.2022 (2021).

Both the USPSTF and the NCCN recommend beginning low dose CT screening for people who are aged 50 years and older. The USPSTF recommends screening until age 80, while the NCCN notes that the upper age limit is uncertain and that "one can consider screening beyond age 77 as long as patient functional status and co-morbidity allow consideration for curative intent therapy." Both the USPSTF and the NCCN recommend low dose CT screening for people with a history of $\geq$ 20 pack-years of smoking cigarettes. The USPSTF recommends ending low dose CT screening after 15 years from smoking cessation, while the NCCN sets no limit for screening based on the number of years since quitting smoking.

Neither the USPSTF nor the NCCN use any lung cancer risk factor other than age and smoking in risk assessment for lung cancer screening. However, the NCCN recognizes the relevance of occupational exposures, personal history of lung cancer, family history of lung cancer, exposure to radon, and history of lung disease as factors in decision-making about lung cancer screening (NCCN Version 1.2022.)

The DOE FWP follows eligibility criteria that are generally consistent with the USPSTF and the NCCN. However, the DOE FWP recognizes that it is primarily an occupational disease screening program. Individual FWP projects may include the history of exposure to occupational lung carcinogens (or proxy variables) and other lung cancer risk factors as noted by the NCCN in decision-making about eligibility criteria for offering low dose CT scanning for lung cancer screening as part of the FWP.

DOE FWP offers low dose CT scanning to former DOE workers at the discretion of the individual FWP projects. Workers who participate in a non-FWP annual lung cancer screening program should not also receive annual low dose CT scanning in a DOE FWP project. Workers who are enrolled in a FWP low dose CT scanning program may not be offered periodic chest x-rays on re-screen exams if they receive annual low dose CT scans.
Workers with positive findings on the low dose chest CT scans are referred to their personal health care providers for follow-up.

[This guidance is revised periodically and was last revised on November 7, 2022.