



Former Worker Medical Screening Program



Serving the Former Department of Energy Workforce

2011 Annual Report

**Published
February 2012**

“Thanks for keeping after me. I went for many years receiving post cards from you, and I wouldn’t reply until finally I decided what the heck I’m going to take the physical and see what happens. So far, so good...thanks again.”
- *Denzel Clark, Alabama*

“Keep former Amchitka workers well informed and take good care of them.” - *Oscar Larson, Alaska*

“As the result of the NSSP examination and follow-up with my doctor, I was diagnosed with an aggressive cancer. It was diagnosed very early, and my doctor is expecting a full recovery. We are very happy about the program and very grateful that we had the opportunity to participate.” - *NSSP participant, Arizona*

“The program was very helpful, I see no need to change anything.” - *National Supplemental Screening Program (NSSP) participant, Arkansas*

“I thought that the program was very helpful. I like that I am able to receive tests that are not normally offered during routine doctors visits. It was very professional and I am pleased that they are concerned enough to continue screening.”
- *Linda Weekes, California*

“Thank you for your concerns and effort to bring this matter to the attention it deserves. God bless you and your families.” - *William Mendez, Colorado*

“I had a very pleasurable experience at the facility where I had my exam and appreciate the NSSP taking the time to coordinate beryllium testing for my wife who is in hospice care.” - *NSSP participant, Connecticut*

“The NSSP did a very good job, and I am going to follow up with my M.D. with the results.” - *NSSP participant, Delaware*

“This entire experience has made me feel a bit secure about my overall health. Thanks for your support!” - *Building Trades National Medical Screening Program (BTMed) participant, Florida*

“Once I saw the free screening was available, I got tested out to make sure I didn’t have anything. Anybody who worked out there needs to do the same. You work around so many materials that you don’t know how much your life’s been cut short.” - *Harry Carver, Georgia*

“I appreciate the former worker program being persistent in returning my calls, it can be very difficult with the time difference. I also appreciate being notified of the abnormal occult results and will share them with my doctor.” - *NSSP participant, Hawaii*

“After I retired from Idaho National Laboratory in August of 2008, I was contacted by the INL Worker Health Protection Program and asked if I would be interested in completing a physical. Two interesting items were found during my screening: a hardening of the right pleura, which was a result from my working with asbestos, and skin concerns for which I was referred to a dermatologist for follow up. I was then diagnosed with melanoma, and the doctor said if I had waited six more months to come in, I would have lost my arm. I have not had any problems with cancer since, and I appreciate the efforts of the INL Worker Health Protection Program.” - *Burl Summers, Idaho*

“I received very professional service from all of the NSSP contacts I worked with, from the initial interview through follow-up on the exam results. Rebecca Maret and Dr. McInerney were wonderful.” - *Debra L. Spiece, Illinois*

“I am very glad you notified me of my abnormal x-ray. Your notification and encouragement to follow-up with my doctor led to a diagnosis of lung cancer.” - *Robert Woosley, Indiana*

“In April 2009, I was in Iowa City taking all the tests that were required for this medical screening program. I was surprised when they said I had a lung condition that needed medical attention. That medical exam provided important information that I would not have been aware of with my usual doctor’s visit. I am thankful that we caught the cancer before it got too bad. This program has been a life saver so far for me. Thank you so much for the information that I have received from this program.” - *University of Iowa conducted program participant, Iowa*

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Abbreviations Used in This Report

AFL-CIO	<i>American Federation of Labor and Congress of Industrial Organizations</i>
BAWR	<i>Beryllium-Associated Worker Registry</i>
BCTC	<i>Building and Construction Trades Council</i>
BeLPT	<i>Beryllium Lymphocyte Proliferation Test</i>
BeS	<i>Beryllium Sensitization</i>
BHSC	<i>Beryllium Health and Safety Committee</i>
BTMed	<i>Building Trades National Medical Screening Program</i>
BU	<i>Boston University</i>
BUSPH	<i>Boston University School of Public Health</i>
CAOHC	<i>Council for Accreditation in Occupational Hearing Conservation</i>
CBD	<i>Chronic Beryllium Disease</i>
CEDR	<i>Comprehensive Epidemiologic Data Resource</i>
CI	<i>Confidence Interval</i>
COPD	<i>Chronic Obstructive Pulmonary Disease</i>
CPWR	<i>CPWR – The Center for Construction Research and Training</i>
CT	<i>Computed Tomography</i>
DOE	<i>U.S. Department of Energy</i>
DOL	<i>Department of Labor</i>
EEOICP	<i>Energy Employees Occupational Illness Compensation Program</i>
EEOICPA	<i>Energy Employees Occupational Illness Compensation Program Act</i>
EFCOG	<i>Energy Facility Contractors Group</i>
ELCD	<i>Early Lung Cancer Detection</i>
FEV	<i>Forced Expiratory Volume</i>
FMPC	<i>Feed Materials Production Center</i>
FVC	<i>Forced Vital Capacity</i>
FWP	<i>Former Worker Medical Screening Program or Former Worker Program</i>
FY	<i>Fiscal Year</i>
GDP	<i>Gaseous Diffusion Plant</i>
HSS	<i>DOE Office of Health, Safety and Security</i>
IAAP	<i>Iowa Army Ammunition Plant</i>
ICRP	<i>International Commission on Radiological Protection</i>
ILO	<i>International Labour Organization</i>
INL	<i>Idaho National Laboratory</i>
IRB	<i>Institutional Review Board</i>
JHBSPH	<i>Johns Hopkins Bloomberg School of Public Health</i>
JOTG	<i>Joint Outreach Task Group</i>
K-25	<i>Oak Ridge K-25 Gaseous Diffusion Plant</i>
LANL	<i>Los Alamos National Laboratory</i>
NCI	<i>National Cancer Institute</i>

NHANES	<i>National Health and Nutrition Examination Survey</i>
NIH	<i>National Institutes of Health</i>
NIHL	<i>Noise-Induced Hearing Loss</i>
NIOSH	<i>National Institute for Occupational Safety and Health</i>
NLST	<i>National Lung Screening Trial</i>
NNSS	<i>Nevada National Security Site</i>
NSSP	<i>National Supplemental Screening Program</i>
NTS	<i>Nevada Test Site</i>
PACE	<i>Paper, Allied-Industrial, Chemical, and Energy Workers International Union</i>
OCAW	<i>Oil, Chemical, and Atomic Workers Union</i>
ORNL	<i>Oak Ridge National Laboratory</i>
OSHA	<i>Occupational Safety and Health Administration</i>
PFT	<i>Pulmonary Function Test</i>
PII	<i>Personally Identifiable Information</i>
SNL	<i>Sandia National Laboratories</i>
SOMD	<i>Site Occupational Medical Director</i>
SRS	<i>Savannah River Site</i>
UCSF	<i>University of California, San Francisco</i>
UNSOM	<i>The University of Nevada School of Medicine's Department of Family and Community Medicine</i>
WHPP	<i>Worker Health Protection Program</i>
Y-12	<i>Y-12 National Security Complex</i>

Foreword

One of our key Management Principles at the U.S. Department of Energy (DOE) is, “we will treat our people as our greatest asset.” We consider these assets to include both current and former workers who have served the Nation in its National security and other missions. The Office of Health, Safety and Security (HSS) is proud to lead the Department’s commitment to this principle through the management of several initiatives, including the Former Worker Medical Screening Program (FWP).

In 2011, the FWP continued to support this Management Principle, which is also supported by the U.S. Congress. The National Defense Authorization Act for Fiscal Year 1993 called for DOE to provide ongoing medical evaluations, at no cost, to all DOE Federal, contractor, and subcontractor workers. Medical screening examinations are designed to check for adverse health effects related to occupational exposures and are conducted by dedicated medical experts from consortia of universities, unions, and commercial organizations with expertise in administering medical programs. This year marks 15 years of service to the former DOE workforce, providing 85,586 screenings.

The recognition of DOE workers’ faithful service and commitment to their country was epitomized by the U.S. Senate’s unanimous approval, for the third consecutive year, of a resolution dedicating October 30 as the National Day of Remembrance for Cold War nuclear weapons workers. This day honors the hundreds of thousands of American workers who served our Nation in building its nuclear defense and contributing to its security from World War II through the Cold War.

From the earliest days of the Manhattan Project in the 1940s, DOE and its predecessor agencies, the Atomic Energy Commission and the Energy Research and Development Administration, developed a nuclear weapons arsenal through a nationwide industrial complex working with hazardous materials and processes. The nuclear weapons complex and its committed workers, under the heightened threat of nuclear conflict, worked with a sense of urgency and extraordinary dedication. Equally important is the fact that they worked in close quarters, in many cases, with a variety of occupational hazards for many years prior to the emergence of modern health and safety regulations. Developing and building the Nation’s nuclear weapons arsenal continued for decades, the stockpile continues to be maintained, and clean up of many DOE weapons sites is ongoing.

While we have made great strides throughout the past 15 years in identifying, locating, and offering medical screening services to our former workers, there are still many who have not been served, so this effort continues to be a high priority. Because many occupational-related health diseases have long latency periods, re-screening efforts are crucial to detecting these conditions.

HSS, in partnership with the DOE-funded organizations administering the program, will continue to meet our commitment to these workers who made great sacrifices for our National security. The FWP demonstrates the importance of treating our people as our greatest asset.

Glenn S. Podonsky
Chief Health, Safety and Security Officer
U.S. Department of Energy

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Executive Summary

The U.S. Department of Energy (DOE), Office of Health, Safety and Security (HSS), is pleased to present the 2011 Annual Report of the DOE Former Worker Medical Screening Program. The program, also known as the Former Worker Program (FWP), makes ongoing medical evaluations available, at no cost, to all former DOE Federal, contractor, and subcontractor workers from all DOE sites.

The FWP was mandated by the U.S. Congress as part of Section 3162 of the National Defense Authorization Act of Fiscal Year (FY) 1993 (Public Law 102-484). The medical exams offered by the FWP are designed to detect work-related health effects at an early stage when treatment is more likely to be effective. The range of potentially hazardous exposures is broad and includes radiation, beryllium, asbestos, lasers, silica, lead, cadmium, chromium, solvents, noise, and other occupational exposures. The estimated population of former workers who may be eligible to receive these medical screening services is upwards of 600,000 individuals.

Program activities began in 1996, and for 15 years, the FWP has provided a valuable service to the DOE former workforce. To ensure objective and credible medical examinations, DOE, by design, offers exams by third-party providers. The administration of medical evaluations is built on the principles of absolute confidentiality and respect for the privacy of individuals. Exams are offered at clinics in communities near DOE sites, as well as through a large network of health clinics nationwide. This vast geographic coverage enables ready access and ease of access to a participating health clinic from practically anywhere in the country. In fact, this nationwide network of clinics has allowed the FWP to provide participant exams in all 50 states.

In 2011, the FWP continued to successfully fulfill its congressional mandate of delivering free medical screening services to all interested former workers. The FWP effectively addressed the enormous logistical, program management, and program execution challenges that are inherent in any program of this size, depth, and reach. The program continued implementing numerous outreach and awareness campaigns to inform and encourage former workers to take advantage of its potentially life-saving medical screening benefits.

The program activities undertaken in 2011 focused on meeting the following strategic objectives:

- **Deliver high-quality medical screening services to thousands of former workers nationwide.**

To date, 85,586 screenings have been performed. In FY 2011 alone, 4,767 initial medical evaluations and 4,193 re-screen exams were conducted.

- **Enhance the efficiency and effectiveness of program execution.**

The overall success of the FWP is ultimately measured by the number of former workers who can be identified, located, contacted, and provided with timely medical evaluations and follow-up recommendations. This process necessitates close coordination, timely communication, frequent interface among several stakeholders, and adequate protection of personally identifiable information (PII).

In 2011, HSS continued to focus on several fronts to enhance program effectiveness. These included:

- *Forged stronger working relationships with DOE program offices, field offices, contractors, and labor unions to more effectively and efficiently access employment records and obtain “last known” contact information.* The lessons learned from this experience have resulted in improved communication and sharing of employee rosters.

- *Strengthened the effectiveness and coordination of various outreach and awareness campaigns by continuing to partner with other Federal agencies in the previously established Joint Outreach Task Group.* The agencies and entities involved include HSS, the Department of Labor (DOL), the National Institute for Occupational Safety and Health (NIOSH), the Offices of the Ombudsman for DOL and NIOSH, and the DOE-funded FWP projects. This effort enabled more effective outreach, enhanced communication, and more clarity and consistency in the information and guidance provided to former workers to allow them to make informed decisions regarding their rights and benefits.

Goals and Priorities for 2012

The FWP goals, priorities, and commitments for 2012 are constant with respect to delivering high-quality medical evaluation services to former workers. It is recognized that the FWP is inherently a dynamic program and will inevitably be faced with the next generation of former workers, who will have different health profiles and perhaps unique medical screening needs due to the ever changing mission and work of the Department. One important goal of the program is to continue to produce an effective outreach and awareness campaign so that potential work-related illnesses can be detected early and acted upon in a timely fashion.

The continued success of the FWP requires a robust program management framework that can effectively respond to changing program challenges and opportunities. The FY 2012 plans and priorities are designed to fulfill this vision. To this end, the FWP will:

- Monitor and ensure continued satisfaction of the program's ultimate clients, i.e., the former workers, with the delivery of program services. Related activities include assessing and improving performance metrics, using focused surveys, and providing a timely response to any programmatic areas that warrant improvement.
- Identify and reach out to newly-identified former workers. Related activities include leveraging all existing organizational relationships to locate employment rosters and contact information, making greater use of information technology tools and search engines, and implementing targeted outreach and awareness campaigns.
- Expand, within the existing budget, the use of low-dose computed tomography (CT) scanning for early lung cancer detection beyond the currently screened worker populations to other FWP participants who are at risk of lung cancer and meet the established eligibility criteria, including a history of at-risk occupational exposures.
- Integrate the de-identified (i.e., with personal identifiers removed) FWP medical screening results with existing site-specific medical and hazard exposure monitoring practices. These results provide valuable insights that can strengthen current worker health and safety protection practices.
- Share the collected, de-identified information to inform researchers. Part of this effort involves the inclusion of FWP data in the DOE Comprehensive Epidemiologic Data Resource, an electronic database that allows health researchers throughout the world to access data from health studies funded by DOE and other health-related activities regarding current and former DOE workers.
- Provide proactive program-wide policy, guidance, coordination, and oversight to ensure protection of former workers' privacy rights and PII.
- Ensure closer synergy between the FWP and the Energy Employees Occupational Illness Compensation Program to streamline the process and minimize the burden on former workers who wish to file a claim for benefits under the Energy Employees Occupational Illness Compensation Program Act, which is overseen by DOL.

Ultimately, the results of medical evaluations provide valuable insights to advance the scientific and public health communities' understanding of the health effects that may result from work-related exposures. This improved knowledge has led to enhanced safety and health measures that will better protect the current and future generations of workers.

Throughout the past 15 years, the FWP has served as a benefit to the former DOE workforce. While the program has identified, located, and offered medical screening services to thousands of former workers, there are still many who have not yet been served. There is still much work to be done to continue identifying, locating, and screening interested workers. Because many occupational-related conditions have long latency periods, re-screening efforts are crucial to detecting these diseases. Therefore, the FWP will continue to fulfill its obligation to the original mandate, as well as to fulfill the huge debt we owe the workers who served our Nation during World War II, the Cold War, and beyond.

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1.0 Program Overview

This 2011 Annual Report presents a detailed overview of the accomplishments, progress, and future endeavors of the U.S. Department of Energy (DOE) Former Worker Medical Screening Program, or Former Worker Program (FWP). The FWP is a congressionally mandated program that is responsible for screening former DOE workers for potential adverse health outcomes related to occupational exposures including but not limited to radiation, beryllium, asbestos, lasers, silica, welding fumes, lead, cadmium, chromium, solvents, and noise. This year marks 15 years of service to our former workforce.

The program was established following the issuance of the National Defense Authorization Act for Fiscal Year (FY) 1993 (Public Law 102-484), which called for DOE to:

“... establish and carry out a program for the identification and on-going medical evaluation of its... former employees who are subject to significant health risks as a result of the exposure of such employees to hazardous or radioactive substances during such employment.”

Since the inception of the FWP, DOE has made great strides in addressing the occupational health legacy of its nuclear weapons design and production activities. The FWP, managed by the DOE Office of Health, Safety and Security (HSS), uses independent occupational health experts from universities, labor unions, and commercial organizations to administer the medical screening program. A large part of the FWP’s success is rooted in the program’s in-depth infrastructure, which includes a nationwide, comprehensive network of health clinics that provide for services in close proximity to most workers’ residences (see Figure 1). The use of third-party providers and clinics that are familiar to the workers has resulted in the program’s high degree of credibility and objectivity, and the overall satisfaction of its participants.

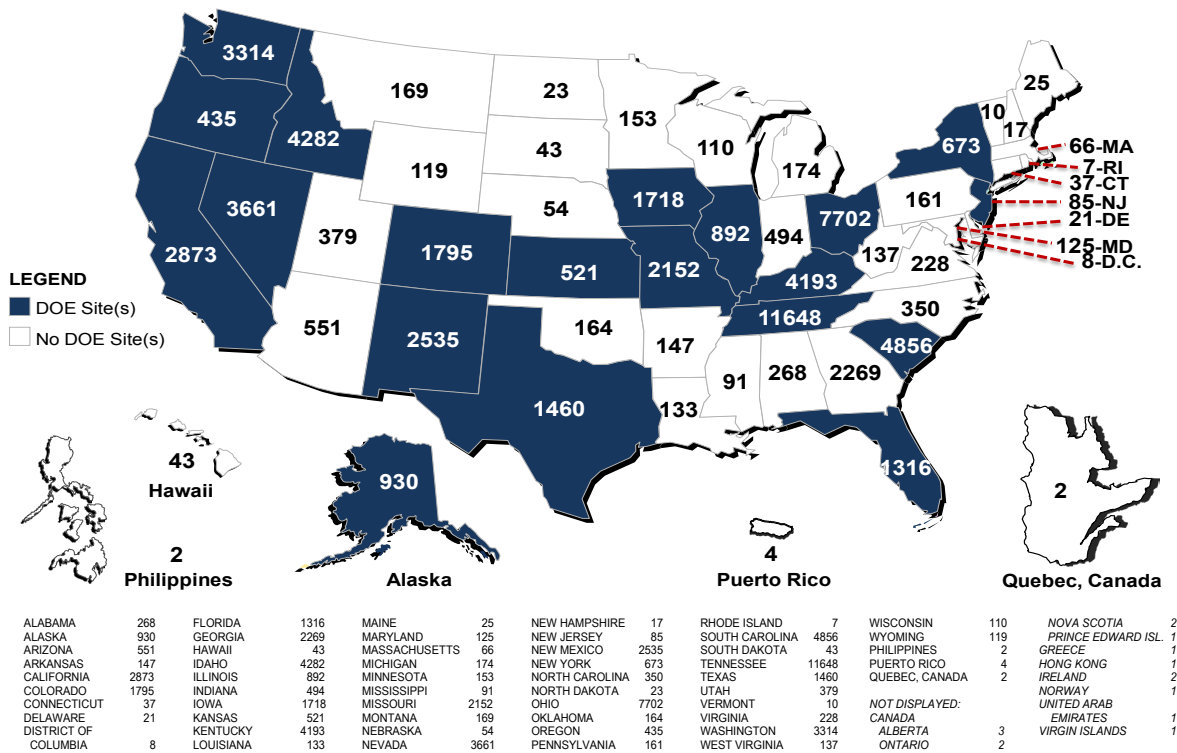


Figure 1. Participants Screened by State of Residence through September 2011¹

The estimated population of former workers who may be eligible to receive these medical screenings is upwards of 600,000 individuals. Almost 397,000 potential FWP participants have been contacted to date. Of those, 69,432 have participated in the program. A total of 85,586 exams have been conducted through the FWP, 68,082 initial exams and 17,504 re-screen exams. In addition, 1,350 workers have participated solely in the Early Lung Cancer Detection (ELCD) program (see Section 2.0, Program Implementation, for more information regarding this program).

The FWP infrastructure consists of six designated regional projects located near major DOE sites, as well as two nationwide projects. The nationwide projects include the Building Trades National Medical Screening Program (BTMed) and the National Supplemental Screening Program (NSSP). The BTMed provides medical screening exams for construction workers from 26 DOE sites. BTMed is structured to meet the requirements of former workers who have had many different employers and highly intermittent job-related exposures due to the nature of the work conducted by the building trades at DOE sites. These workers are exposed not only to the hazards typical of construction workers, but, potentially, also to additional hazardous substances within the production environment. In addition to providing medical exams to workers from eight primary DOE sites, the NSSP also provides medical screening services to former DOE workers from sites not covered by a regional project, workers whose regional project has been phased out, or workers who no longer live in close proximity to the regional screening clinics. Since many former workers move away from DOE sites once they retire/leave employment, this supplemental program ensures that all former DOE workers have easy access to screening, regardless of their previous worksite or location. Figure 2 provides a map indicating the DOE sites where regional projects have been initiated. The DOE sites, sponsoring organizations, and the year that screening was initiated are provided in Appendix A, and individual FWP projects are described in Appendix B.

¹ In previous years, the number of exams (initial and re-screen) were shown rather than number of participants. Because of this change in reporting, the numbers reported here cannot be directly compared to those provided in previous annual reports.

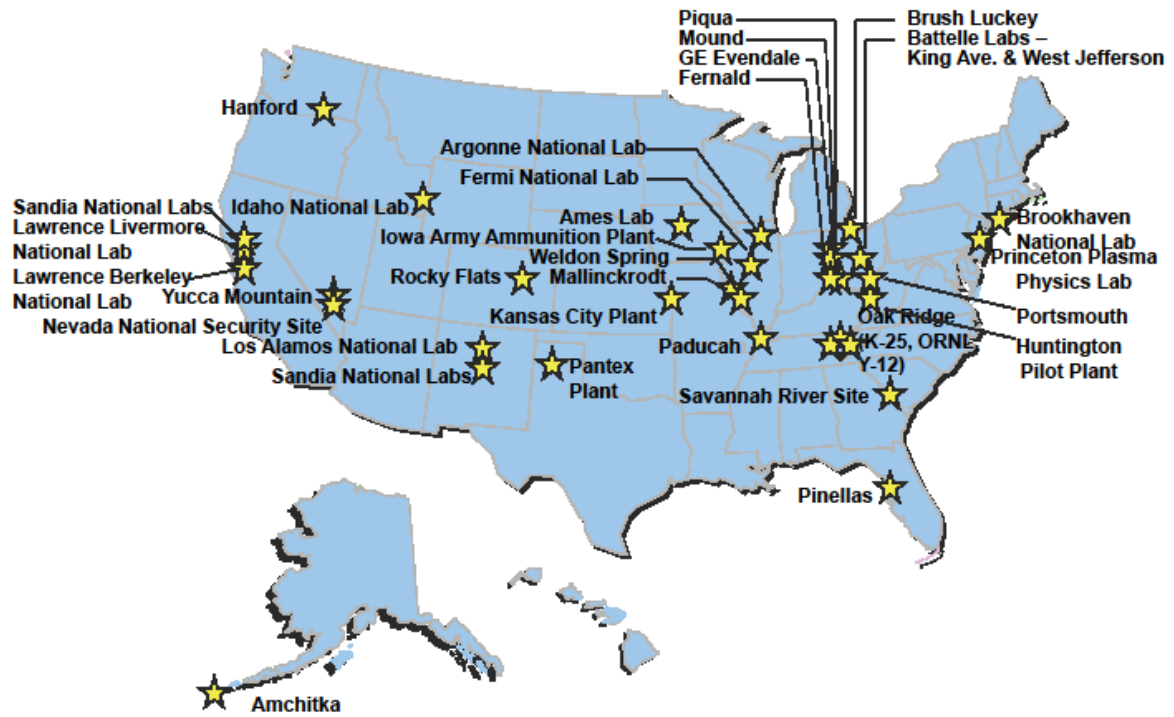


Figure 2. DOE Sites Served by FWP Regional Projects

The FWP directly benefits former DOE workers by: (1) identifying health problems at an early stage when they are more treatable, and (2) improving workers' understanding of health risks they may face due to possible exposures during their prior employment with DOE. To date, FWP has provided 85,586 free medical screening examinations to former Federal, contractor, and subcontractor employees who worked for the Department and/or its predecessor agencies (the Atomic Energy Commission and the Energy Research and Development Administration).

Tribute to Sylvia Kieding (1945-2011), Co-Founder of the Worker Health Protection Program

Not long after President Nixon declared war on cancer, the age-old fight against occupational hazards gained a new foot soldier, a young energetic woman named Sylvia Kieding. In 1973, Sylvia moved from her native Kentucky, where she had graduated from the University of Kentucky, to Denver and began a long and distinguished career dedicated to the elimination of occupational hazards. She began as secretary to Jeanne Stellman in the Health and Safety Department of the Oil, Chemical, and Atomic Workers (OCAW) Union. Those were heady days for occupational safety and health with the formation of the Occupational Safety and Health Administration (OSHA) in 1971; the subsequent appointment of Eula Bingham as Assistant Secretary of Labor for OSHA; and, most importantly, the leadership by OCAW, especially its dynamic Legislative Director, Tony Mazzocchi. Sylvia's responsibilities grew steadily within the Health and Safety Department, and she acquired a lifelong skill for and deep dedication to helping individual workers and local unions address workplace threats to their health and welfare. Sylvia was soft-spoken yet smart and perseverant, and she visited and helped innumerable OCAW workers during her decades of work. Sylvia eventually became the head of the OCAW Health and Safety Department and maintained its preeminence, even during difficult times in the union and within the occupational health and safety movement. Other notables – Steve Wodka, Rafael Moure-Eraso, Chris Oliver, and others – spent important time in the department, but Sylvia remained the link that held together the union's tradition in health and safety, even later on when it merged with the United Paperworkers union to become Paper, Allied-Industrial, Chemical, and Energy Workers International Union (PACE) and then when PACE merged with the United Steelworkers of America to form the United Steelworkers.



For Sylvia, helping to create, launch, and direct a medical screening program for former DOE workers in the 1990s was a dream. She had visited with many of the OCAW local unions at DOE sites over the decades and understood both the prevalence of historic workplace hazards and the scarcity of occupational health care at these sites. She also believed what Tony Mazzocchi had promoted – that occupational medicine should be independent of the workplace so that doctors can provide medical advice to workers, uninfluenced by the interest of various parties in the workplace. Third, and at the heart of what Sylvia believed, she envisioned a medical screening program for DOE workers that would be established and operated with significant participation by workers as equal partners in all aspects of the screening program. Why? To paraphrase Sylvia, “to ensure that the collective knowledge of workers was used, to make their priorities rise to the fore, and to focus on the needs of workers.” In her quiet and effective way, Sylvia made sure that the Worker Health Protection Program – the FWP medical screening program that serves DOE workers at 11 sites (including those that involved the former OCAW local unions) – included workers and their representatives as full and equal collaborators, thereby guaranteeing its credibility, endurance, and effectiveness.

Sylvia Kieding will be missed – her still, quiet voice and her deep knowledge and devotion.

Steven Markowitz, MD

Director, Worker Health Protection Program, Queens College, City University of New York

**Reflections on 15 Years of the FWP at the
Nevada Test Site (now known as the Nevada National Security Site)
Lewis Pepper, MD²
Boston University/Queens College**

Following the March 1996 publication of a Federal Register Notice requesting applications for developing a medical evaluation program for former DOE workers at significant risk for health problems due to exposures to hazardous or radioactive substances during employment at a DOE site, we at Boston University's School of Public Health embarked on writing a proposal for medical screening of the former Nevada Test Site (NTS) workforce.

There had been more than four decades of nuclear weapons testing at NTS when we began our investigation on worker health. NTS is situated in a remote area more than 60 miles north of Las Vegas, and like much of the DOE complex, it was shrouded in the veil of national security. Prior to our work, no major research or intervention program had attempted to evaluate the health status of the workers who built NTS's vast tunnel complexes, shafts, laboratories, and other facilities that were integral components of the weapons testing program. Over the weapons testing period, 1951-1992, more than 800 nuclear explosions took place at NTS, many of which involved the doubly dangerous and dirty work of building and then re-entering the tunnels and shafts used for the weapons tests.

Partly because of this dangerous work, NTS workers were a tight-knit community. At the peak of underground testing, as many as 15,000 workers were employed at NTS. Geographical isolation, patriotism, pride, and the novelty of the "final product" all cemented the bonds of community among NTS workers. Co-workers shared state secrets, a common purpose, and close working and living quarters that health experts had not previously asked them about.

Based on their significant exposure history and the risk we believed it posed to their health status, we proposed to focus our project on the underground and excavation construction workers and re-entry crews at NTS.

Our early work included focus and risk-mapping sessions, venues in which we hoped to tease out a more comprehensive picture of the hazards and harms this workforce experienced. The former worker community did not immediately embrace our efforts. Although we had the support of the major Construction Worker Union Federation, individual workers had to shed their initial suspicion about outsiders and trust that we would provide them with something they had not previously had, access to independent and skilled occupational medicine providers. While the cultural shift from secrecy and suspicion to openness and trust wasn't immediate, there was a gradual and perceptible change.

The earliest screenings were held every quarter over a three-day period at a University of Nevada Family Medicine clinic, and they were a sight to behold. Fifty participants came each day from throughout Nevada, Utah, California, and New Mexico to get screened. They came to talk with former colleagues who they hadn't seen in decades. And as they were fond of telling us, they wanted to let the world know about the health status of their group and about what they did for their country.

Although the participants were an incredibly patriotic group – after all, they worked in harm's way for years because of their convictions about their mission – they also believed that they shouldn't suffer from the effects of their work. In Nevada, before the FWP was started, NTS workers found it extremely difficult to obtain workers' compensation for most work-related diseases and cancers. When we asked why they thought the

2 The Principal Investigator for this project, Lewis Pepper, MD, is currently working at both Boston University (BU) and Queens College; however, this work was conducted under the BU cooperative agreement with DOE.

experience was so difficult, most former workers said that, among other reasons, there were few physicians who would go to bat for them in worker compensation cases.

Aside from the success of setting up the FWP, one of the greatest achievements of the FWP was its support in the establishment of the Federal Energy Employees Occupational Illness Compensation Program (EEOICP). The effort to establish a Federal compensation program for DOE employees was led by then Assistant Secretary for Environment, Safety and Health, Dr. David Michaels. Town hall style meetings were established throughout the country wherever there were DOE facilities. Dr. Michaels, along with local leaders and often Congressional representatives, sat in witness as former workers or their survivors provided emotional testimony about their work and about the illnesses which befell many of them or their friends. These workers, many of whom had previously been reluctant to share their experiences and illnesses with anyone, provided the motive force that enabled Congress to go forward and pass this historic legislation, the Energy Employees Occupational Illness Compensation Program Act of 2000.

The EEOICP was an early success of the FWP as it represented an acknowledgement by our country of the tremendous sacrifices made by many former DOE workers. This effort brought together a truly national coalition of labor leaders, academicians, and political leaders in common purpose. At the same time, the FWP provided many worker participants information about their health status that they could use as part of their application for appropriate and just compensation.

Today, the program at the Nevada National Security Site continues to screen former workers. Former workers continue to meet at our screening site where they exchange phone numbers, update each other on their families, and also share long-forgotten experiences that they share with us. Four thousand workers have taken part in this medical screening program, with new former workers taking part all the time. The success of our program and the trust it has created with the former worker community has allowed us to benefit from the information they share with us about hazards or processes we knew little about as we continually look for ways to update and improve our program.

However, the benefits of the FWP extend beyond the former DOE worker population. Our experiences provide rich models for others looking to develop programs for similar at-risk populations. We have generated information about hazards and medical screening that can start to address questions of chronic exposure and disease and have created methods that allow us to consider these questions. So, as I look back at the FWP experience, I say that we've made a good start, and I look forward to the next 15 years.

2.0 Program Implementation

Program implementation focuses on four specific activities, which are:

- **Outreach:** Identify and notify eligible DOE workers about FWP medical screening services.
- **Medical Screening:** Provide appropriate medical screening exams, including an evaluation of work-related exposure, to former workers who choose to participate in the program.
- **Communicate Results:** Provide information and assistance to workers about follow-up medical care and possible compensation for work-related illnesses.
- **Sharing Data:** Use the collected information to implement new strategies for worker safety and health at DOE sites and to inform researchers.

Outreach: Identify and notify eligible DOE workers about FWP medical screening services.

All former DOE Federal, contractor, and subcontractor employees from all facilities are eligible to participate in the program, not just those involved in the nuclear weapons program. Although the historical best estimate for the population of former workers who are entitled to receive medical evaluations under the FWP is upwards of 600,000 individuals, the precise total universe of such workers remains unknown.

Most of the FWP projects use multiple outreach methods to increase the visibility of the program in communities surrounding DOE sites and to notify potentially eligible DOE workers about the availability of FWP services. These methods are three-fold: 1) roster-based, 2) community-based, and 3) organization-based.

To implement efficient and inclusive screening programs, HSS works closely with DOE Headquarters program offices to obtain *rosters* of former employees from site contractors and DOE site offices. Rosters are lists of names, along with other identifying information, of former DOE workers that may be available from employers or DOE. Invitations are sent by the FWP projects to employees on the rosters, using the last known addresses. When addresses are found to be outdated or inaccurate, supplemental outreach methods are used; these include Internal Revenue Service mailings and address-update services, such as credit bureaus.

However, from the inception of the FWP, DOE recognized the challenges inherent in locating workers to participate in the medical screening program. Locating former workers is difficult because there



Commemorative event held in 2011 for former Iowa Army Ammunition Plant workers.

is no centralized database of DOE workers, and many workers, who were intermittently employed by subcontractors, typically do not leave a copy of employee records with the prime contractor when their job is completed. The result is that the availability of rosters varies greatly by site.

To overcome this obstacle, the FWP also employs a *community-based* approach to increase the likelihood of successfully locating and informing former workers of the program. Chief among these practices is the greater reliance on former workers themselves to serve as program advocates and ambassadors. Specifically, the FWP projects have recruited former workers to serve as local outreach coordinators. These coordinators or local “ground teams” are an effective resource to identify and reach out to their former colleagues and coworkers.

Organization-based approaches center on DOE workers’ direct or indirect contact with their former employers, unions, or news media; these contacts are enhanced by the relative closeness of rural communities where many DOE facilities are located. Local unions are also actively involved and engaged with the FWP in identifying potential participants. A great advantage of both the community- and organization-based outreach is that the communication can be targeted either to the individual DOE worker or to an entire DOE worker population.

The necessity for effective and creative outreach has gained increasing prominence over the life of the FWP, as the less easily located and notified workers require added effort and attention in order to fulfill the mandate of the FWP.

As of September 30, 2011, almost 397,000 potential FWP participants have been contacted. Those who are interested and eligible have either completed their examinations or are in the process of being scheduled for an exam.

Former Worker Program Site Needs Assessments – Recollections from the 1990s
Steven Markowitz, MD, Director, Worker Health Protection Program,
Queens College, City University of New York

When FWP began in 1996-1997, DOE required a needs assessment for each designated DOE site prior to establishing a medical screening program for former workers at that particular site. The overall goal was to understand and establish what a medical screening program for former DOE workers at a given site would require.

In the Worker Health Protection Program (WHPP), established by the Oil, Chemical, and Atomic Workers Union, first at the gaseous diffusion plants in 1996-1997 and subsequently at the Idaho National Laboratory in 1997-1998, WHPP conducted a broad needs assessment with the following components:

1. Collection and evaluation of existing exposure, epidemiological, and medical data pertaining to each site
2. Design and completion of a questionnaire survey that was mailed to a large sample of former nuclear weapons workers at each site
3. Conduct of focus group sessions for former workers at each site
4. Completion of an inventory on health care providers and community resources in the areas of the targeted sites
5. Identification of rosters of names, last known addresses, and other identifying information on former workers at each of the site.

This approach had several advantages. Existing studies of exposure and health outcomes were useful when available, but we found that there were large gaps in data. Through the questionnaire survey and focus groups, we expanded the knowledge on exposure and health outcomes gained through the studies and also gained an understanding of what health problems and working conditions were perceived to be of most importance to site workers, especially during previous decades. We mined the knowledge of workers in their 60s, 70s, and 80s, while they were still alive to offer such knowledge. In doing so, we were mimicking the academic approach of combining quantitative and qualitative information to develop a better understanding of the problem under examination. An added benefit to the questionnaire survey and focus groups is that we began to inform and excite a large number of workers and the local union at the DOE sites about the imminent establishment of a medical screening program for them. Since our program plan was to use local health providers to conduct FWP medical screening, we learned through our systematic search, and also from the opinions of the workers, which providers were highly regarded, geographically accessible, and might be willing to participate in a medical screening program.

WHPP began screening in 1997 and continues to thrive, now at 11 DOE sites. The needs assessments that were conducted for DOE have proven to be an important part of our success.

Medical Screening: Provide appropriate medical screening exams, including an evaluation of work-related exposure, to former workers who choose to participate in the program.

Conventional Medical Screening Program

Medical screening is a strategy used to optimize health and to identify diseases or conditions in a select population at an early stage, often before symptoms and signs develop. The primary purpose of screening is early diagnosis and referral for treatment of the individual. A comprehensive medical screening program evaluates employees' health as it relates to their potential occupational exposures to hazardous agents.

The FWP uses a customized medical screening protocol that was developed by a team of independent physicians specializing in occupational medicine and disease. The protocol is periodically updated, as necessary, based on new research findings within the scientific/medical community. The targeted health conditions include chronic lung and pleural diseases, beryllium-related disorders, hearing loss, and damage to other selected major organ systems that may be associated with occupational exposures.

The FWP generally applies the following criteria to the consideration of new screening tests:

- The condition sought should be an important health problem for the individual and community.
- There should be an accepted treatment or useful intervention for patients with the disease.
- The natural history of the disease should be adequately understood.
- There should be a latent or early symptomatic stage.
- There should be a suitable and acceptable screening test or examination.
- There should be facilities available to diagnose and treat the identified condition.
- There should be an agreed policy on whom to treat as patients.
- Treatment started at an early stage should be of more benefit than treatment started later.
- The cost should be economically balanced in relation to possible expenditure on medical care as a whole.
- Case finding should be a continuing process and not a one-time event.

The initial medical screening examination includes a physical examination and may consist of the following based on the individual's occupational exposure history:

- Chest x-ray with interpretation for occupational lung disease (B reading)
- Spirometry (breathing test)
- Beryllium Lymphocyte Proliferation Test (BeLPT)
- Blood chemistry test
- Urinalysis
- Audiometry (hearing test).



Photo from Line 1 IAAP medical screening.

Participation in the FWP is completely voluntary, and participants can refuse any portion of the screening examination.

Prior to participating in the medical screening program, former workers must complete an occupational history questionnaire, either on their own or via an interviewer-conducted session. The local outreach coordinators employed by the FWP projects are, in many cases, former workers with knowledge of DOE sites and exposures. One of their responsibilities is to conduct these occupational history questionnaire interviews. The exposures indicated on the occupational history questionnaire determine which tests will be offered. A listing of exposures and medical evaluations offered through the FWP is available in the medical protocol posted on the FWP website (see Appendix F).

The enabling legislation for the FWP also called for the program to provide ongoing medical evaluations; therefore, former workers are entitled to a re-screen examination three years after their initial medical screening and every three years thereafter. The re-screening improves the detection of latent occupational disease and adds a public health component to the medical screening program.

Certain tests may be medically indicated only during the initial screening exam and, therefore, excluded from the re-screen exam. For example, audiometry is not offered on the re-screen exam, since occupational hearing loss would typically be detected during the initial screening exam of retired workers.

When former workers participate in the initial screening, the results of the clinical exam and screening tests provide a baseline for their individual health status. Every three years, these participants are invited to participate in a re-screening examination. The repeat physical exam and diagnostic tests afford the opportunity to look for any changes in their overall health condition from the previous exam, making early referral and treatment more effective for a positive outcome.

A value-added benefit to the DOE FWP is the inclusion of a complete physical exam and an opportunity for health practitioners to provide wellness counseling. Studies have shown that individuals are more likely to stop smoking, for example, when a health care provider counsels them to do so. Similarly, the re-screening examination is an opportunity to educate former workers about behavior changes to improve their overall health status for improved quality of life.

In addition, the collection and analysis of this information can assist with identifying disease trends at a particular site, within a specific population (job class) of workers, or for a specific exposure/hazard. An evaluation of the findings, specifically those found during re-screening examinations, may help establish more accurate latency periods for a particular disease. A number of the work materials and processes that have an established association of exposure with a particular disease risk often have a period of latency (the time between the exposure and potential onset of the disease). In some cases, the latency period may be decades.

After a participant receives their screening exam, the results from the medical screening exams are sent to the FWP project office, usually within 24 to 48 hours of the exam, where they are reviewed by a health care professional for any abnormal findings that may require immediate attention. It is sometimes the case that participants may have an abnormal lab test or finding, such as high blood pressure, elevated blood sugar, or abnormal urinalysis, that requires follow-up or a repeat test. These participants are then contacted by phone, informed of the finding, and provided recommendations for further evaluation and treatment by their primary care physicians. The findings are documented in a letter to the participant, otherwise known as an “urgent letter,” that is sent by overnight mail.

The screening exam findings related to occupational exposures are reported in a results letter that is provided to the participant several weeks after the screening examination. Workers with findings that may be related to their work history at a DOE site are referred to the Department of Labor (DOL) to file a claim under the Energy Employees Occupational Illness Compensation Program Act (EEOICPA). Although the primary focus of the results letter is to provide a synopsis of any possible occupational-related findings and follow-up recommendations for those findings, the letter also includes a summary of all the findings, including non-occupational findings, discovered during the screening.

The results letter also includes general health/public health advice for workers, such as recommendations for smoking cessation.

As of September 2011, 68,082 initial exams have been conducted and 17,504 re-screens have been performed three or more years after the initial screening and evaluation. A breakdown of the number of initial and re-screen exams by DOE site is presented in Appendix C. A detailed description of each of the components of the medical exams, along with medical findings broken out by DOE site, can be found in Appendix D. A summary of medical evaluations performed to date is presented in Tables 1-4 and in the narrative thereafter. Only new abnormal findings on re-screen exams are reported.

Table 1. Chest X-ray Findings on Initial and Re-screen Exams (through September 2011)

Screening Exam	Workers Screened	Asbestos-related Lung Disease	Silicosis	Other Dust-related Disease	Lung Nodules, Nodes, or Lesions
Initial	60,723	7,485 (12.3%)	199 (0.3%)	1,206 (2.0%)	1,928 (3.2%)
Re-screen	14,797	1,041 (7.0%)	15 (0.1%)	119 (0.8%)	287 (1.9%)

Table 2. Spirometry Findings on Initial and Re-screen Exams (through September 2011)

Screening Exam	Workers Screened	Obstructive Airways Dysfunction Detected
Initial	60,441	12,914 (21.4%)
Re-screen	14,085	2,551 (18.1%)

Table 3. Results of Beryllium Lymphocyte Proliferation Tests on Initial and Re-screen Exams (through September 2011)

Screening Exam	Workers Screened	1 Abnormal	2 Abnormal	1 Abnormal and 1+ Borderline
Initial	46,695	784 (1.7%)	524 (1.1%)	187 (0.4%)
Re-screen	12,922	151 (1.2%)	137 (1.1%)	43 (0.3%)

Table 4. Audiometry Findings on Initial Exam (through September 2011)

Workers Screened	Noise Induced Hearing Loss
53,782	32,738 (60.9%)

- 60,723 workers received an initial chest x-ray:
 - 12.3% demonstrated findings consistent with asbestos-related non-malignant disease of the chest³.
 - 0.3% demonstrated findings consistent with silicosis⁴.
 - 2.0% had findings consistent with other dust-related lung disease.
 - 3.2% showed a nodule, lymph node, or other abnormality that possibly represented a cancer.
- 14,797 workers received a chest x-ray on re-exam:
 - 7.0% demonstrated findings consistent with asbestos-related non-malignant disease of the chest.
 - 0.1% demonstrated findings consistent with silicosis.
 - 0.8% had findings consistent with other dust-related lung disease.
 - 1.9% showed a nodule, lymph node, or other abnormality that possibly represented a cancer.
- 60,441 workers received a pulmonary function test (PFT) on initial exam:
 - 21.4% demonstrated PFT findings that were consistent with either chronic obstructive pulmonary disease (COPD)⁵ or asthma⁶.
- 14,085 workers received a PFT on re-exam:
 - 18.1% demonstrated PFT findings that were consistent with either COPD or asthma.
- 46,695 workers received a BeLPT (testing for beryllium sensitization) on initial exam:⁷
 - 1.7% received one abnormal BeLPT.
 - 1.1% received two abnormal BeLPTs.
 - 0.4% received one abnormal and one or more borderline BeLPTs.
- 12,922 workers received a BeLPT on re-exam:
 - 1.2% received one abnormal BeLPT.
 - 1.1% received two abnormal BeLPTs.
 - 0.3% received one abnormal and one or more borderline BeLPTs.

3 Asbestos-related disease, or asbestosis, is a lung disease caused by breathing in asbestos fibers.

4 Silicosis is a lung disease caused by breathing in silica dust.

5 Chronic Obstructive Pulmonary Disease is a progressive lung disease caused by long-term exposure to lung irritants, such as cigarette smoke, air pollution, chemical fumes, or dust.

6 Asthma is a chronic inflammatory disease of the bronchial tubes, or airways, that causes swelling and narrowing of the airways. It is thought to be caused by a combination of environmental and genetic factors.

7 Individuals with one abnormal BeLPT are encouraged to file a claim with the Department of Labor Energy Employees Occupational Illness Compensation Program. Beryllium sensitization is diagnosed by an occupational medicine physician based on abnormal BeLPT results.

- 53,782 workers received an audiogram (hearing test):
 - 60.9% demonstrated hearing loss for normal speech tones.

The medical screening examinations, while focusing on the detection of occupational disease, also provide an overall picture of the “general health” of DOE former workers. In addition to its core function of identifying conditions that may have been related to workplace exposures, the program also provides some general health screening services at little additional cost to the Department.

Participants are screened for some common non-occupational health conditions, such as blood sugar (diabetes), cholesterol (coronary artery disease), blood pressure (cardiovascular disease/hypertension), obesity, elevated creatinine levels (a blood test used to assess kidney function), and smoking (heart and lung disease and cancer). While not intended to be a comprehensive examination, these tests provide for the early detection and treatment of these conditions without significantly impacting on the overall focus and cost of the program.

The standard medical screening protocol used by the FWP is known to detect incidental findings. An incidental finding, or unanticipated abnormal finding, is information discovered during routine medical checks that, in many cases, ends up saving lives. Some of these include:

- Chest x-ray: pneumonia, abdominal aortic aneurysm
- Audiogram (hearing test): age-related hearing changes
- Complete blood count: anemia
- Physical exam: non-cancerous skin conditions.

The results of general health screening tests, as well as incidental findings picked up on examination, can be of great benefit to a participant. Many of the conditions that fall into this category can be readily treated and can significantly improve one’s longevity and quality of life. DOE and the FWP projects are committed to ensuring that the overall wellbeing of our workers is evaluated within the program.

Early Lung Cancer Detection Program

Because essential activities were undertaken to fulfill the Department’s mission that placed many of its workers at risk for lung cancer, DOE initiated the ELCD program. The primary goal of the ELCD is to detect lung cancers at an early stage when they are more treatable.

In 2000, the Worker Health Protection Program (WHPP), one of the FWP projects, began to screen Gaseous Diffusion Plant (GDP) workers for lung cancer using a state-of-the-art low-dose helical computed tomography (CT) protocol. The lung cancer screening program was provided to individuals, both current and former production workers, who met established eligibility criteria, including a history of at-risk occupational exposures. The helical CT is more informative than conventional chest x-rays in detecting pleural and interstitial lung diseases.

From 2000-2006, WHPP used low-dose CT scans as a primary screening test for ELCD among workers with histories of significant occupational exposure during employment with DOE at the three GDPs (Oak Ridge K-25, Paducah, and Portsmouth). In 2006, WHPP began a similar program at the Y-12 National Security Complex and Oak Ridge National Laboratory (ORNL). In 2010, WHPP started to offer CT screening to workers at Mound Plant and the Feed Materials Production Center (FMPC or Fernald) and restarted screening at the GDPs.

FWP medical screening services, including the ELCD, are covered by DOE human subjects protection requirements. Steps have been taken to ensure that participants are fully informed of the possible risks and benefits of the ELCD. The WHPP screening program is overseen and approved by two Institutional Review Boards (IRBs), which are committees that oversee the protection of human subjects.

From 2000 through September 30, 2011, WHPP performed chest CT scans on 11,286 workers. The total number of CT scans that have been taken in the program, including the repeat scans for indeterminate nodules, is 29,443. Results of WHPP's lung cancer screening program are summarized in Table 5. Seventy-seven ELCD program participants have been identified as having primary lung cancer. After staging the cancers, WHPP determined that 51 of the 72 (71%) individuals whose lung cancers have been staged to date (5 are pending) had a Stage I or II non-small cell or limited small cell cancer at the time of diagnosis (Table 5). The stage of cancer is a descriptor (usually numbers I to IV) of how much the cancer has spread. These findings indicate that CT screening is more informative than conventional chest x-rays in detecting lung cancer at an early stage when treatment is more likely to be effective.

**Table 5. Stage of Lung Cancers Detected by WHPP
Early Lung Cancer Detection Program, 2000-September 30, 2011⁸**

Site of ELCD Program	Number of Participants Screened	Number of Lung Cancers Detected	Number of Detected Lung Cancers That Were Staged	Number (%) of Early (Stage I or II Non-Small Cell or Limited Small Cell) Cancers Detected
Paducah	1,872	12	8	7 (88%)
Portsmouth	2,163	19	19	15 (79%)
K-25	2,700	23	22	18 (82%)
ORNL	1,133	8	8	2 (25%)
Y-12	2,598	14	14	9 (64%)
Mound Plant	486	1	1	0
FMPC	334	0	0	0
Total	11,286	77	72	51 (71%)

The ELCD program has also detected other diseases of importance, as shown in Table 6.

Table 6. Other Diseases Found on CT Scan

Condition	Number Detected
Thyroid cancer	4
Kidney cancer	4
Aortic aneurysms	19
Pneumonia	25

The WHPP ELCD program has contributed to the peer-reviewed literature, which has established that low-dose CT scans can improve the detection of early lung cancer.

In April 2010, DOE approved the expansion of the ELCD, within the existing funding, to other FWP participants who are at high risk of lung cancer and meet the established eligibility criteria. Also, DOE continued to monitor related efforts, such as the National Institutes of Health (NIH)-sponsored National Lung Screening Trial (NLST), which investigated the potential benefits of CT scans for a population of nearly 50,000 individuals at increased risk of lung cancer. The main objective of the NLST was to compare two ways of detecting lung cancer: 1) low-dose helical CT, and 2) standard chest x-ray, to see if CT screening could reduce lung cancer specific mortality relative to chest x-ray.

⁸ Early cancer is defined as Stage I or II non-small cell or limited small cell.

On June 29, 2011, the primary results of the NLST were published online in the New England Journal of Medicine and appeared in the print issue on August 4, 2011. The initial NLST's findings reveal that participants who received low-dose helical CT scans had a 20% lower risk of dying from lung cancer than those who were screened with chest x-rays. An additional finding, which was not the main endpoint of the trial's design, showed that all-cause mortality (deaths due to any cause, including lung cancer) was 7% lower in those screened with CT relative to those screened with chest x-ray. However, the results of the NLST do not answer the important questions that remain about what to do to minimize lung cancer and lung cancer deaths in non-smokers. While the national medical authorities begin their discussion on how to consider these findings, the National Institute for Occupational Safety and Health (NIOSH) is consulting with the NLST investigators, and working with stakeholders in labor, industry, and the occupational medicine clinical community to consider the meaning of these findings for workers potentially at risk for lung cancer because of occupational exposures.

While national medical authorities begin their discussions on how to apply the NLST's findings throughout the country, HSS is assessing efforts to provide low-dose CT screenings to other eligible DOE workers. As a result, BTMed, another component of the FWP, began a pilot screening program in April 2011. This pilot program, coordinated by CPWR – The Center for Construction Research and Training and supported by the Building and Construction Trades Department of the American Federation of Labor and Congress of Industrial Organizations (AFL-CIO) and the Knoxville Building and Construction Trades Council that represent construction workers at the Oak Ridge Reservation, included 100 participants at Oak Ridge. Baseline scans have been completed, and workers are now coming back for their 3- or 6-month follow-up scans to check on indeterminate nodules. Data from this pilot program will be presented in next year's annual report.

An additional component of the FWP's CT scanning program is monitoring the mortality of the participants screened for ELCD at the GDPs from 2000 through 2006. This monitoring continues to be performed through periodic receipt of vital status and cause-of-death information from the National Death Index. HSS will continue to review this information, as well as relevant publications, to determine the effectiveness of providing CT scanning through the FWP.

Ultimately, the results of CT scans and medical evaluations provide valuable insights to advance the scientific and public health communities' understanding of the health effects that may result from work-related exposures. This improved knowledge is likely to lead to enhanced safety and health measures that will better protect the current and future generation of workers.

Communicate Results: Provide information and assistance to workers about follow-up medical care and possible compensation for work-related illnesses.

Occupational medicine physicians review the results from the screening exams, along with the completed medical and occupational exposure history questionnaires, to determine whether the findings may have been caused by a work-related exposure. Workers are provided a summary of the findings from their screening examination in a results letter, along with any necessary follow-up recommendations. Individuals who are found to have adverse medical findings are referred to their personal physicians or a specialist for follow-up care.

When appropriate, the physicians who write the results letters include language regarding the possible work-relatedness of a condition, especially if the condition is known to be a potential occupational disease. The inclusion of this language, known as "causation" language, can be very helpful for participants who decide to file a claim under the EEOICPA, which is administered by DOL. Moreover, participants are informed of their possible eligibility for EEOICPA benefits in the results letters. EEOICPA provides compensation to eligible employees and former employees of DOE, its contractors and subcontractors, or certain survivors of such individuals for occupational illness or death arising from work in covered DOE facilities, atomic weapons employers' facilities, and beryllium vendors.

The FWP complements the Energy Employees Occupational Illness Compensation Program (EEOICP), as it offers former DOE workers medical evaluations that are conducted by expert occupational medicine physicians, providing workers, and by extension DOL claims examiners, with objective information for decision-making about the appropriateness of compensation. In addition, FWP project staff, many of whom are former DOE workers, are able to assist participants by providing useful site and exposure information to include in their claims packages. While participation in the medical screening program is not required for filing a compensation claim, the medical results are often useful in supporting an EEOICPA claim. The FWP will also refer individuals to other state and Federal workers' compensation programs when appropriate.

Sharing Data: Use the collected information to implement new strategies for worker safety and health at DOE sites and to inform industry-specific researchers.

The confidentiality and privacy rights of former workers are not only a legal requirement, they are crucial to establishing and maintaining credibility with the former worker community. All medical information that is collected as part of this program is treated as confidential and is used only as allowed by the Privacy Act of 1974. All FWP activities are conducted with the approval of the IRBs or Human Subjects Committees of DOE and involved universities. All individuals sign an informed consent and Health Insurance Portability and Accountability Act (HIPAA) authorization prior to participation.

De-identified (i.e., with personal identifiers removed), combined medical results from FWP activities are shared with the DOE Field Office Managers and Site Occupational Medical Directors (SOMDs) during site visits and reported on at various meetings. Sharing this information allows DOE sites to incorporate workplace hazard controls and to enhance analysis methods in the areas of maintenance, construction, and decontamination and demolition operations. In addition, DOE has applied operational "lessons learned" to its current workforce based on exposures identified through the FWP.

The gathered data are also valuable for other researchers to review. In order to share this information with researchers while still protecting the workers' right to privacy and confidentiality, the data will be provided in de-identified form to the DOE Comprehensive Epidemiologic Data Resource (CEDR). CEDR is a public-use data repository that was established to improve public access, as well as access by researchers, to data from health studies and other activities funded or conducted by the Department.

In summary, DOE remains committed to ensuring the safety and health of its workforce and to using the information provided through these programs to continually improve worker safety. This continual improvement will positively impact the long-term health of our current workforce, as well as the next generation of DOE workers.

More Than We Imagined The Former Worker Medical Screening Program

That the Department of Energy Former Worker Medical Screening Program (FWP) would be unprecedented was apparent during the initial planning meetings in 1996, which involved brainstorming by DOE, interested unions, and invited members of the occupational health community. For the first time, retired workers of an entire industry would be eligible for expert medical evaluations where likely or possible occupational health conditions would be identified. Despite the logic and simplicity of Section 3162 of the 1993 Defense Authorization Act, which mandated creation of the FWP, no workers in any entire industry had ever previously had the opportunity to learn whether their health problems might be work related. This was a telling commentary on the lack of importance historically given to the occupational burden of disease, especially to those who are so burdened. In creating FWP, DOE not only signified a decisive break with its own past but also with the entire history of occupational health.

Our initial goals, first conceived in 1996, were, therefore, ambitious but nonetheless limited in number. First, we would inform individual DOE workers if their work might have caused or contributed to any of their health problems. Second, we would assemble these individual evaluations into a portrait of the health of populations of DOE workers at various DOE sites. The clinical face of the program would pursue the former, while the public health facet of FWP would address the latter. Knowledge would accrue to individual DOE workers and to the occupational health sciences, even if research was not a primary outcome of FWP. These were ambitious goals but attainable.

Indeed, the ensuing years of FWP experience have shown us that, in fact, we underestimated what FWP could, and has been able to, achieve for DOE workers, both past and present, and for occupational health in general. Consider the following achievements of FWP:

1. Compensation. The engagement of DOE workers in FWP and the knowledge produced by FWP were instrumental in intensifying interest in compensation for occupational disease among DOE workers, which eventually contributed to the passage of the Energy Employees Occupational Illness Compensation Program Act (EEOICPA) of 2000. FWP, thereafter, faithfully served the goals of EEOICPA by providing improved occupational histories and expert evaluations of possible occupational illnesses among former DOE workers.
2. Benefits for Current Workers. FWP has increased knowledge about beryllium-related exposure and sensitivity throughout the DOE complex, which has in turn benefited the health and safety of current workers. DOE supported the early adoption of the use of CT scanning for early lung cancer detection for DOE workers, thereby leading the Nation in this important advance to reduce lung cancer mortality. Current workers at high risk from lung cancer as a result of previous exposure to occupational lung carcinogens may also benefit from CT scanning.
3. Enhanced Human Subjects Protection. The implementation of medical screening under FWP has stimulated important discussions about how to apply DOE's policies on protecting its workers who participate in screening programs and research. FWP has served as a useful laboratory for application of provisions of informed consent, data privacy, and other human research protections within DOE with important lessons for the future for DOE and other agencies, and settings as well.
4. Beneficence (i.e., doing good). FWP has provided a concrete demonstration that DOE, the Federal government, and the country as a whole cares about the ill health legacy of nuclear weapons production on those who dedicated their lives to this work. For many DOE workers and their families, FWP has brought some peace of mind by filling an enormous vacuum of knowledge about how occupational exposures might or might not have impacted the health of the people who worked at these sites.

I feel fortunate to have contributed to this effort and look forward to our continued future achievements.

Steven Markowitz, MD
Director, Worker Health Protection Program
Queens College, City University of New York
December 2011

My Experiences with the DOE Former Worker Program

I have worked with the Johns Hopkins Bloomberg School of Public Health Former Worker Program since 1997, when I was hired as the project coordinator for a program at Los Alamos National Laboratory (LANL). This was a unique experience that enabled me, a doctoral student at the time, to participate in every aspect of the program—from project development to participation in screening examination sessions. As project coordinator, I worked with all members of the program team, including occupational medicine physicians, industrial hygienists, epidemiologists, and a behavioral scientist. My duties included acting as the primary data collector for the LANL Needs Assessment and helping to prepare and conduct focus groups with former workers from LANL and the Building Trade Unions, in order to learn about the facility and the workers' experiences during their employment there.

Once the DOE accepted our proposal to develop a screening program for LANL former workers, I was able to engage with all aspects of the development of a screening program. We decided to perform the examinations ourselves in New Mexico, and my first task was to find an office and hire employees to staff it. We worked with former LANL workers in focus groups to develop recruitment materials and the materials used to inform workers of their examination results. We developed surveys to collect exposure information and work and medical histories, and consent forms to obtain permission for surveys, examinations, and testing.

As the program has progressed, I too have progressed from a doctoral student to a Co-Investigator and then a Principal Investigator. We have added another site to our program, and we now conduct screening examinations and testing for former workers from Los Alamos and Sandia National Laboratories.

Throughout the years, I have learned not only about program development, tracking and recruiting individuals, communicating with program participants, and developing protocols for the examinations and testing of former workers—but also about courage and about devotion to one's country. While these former workers were often placed in precarious situations during their employment, they met their responsibilities with dedication and perseverance, in the belief that their work was part of our country's national security mission.

Maureen Cadorette, RN, PhD
Johns Hopkins Bloomberg School of Public Health

3.0 Program Accomplishments and Initiatives

3.1 Overall Program Accomplishments

The program continued to fulfill its critical mandate of providing medical screening services, at no cost, to all interested former DOE workers. To date, 85,586 screenings have been performed. In FY 2011 alone, 4,767 initial medical evaluations and 4,193 re-screen exams were conducted.

The program has resulted in a high level of satisfaction among participating former DOE workers. In FY 2011, an average of 98.1% of the participants indicated satisfaction with the program. The vast majority of participants are very satisfied with the program in general, the services they receive, the quality of the personnel, and the timeliness of service delivery.

The program is served by renowned occupational medicine physicians from across the country. To overcome both the longstanding shortage of occupational medicine expertise in communities surrounding DOE sites and the perceived lack of objectivity of local physicians expressed by some DOE workers, DOE has been able to match and connect national occupational medicine expertise with local parties throughout the DOE complex. These physicians have worked with DOE to develop and conduct the FWP medical screening program using clinics in DOE communities, as well as a nationwide network of clinics and prominent medical institutions with expertise in respiratory conditions. These physicians have worked with local clinics to ensure highly accessible and appropriate medical screening services and follow-up. In some instances, FWP project personnel have provided occupational medicine training and clinical sessions to medical clinic staff in DOE communities in order to offer the best quality service to FWP participants.

The program has resulted in the identification of conditions at early stages, allowing for successful treatment. The FWP has identified pre-cancerous conditions and cancers at early stages, allowing successful treatment and, in some cases, the elimination of the disease, thus substantially improving the health and wellbeing of many former workers who participated in the program. With the knowledge that DOE is committed to worker safety and health, current workers will likely have fewer concerns about working at DOE sites, may remain with DOE longer than they might have otherwise, and will be more productive while employed. In addition, a valuable added benefit of the medical screenings provided through the FWP is the identification of non-occupational health conditions, such as uncontrolled high blood pressure, diabetes, and elevated cholesterol levels.

FWP screening exam results continue to benefit former workers by providing useful information to support EEOICPA claim adjudication. The FWP provides former DOE workers with an accessible, affordable means of obtaining a medical evaluation targeted at work-related health conditions. While participation in the medical screening program is not required for filing an EEOICPA compensation claim, the medical results have been useful in supporting workers' claims. In this regard, the program has served as a value-added and critical complement to the DOL EEOICP.

The program has advanced the state of medical knowledge. The FWP has contributed to peer-reviewed scientific literature, either directly by studying former workers in the context of the screening program or by recruiting former workers in the program as research participants for scientific studies funded by the NIH or other research funding sources. Appendix E lists the major publications that have benefited from program activities to date. Some of the topics include beryllium sensitization, hearing loss, and pulmonary abnormalities among former DOE workers. Not included in the list are numerous briefings to small groups, including DOE staff, SOMDs, and site employees.

3.2 2011 Initiatives

HSS continues to explore ways in which it can enhance the FWP. It is the responsibility of the Department to ensure that the services rendered through the FWP are of the highest quality and are delivered effectively, compassionately, and in a timely manner. To achieve this goal, it is necessary for HSS to communicate with stakeholders and to request feedback concerning the program, which is why outreach and collaborative activities are of the highest priority to those who serve the former DOE workforce through the FWP. Since the publication of the 2010 FWP Annual Report in February 2011, HSS has undertaken a number of initiatives to build upon past successes of this program, focusing on communication, outreach, and strengthening relationships with stakeholders, including:

Strengthened its partnership with other Federal agencies on outreach initiatives.

The Joint Outreach Task Group (JOTG) includes representatives from HSS, DOL, NIOSH, the Offices of the Ombudsman for DOL and NIOSH, and the DOE-funded FWP projects. The JOTG was established in 2009 under the premise that agencies/programs with common goals can work together by combining resources and coordinating outreach efforts. In addition, this partnership among different government agencies responds to the President's recommendations for transparency and open government. Each involved agency has a different mission, but the missions are complementary. By working together, the agencies are better able to serve the DOE workforce. The task group conducts monthly conference calls, thereby encouraging communication and collaboration. The JOTG's 2011 achievements in support of the FWP and EEOICP include:

- Held eight "Town Hall" meetings in and near the communities of seven DOE sites.

In 2011, the JOTG held eight "Town Hall" meetings in and near the following seven DOE sites: Kansas City Plant, ORNL, Y-12 National Security Complex, the former Oak Ridge K-25 GDP, Savannah River Site, Argonne National Laboratory, and Fermi National Accelerator Laboratory.

- Maintained and supported the JOTG calendar of events.

The JOTG created a monthly calendar of community events that is available on the DOE HSS website to facilitate interagency and community involvement in these events.

- Held four DOE EEOICPA process overview sessions that included the review of records handling practices for seven DOE sites.

The DOE EEOICPA process overview sessions are geared toward improving communication and enhancing collaboration among the JOTG members. The meetings are hosted by the DOE EEOICPA point of contact at each site and bring together the DOE-funded FWP projects and the agencies involved in EEOICP activities to: (1) provide a better understanding of DOE's process for responding to records requests in support of claims filed under EEOICPA, and (2) increase awareness of the variety and quantity of records available at the DOE sites.

The JOTG focuses on educating the former workers on the programs and resources available to them.

Released the EEOICPA and FWP educational brochure.

In 2011, the JOTG released an educational brochure that provides a summary of the agency roles and programs available for assisting DOE nuclear weapons facility workers and their families. The brochure is available at all of the outreach events hosted by the members of the JOTG, as well as on the DOE HSS website at:

http://www.hss.doe.gov/healthsafety/FWSP/Formerworkermed/factsheets/Joint_Outreach_Task_Group_trifold.pdf

Enhanced relationship with DOE Field Offices and sites through regular visits.

One major component of HSS's ongoing outreach plan is aimed at increasing awareness and support of FWP among senior Federal and contractor managers at DOE sites and laboratories.

In 2011, the FWP projects teamed with multiple DOE sites on various outreach efforts, including: participating in onsite health and safety fairs, providing FWP brochures in exit packets for workers separating from the site, and publishing program materials and hyperlinks on retiree and DOE site webpages.

In addition, HSS participated in meetings with four sites across the DOE complex. Attendees included Federal and contractor Human Resources department staff, members of the onsite medical department (including the SOMDs), and staff from the site health and safety department. The meetings focused on opening the lines of communication between the FWP and current workers, providing an overview of FWP and a summary of findings to date, and discussing methods for locating and reaching out to former workers.

Strengthened interfaces with SOMDs.

Maintaining a strong relationship between the DOE SOMDs and the FWP projects is important for both the former workforce and current DOE workers. The SOMDs are a valuable asset to the FWP in that they can facilitate the transition of workers from their current onsite health maintenance program to the appropriate former worker medical screening program. At the same time, the findings from the FWP screening exam can be useful for the SOMDs to guide them in establishing protections to limit or possibly eliminate hazardous exposure for the current workforce.

To encourage this relationship, HSS Headquarters personnel, as well as staff from the FWP projects, regularly include the SOMDs in meetings held on site and share the findings from the screening exams with them. In the spring of 2011, the DOE FWP Program Manager, as well as staff from the FWP projects, joined the SOMDs at the Energy Facility Contractors Group (EFCOG) Occupational Medicine Subgroup for three days of meetings with doctors from sites across the complex.

Participation in the EFCOG Occupational Medicine Subgroup meetings allows FWP staff and SOMDs to share ideas and plan future joint initiatives related to the health and safety of DOE workers. The desired outcome from these interactions is to influence more effective medical monitoring of the current workforce and future medical screening of these individuals when they become former workers. HSS and the DOE-funded FWP projects recognize the importance of this relationship and will continue to support ongoing interactions with the SOMDs.

Participated in a Beryllium Health and Safety Committee meeting.

The DOE FWP Program Manager provided an overview of the program, along with medical findings to date, at the fall 2011 Beryllium Health and Safety Committee (BHSC) meeting. The BHSC promotes activities/efforts that will help in understanding and preventing beryllium-induced conditions and illnesses, including beryllium sensitization and chronic beryllium disease (CBD), which may be caused or exacerbated by workplace exposure to beryllium. The BHSC mission is primarily educational in nature, and is accomplished through generation, collection, and dissemination of information to members and other interested parties.

Participated in a Beryllium-Associated Worker Registry meeting.

The DOE FWP Program Manager was invited to present beryllium screening findings at the spring 2011 Beryllium-Associated Worker Registry (BAWR) webinar on analyses of beryllium health and exposure data. BAWR is a surveillance registry of current workers who are exposed to beryllium in their current job, or may have been exposed to beryllium in the past from work conducted at a DOE site. The goal of the registry is to determine the incidence and prevalence of beryllium sensitization and CBD.

A Second Generation Oak Ridge Asbestos Worker Out Of Local 46 Reflects On His Role in the Building Trades National Medical Screening Program

When Johnny Ballinger looks at the photograph of the 28 insulators he worked alongside at the Oak Ridge Reservation when he started in 1961, he sees those faces disappear. Of those 28 men, only he and his own brother remain.



“When I started out there, they told me nothing would hurt you,” Johnny explains. “We didn’t wear but the clothes on our backs.” Then, in November of 1968, he was diagnosed with the very first case of asbestosis in Tennessee and needed to have a lobe of his lung removed. “The Oak Ridge doctor even kept it to use as a model.”

Such an experience makes it easy for anyone to see why the Building Trades National Medical Screening Program (BTMed) has been so important to Johnny. For he isn’t only a participant in the BTMed, he also conducts the Oak Ridge work history interviews for construction workers, a job he has been steadily doing ever since 2002.

“Over the past ten years, there isn’t a day that goes by that I don’t feel such satisfaction in having helped other Oak Ridge workers. But what do I really enjoy most? Seeing someone walk through the door who I haven’t seen since we were working on the site together 25 years ago. We rehash all kinds of stories, some of which I’d long forgotten.”

For Johnny, being a part of the BTMed staff has extended beyond work and into an experience that is personally rewarding. “Many of my co-workers have found conditions early that they’ve been able to treat before it cost them their lives. Just having a hand in making that happen makes me feel incredibly humble. Saving lives, that’s God’s work, but having a simple hand in it, that’s a blessing I’ll always be grateful for.”

“I worked out on Oak Ridge for three decades to help protect our great country, and now I’ve been working for one decade to help save the workers who helped protect our great country. The site, this program, the work I’ve done and continue to do, it’ll always be a part of me.”

4.0 Program Goals and Priorities for 2012

DOE has made great advances in addressing the occupational health legacy of its over 60 years of nuclear weapons design and production. The FWP is a prime example of DOE's commitment to its workforce and demonstrates the feasibility and value of conducting targeted medical screening programs for occupational diseases.

In 2012, the Department will continue to meet its obligation through the FWP while undertaking a number of initiatives to improve upon past successes of this program. DOE will conduct the following activities:

1. Maintain program elements and practices that account for the program's high degree of success. These include:

- Ensure that the most cost-effective means are used to improve coordination, maximize the number of screenings, and make screening services available to all eligible workers from all DOE sites. HSS will continue to monitor and ensure former workers' continued satisfaction with the delivery of services by assessing and enhancing performance metrics, using focused surveys, and providing timely response to any programmatic areas that warrant improvement.
- Meet with the FWP projects twice a year to share and disseminate knowledge and lessons learned throughout the FWP to ensure that the best methods for conducting outreach, medical assessment, and follow-up processes are being used. Through these collaborative meetings, HSS will continue to improve program implementation, maintain consistency across the projects, and evaluate new screening methodologies.
- Publish an annual report to promote transparency and communicate program findings to all stakeholders.
- Meet with and inform DOE sites' senior management and worker populations about the FWP, its relationship to the EEOICP, and how the programs can benefit workers.
- Work with DOE sites to make certain that current workers are informed and updated regarding their rights and eligibility to participate in the FWP upon leaving DOE employment.
- Work with DOE program offices to obtain rosters of former workers from sites where new FWP projects have recently started, as well as updated rosters of workers who have retired or separated since previous rosters were obtained.
- Collaborate with DOL, the DOL Resource Centers, NIOSH, and the Offices of the Ombudsman for DOL and NIOSH to work on outreach initiatives related to the FWP and EEOICP programs. In 2012, the JOTG will look for new and innovative ways to reach out to the DOE workforce and their families with information about the programs and services available to them.
- Share de-identified, group data with DOE SOMDs. In so doing, DOE not only informs the SOMDs of the medical findings but also provides useful information for improving current workers' health and safety programs. In particular, this information is important for construction workers performing maintenance, remodeling, or cleanup in buildings contaminated with beryllium, asbestos, or other hazardous materials.
- Meet annually with the SOMDs and site representatives, and participate in the EFCOG Occupational Medicine Subgroup meetings and BHSC meetings. These opportunities allow HSS to share the findings of the FWP and work with staff from DOE sites to determine how data collected through

this program can be translated into improved health and safety programs throughout the DOE complex.

2. Build on lessons learned to continuously improve program implementation. These include:

- Make greater use of information technology tools and search engines to identify and contact former workers, and implement targeted outreach and awareness campaigns.
- Continue to improve the delivery of exams and the timeliness of providing results, information, and assistance regarding follow-up medical care and compensation.
- Expand, within available funding, the use of low-dose CT scanning for ELCD to other FWP participants who are at risk of lung cancer and meet the established eligibility criteria including a history of at-risk occupational exposures. In addition, DOE will continue to monitor related efforts, such as those activities to be undertaken by NIOSH, that will carefully consider the NIH's findings; consult further with NIH investigators; and work with stakeholders in labor, industry, and the occupational medicine clinical community to understand the meaning of these findings for workers potentially at risk for lung cancer because of occupational exposures.
- Expand the sharing of data with CEDR. HSS is exploring ways to provide FWP data to CEDR on a more current basis but within the requirements of the consent forms signed by program participants. To date, only data from FWP projects that have phased out and transitioned into the Nssp have been uploaded to CEDR.
- Enhance proactive management of issues, such as protection of personally identifiable information and former worker privacy rights, which directly impacts the credibility of the FWP. These enhancements will also include a more rigorous ongoing self-assessment of program effectiveness, quality assurance, and quality control.

To look back at where the program started and compare that with where the program is now, it's incredible to see how much it's grown. Doing so also makes me realize how long I've been part of it! Having been in Oak Ridge since the program first began with just three sites (Hanford, Oak Ridge, and Savannah River), I've been able to see the Building Trades National Medical Screening Program (BTMed) develop into a national program that now serves sites all across the DOE complex (26 sites to be exact). That means thousands of construction workers are getting screened every year.

The reason for this growth is simple, BTMed has always put the worker first. For me, that's the best part – meeting the workers in-person, talking to them, and hearing their stories, all while helping them through the screening process. We develop a relationship that makes the workers feel comfortable in getting their health examined, which makes it easy for me when I help them understand what their medical reports are saying. Sometimes the amount of personal contact I get to experience makes me even feel guilty because *I'm* the one who gets to hear the success stories firsthand, like when someone calls and says “you saved my life!”

One of my all-time favorite stories is about a steamfitter who worked at Oak Ridge for more than 10 years. His wife nagged him and nagged him and nagged him to come in for a screening. Finally, he did, and the screening discovered early stage colon cancer. His wife saved his life! And because of BTMed, he's now able to spend many more years with his wife – and their great-grandchildren. I sure hope he gave her a big kiss!

There are a lot of cases like that, though – when a worker finds out about a medical condition he didn't know he had. There are many silent killers out there. So many workers make a lifestyle change after their initial exam and come back for their re-screening in such better health. This program not only helps detect current conditions, it also helps prevent future ones from developing. The program pays for itself so I'd love to see more done for it through additional funding, so that construction workers could receive CT scans. Having formed such a well-established foundation, this program is something whose continued growth is hard not to envision. And I love being a part of it, everything I get to do to help others on a daily basis. So I won't just be here to see where this program goes in the future, I'll be the one who gets to hear about it firsthand from the workers whose lives it saves!

- Kim Cranford, RN, Medical Review Program Manager, Oak Ridge Outreach Office



Kim Cranford has been the Oak Ridge Medical Review Program Manager for BTMed since 1998, the year medical screenings were first offered to former DOE construction workers. She reviews workers' medical reports for any indicated health issue. She calls the worker to personally explain the findings and what they mean to the worker. This gives the worker the knowledge to understand their health and to make informed decisions about it.

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Appendix A: Implementing Organizations

Location	DOE Site ⁹	Year Screening Initiated	Organization	Key Personnel
Alaska	Amchitka Island Test Site	2000	CPWR - The Center for Construction Research and Training, University of Cincinnati Medical Center, Duke University Medical Center, and Zenith American Solutions 1-800-866-9663	Knut Ringen, DrPH, MHA, MPH
California	Lawrence Berkeley National Laboratory	2008	Boston University School of Public Health and University of California, San Francisco 1-866-460-0628	Lewis Pepper, MD, MPH Robert Harrison, MD, MPH
	Lawrence Livermore National Laboratory	2007		
	Sandia National Laboratories	2007		
Colorado	Rocky Flats Plant (Construction Workers)	2006	CPWR - The Center for Construction Research and Training, University of Cincinnati Medical Center, Duke University Medical Center, and Zenith American Solutions 1-800-866-9663	Knut Ringen, DrPH, MHA, MPH
Colorado	Rocky Flats Plant (Production Workers) ¹⁰	1999	Oak Ridge Associated Universities, Comprehensive Health Services, National Jewish Health, University of Colorado Denver, and Axion Health 1-866-812-6703	Donna Cragle, PhD John McInerney, MD Lee Newman, MD
Florida	Pinellas Plant (Construction Workers)	2005	CPWR - The Center for Construction Research and Training, University of Cincinnati Medical Center, Duke University Medical Center, and Zenith American Solutions 1-800-866-9663	Knut Ringen, DrPH, MHA, MPH
Florida	Pinellas Plant (Production Workers)	2005	Oak Ridge Associated Universities, Comprehensive Health Services, National Jewish Health, University of Colorado Denver, and Axion Health 1-866-812-6703	Donna Cragle, PhD John McInerney, MD Lee Newman, MD
Idaho	Idaho National Laboratory (Construction Workers)	2005	CPWR - The Center for Construction Research and Training, University of Cincinnati Medical Center, Duke University Medical Center, and Zenith American Solutions 1-800-866-9663	Knut Ringen, DrPH, MHA, MPH

9 The sites listed are those where a specific project has been initiated. Multiple small sites are also served by CPWR - The Center for Construction Research and Training, through the Building Trades National Medical Screening Program (for construction workers), and by Oak Ridge Associated Universities, through the National Supplemental Screening Program (for production workers).

10 This cohort transitioned from the University of Colorado Health Sciences Center to Oak Ridge Associated Universities in 2006.

Location	DOE Site ⁹	Year Screening Initiated	Organization	Key Personnel
Idaho	Idaho National Laboratory (Production Workers)	2000	United Steelworkers and Queens College of the City University of New York 1-888-241-1199	Jim Frederick Steven Markowitz, MD Lewis Pepper, MD
Illinois	Argonne National Laboratory Fermi National Accelerator Laboratory	2006 2006	Oak Ridge Associated Universities, Comprehensive Health Services, National Jewish Health, University of Colorado Denver, and Axion Health 1-866-812-6703	Donna Cragle, PhD John McInerney, MD Lee Newman, MD
Iowa	Ames Laboratory Iowa Army Ammunition Plant	2006 2001	University of Iowa College of Public Health 1-866-282-5818	Laurence Fuortes, MD, MS
Kentucky	Paducah GDP (Construction Workers)	2004	CPWR - The Center for Construction Research and Training, University of Cincinnati Medical Center, Duke University Medical Center, and Zenith American Solutions 1-888-464-0009	Knut Ringen, DrPH, MHA, MPH
Kentucky	Paducah GDP (Production Workers)	1999	United Steelworkers and Queens College of the City University of New York 1-888-241-1199	Jim Frederick Steven Markowitz, MD Lewis Pepper, MD
Missouri	Kansas City Plant (Construction Workers)	2005	CPWR - The Center for Construction Research and Training, University of Cincinnati Medical Center, Duke University Medical Center, and Zenith American Solutions 1-800-866-9663	Knut Ringen, DrPH, MHA, MPH
Missouri	Kansas City Plant (Production Workers)	2005	Oak Ridge Associated Universities, Comprehensive Health Services, National Jewish Health, University of Colorado Denver, and Axion Health 1-866-812-6703	Donna Cragle, PhD John McInerney, MD Lee Newman, MD
Nevada	Nevada National Security Site (previously known as Nevada Test Site) and Other Las Vegas Locations	1997	Boston University School of Public Health and University of California, San Francisco 1-877-771-7977	Lewis Pepper, MD, MPH Robert Harrison, MD, MPH
New Jersey	Princeton Plasma Physics Laboratory	2007	Oak Ridge Associated Universities, Comprehensive Health Services, National Jewish Health, University of Colorado Denver, and Axion Health 1-866-812-6703	Donna Cragle, PhD John McInerney, MD Lee Newman, MD

Location	DOE Site ⁹	Year Screening Initiated	Organization	Key Personnel
New Mexico	Los Alamos National Laboratory Sandia National Laboratories	2000 2006	Johns Hopkins Bloomberg School of Public Health 1-877-500-8615	Brian Schwartz, MD, MS Maureen Cadorette, RN, MPH, PhD, COHN-S
New York	Brookhaven National Laboratory (Construction Workers)	2005	CPWR - The Center for Construction Research and Training, University of Cincinnati Medical Center, Duke University Medical Center, and Zenith American Solutions 1-888-464-0009	Knut Ringen, DrPH, MHA, MPH
New York	Brookhaven National Laboratory (Production Workers)	2011	Queens College of the City University of New York 1-888-241-1199	Steven Markowitz, MD Lewis Pepper, MD
Ohio	Feed Materials Production Center (otherwise known as Fernald) Mound Plant Portsmouth GDP (Construction Workers)	2005 2005 2004	CPWR - The Center for Construction Research and Training, University of Cincinnati Medical Center, Duke University Medical Center, and Zenith American Solutions 1-888-464-0009	Knut Ringen, DrPH, MHA, MPH
Ohio	Feed Materials Production Center (otherwise known as Fernald) (Production Workers)	2006	Queens College of the City University of New York and the Fernald Medical Screening Program 1-888-241-1199	Steven Markowitz, MD Lewis Pepper, MD Ray Beatty
Ohio	Mound Plant Portsmouth GDP (Construction Workers)	2005 2004	CPWR - The Center for Construction Research and Training, University of Cincinnati Medical Center, Duke University Medical Center, and Zenith American Solutions 1-888-464-0009	Knut Ringen, DrPH, MHA, MPH
Ohio	Mound Plant Portsmouth GDP (Production Workers)	2005 1999	United Steelworkers and Queens College of the City University of New York 1-888-241-1199	Jim Frederick Steven Markowitz, MD Lewis Pepper, MD
South Carolina	Savannah River Site (Construction Workers)	1999	CPWR - The Center for Construction Research and Training, University of Cincinnati Medical Center, Duke University Medical Center, and Zenith American Solutions 1-800-866-9663	Knut Ringen, DrPH, MHA, MPH
South Carolina	Savannah River Site (Production Workers) ¹¹	1999	Oak Ridge Associated Universities, Comprehensive Health Services, National Jewish Health, University of Colorado Denver, and Axion Health 1-866-812-6703	Donna Cragle, PhD John McInerney, MD Lee Newman, MD

11 This cohort transitioned from the Medical University of South Carolina to Oak Ridge Associated Universities in March 2010.

Location	DOE Site ⁹	Year Screening Initiated	Organization	Key Personnel
Tennessee	Oak Ridge K-25 (Production Workers)	1999	United Steelworkers and Queens College of the City University of New York 1-888-241-1199	Jim Frederick Steven Markowitz, MD Lewis Pepper, MD
Tennessee	Oak Ridge Reservation ¹² (Construction Workers)	1998	CPWR - The Center for Construction Research and Training, University of Cincinnati Medical Center, Duke University Medical Center, and Zenith American Solutions 1-888-464-0009	Knut Ringen, DrPH, MHA, MPH
Tennessee	Oak Ridge National Laboratory Y-12 National Security Complex (Production Workers)	2005 2005	Queens College of the City University of New York and Atomic Trades & Labor Council 1-800-906-2019	Steven Markowitz, MD Lewis Pepper, MD Garry Whitley
Texas	Pantex Plant	2005	Drexel University and The University of Texas Health Science Center at Tyler 1-888-378-8939	Arthur Frank, MD, PhD
Washington	Hanford Site (Construction Workers)	1998	CPWR - The Center for Construction Research and Training, University of Cincinnati Medical Center, Duke University Medical Center, and Zenith American Solutions 1-800-866-9663	Knut Ringen, DrPH, MHA, MPH
Washington	Hanford Site (Production Workers) ¹³	1998	Oak Ridge Associated Universities, Comprehensive Health Services, National Jewish Health, University of Colorado Denver, and Axion Health 1-866-812-6703	Donna Cragle, PhD John McInerney, MD Lee Newman, MD

12 Includes Oak Ridge K-25, Oak Ridge National Laboratory, and Y-12 National Security Complex.

13 This cohort transitioned from the University of Washington to Oak Ridge Associated Universities in 2007.

Appendix B: Individual Project Descriptions

The U.S. Department of Energy (DOE) Former Worker Program (FWP) projects are briefly described below.

Medical Screening Program for Former Workers

Lawrence Berkeley • Lawrence Livermore • Sandia CA • NNSS



Implementing organizations:

The program is a collaboration between Boston University School of Public Health (BUSPH) and the University of California, San Francisco (UCSF) Division of Occupational and Environmental Medicine.

BUSPH and UCSF, along with members of The University of Nevada School of Medicine's Department of Family and Community Medicine (UNSOM), initially conducted screening and re-screening examinations for former workers of the Nevada National Security Site (NNSS) (formerly known as the Nevada Test Site) from 1998 to 2007. UNSOM resumed screening in September 2010. Contracted Kaiser Permanente locations have conducted examinations for former workers from the Northern California labs since 2007. Re-screening exams began for Northern California former workers in April 2011.

DOE sites/worker populations being served:

Former full-time and part-time employees, contractors, and construction workers are eligible for screenings from the Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, Sandia National Laboratories (CA), and NNSS. The program focuses on the early detection of occupational diseases that may be related to workplace hazards such as asbestos, beryllium, lasers, laser dyes, lead, noise, radiation, silica, and solvents.

Unique features:

- Screening exams were offered at a fifth Kaiser Permanente location in May 2011.
- Outreach efforts have included collaboration with the California and Nevada Energy Employees Occupational Illness Compensation Program Resource Centers and Health Services at the Northern California Labs, which have distributed program brochures to former workers they encounter.
- Project staff members have attended Northern California Lab retiree luncheons to help publicize the screening program and met with interested former workers.
- Program flyers have been posted at places of interest throughout the community such as libraries, coffee shops, and senior centers.

Achievements:

- More than 50,000 names and other personal information have been uploaded into the project's databases from rosters provided by DOE sites.
- Nearly 42% of 27,334 former workers who have been contacted through direct notification mailings have responded.
- Through September 2011, a total of 5,931 initial screening examinations have been performed.
- 1,027 three-year follow-up re-screening examinations have been conducted, including over 170 performed in Northern California.
- 292 six-year, nine-year, or twelve-year follow-up re-screening examinations have been conducted.
- More than 95% of participants were mostly or completely satisfied with their experience.

Medical findings through September 30, 2011:

- Chest x-rays: 4% of those tested demonstrated findings consistent with work-related lung disease.
- Pulmonary function tests: 24% of those tested demonstrated findings consistent with obstructive disease.
- Beryllium Lymphocyte Proliferation Tests (BeLPT): 3% of those tested had at least one abnormal BeLPT.
- Audiometry: 71% of those tested had hearing loss for normal speech tones.

Toll-free numbers:

1-877-653-1962 (Boston, MA Office; Northern California sites)

1-866-460-0628 (Dublin, CA Office; Northern California sites)

1-877-771-7977 (Boston, MA Office; NNSS)

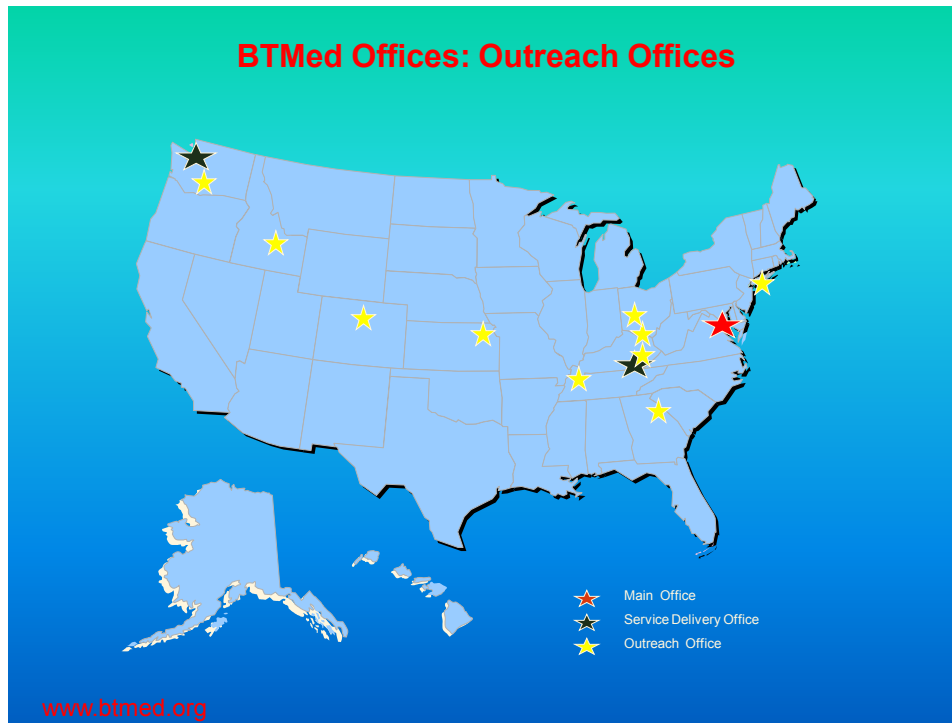
Website:

<http://www.bu.edu/formerworker>

Building Trades National Medical Screening Program (BTMed)

Implementing organizations:

CPWR – The Center for Construction Research and Training, Duke University, University of Cincinnati, and Zenith American Solutions. The program is administered from a main office in Washington, DC; two service delivery offices (Seattle, WA, and Oak Ridge, TN); and ten outreach offices.



Partners:

The Building and Construction Trades Department, American Federation of Labor and Congress of Industrial Organizations (AFL-CIO), with support from Alaska State Building and Construction Trades Council (BCTC), Augusta BCTC, Central Washington BCTC, Colorado State BCTC, Dayton BCTC, Florida Gulf Coast BCTC, Greater Cincinnati BCTC, Greater Kansas City BCTC, Idaho BCTC, Knoxville BCTC, Nassau and Suffolk Counties BCTC, Tri-State (Kentucky, Ohio, and West Virginia) BCTC, West Kentucky BCTC, and St. Louis BCTC.

DOE sites/worker populations being screened:

BTMed provides nationwide services focusing on screening construction workers from 26 DOE sites – Amchitka, Argonne West, Ashtabula, Battelle Laboratories (King Avenue and West Jefferson), Brookhaven National Laboratory, Brush Luckey, Feed Materials Production Center, GE Evendale, Hanford

What are workers saying about BTMed:

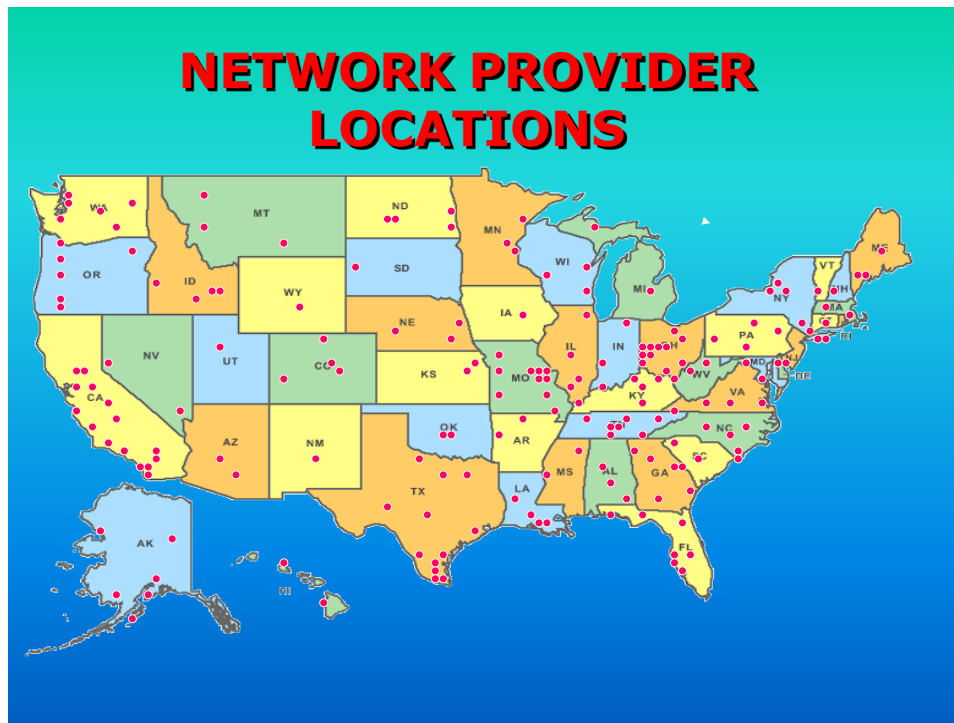
1. This was the finest and most professional exam I've ever had.
2. Thanks for keeping after me. I went for many years receiving postcards from you and I wouldn't reply until I finally decided what the heck, I'm going to take the physical and see what happens.
3. If all government agencies were run like this program, this country would be better off.
4. Thank you for protecting the workers.
5. Excellent work. Keep it up. God Bless.

Site, Huntington Pilot Plant, Idaho National Laboratory, Kansas City Plant, Mallinckrodt, Mound Plant, National Energy Technology Laboratory, Oak Ridge Reservation, Paducah Gaseous Diffusion Plant (GDP), Pinellas, Piqua, Portsmouth GDP, Rocky Flats Plant, Savannah River Site, Shippingport, Weldon Spring, and Yucca Mountain. BTMed also provides medical screening services to former construction workers from sites not covered by a regional FWP project.

Over 34,000 workers have expressed some interest in the program; 24,000 workers have been screened.

Clinics:

BTMed contracts with more than 200 carefully selected clinics to deliver the medical screening exams. Our nurses in Seattle and Oak Ridge review every exam to make sure they have been provided correctly and to make sure the results of the exam are clearly communicated to participants.



Unique features:

More than 600,000 building trades’ workers have put themselves at risk of life-threatening ailments on construction jobs while serving our Nation’s nuclear weapons programs and ongoing maintenance and cleanup of these facilities. Many workers have had significant exposures to asbestos, beryllium, cadmium, chromium, lead, mercury, radiation, silica, solvents, or other health hazards. Construction workers are offered a free medical screening exam through BTMed.

BTMed is the largest medical evaluation program of older construction workers in U.S. history. Because of this, the program has received research findings to complete one of the largest studies ever of occupational risks for chronic obstructive lung disease (COPD).

Achievements:

- BTMed screens almost 200 workers each month. Average participant satisfaction rate exceeds 98%.
- Central DOE Institutional Review Board approval was granted in June 2011.
- Feedback to DOE about findings has led to improved safety and health procedures in DOE facilities, particularly during maintenance, renovation repair, and decontamination and demolition work.
- The program helps participants improve their health and, thereby, reduce future health care use and costs.

Early Lung Cancer Detection:

During the past year, BTMed conducted a pilot screening program using low-dose CT scans to identify lung cancer at the earliest stages when the potential for effective treatment and survival are greatest. This pilot program covered 100 participants at Oak Ridge and found 29 nodules needing additional evaluation. For two participants, immediate biopsies were recommended. Twenty-seven participants had or will have a three-month follow-up scan.

Medical findings through September 30, 2011:

- Chest x-rays: 17.9% demonstrated findings consistent with work-related lung disease.
- Pulmonary function tests: 22.5% demonstrated findings consistent with obstructive disease.
- Beryllium Lymphocyte Proliferation Tests (BeLPT): 2.1% had at least one abnormal BeLPT.
- Audiometry: 57.2% demonstrated hearing loss for normal speech tones.

Toll-free number:

1-800-866-9663

Website:

<http://www.btmed.org>

Pantex Former Worker Program

Implementing organizations:

- Primary: Drexel University School of Public Health
- Outreach: Department of Occupational Health Sciences, The University of Texas Health Science Center at Tyler
- Clinical Services: West Texas A & M Partners Clinic, Amarillo, TX

DOE sites/worker populations being screened:

Pantex Plant, Amarillo, TX

Unique features:

- Former workers' satisfaction with the screening examination process and result letter is an important measure of program success. Participants receive a survey within two weeks of the date their result letter is mailed; no personal identifiers are collected on the satisfaction survey, so the former workers can be assured of the anonymity of their responses. A stamped envelope addressed to the program office is included to facilitate replies. One question on the satisfaction survey asks: *What would you suggest to improve the program?* "This was a better exam than my physician's the past 5 years" is typical of responses to that question.
- As a result of receiving copies of the individualized results letters from Dr. Frank, the program Principal Investigator, program participants report that area physicians now give greater consideration to occupational exposures in the diagnosis of conditions among their patients who have a Pantex work history.
- The results letter for re-screen participants includes a comparison with findings from the initial screening examination.

Achievements:

- As of September 2011, a total of 807 initial exams have been completed since the program started; 755 were conducted at the West Texas A & M Partners Clinic in Amarillo, 15 were conducted by the Occupational Medicine clinic at the University of Texas Health Science Center at Tyler, and an additional 37 have been completed through the National Supplemental Screening Program (NSSP).
- As of September 2011, a total of 167 re-screen examinations have been completed; 164 were conducted by the West Texas A & M Partners Clinic, 3 were conducted by the NSSP.
- The average participant satisfaction rate to date is 99.1% from responding participants. For fiscal year 2011, 55.7% of program participants responded to the satisfaction survey; of these, 100% were satisfied with their participation experience.

Medical findings through September 30, 2011:

Chest x-rays:

- 5.1% (39 of 756) at initial screening exam demonstrated findings consistent with work-related lung disease.

- 4.4% (7 of 160) exams demonstrated evidence of work-related lung disease on the re-screen examination when their initial screening result was normal.
- 3.7% (28 of 756) at initial screening demonstrated suspicious lung nodules, nodes, or lesions (suspicious for cancer).
- 4.4% (7 of 160) demonstrated suspicious lung nodules, nodes, or lesions on re-screen when none were noted on the initial screening results.

Pulmonary function tests:

- 16.7% (126 of 753) of former Pantex workers at their initial screening exam demonstrated findings consistent with obstructive disease.
- 1.3% (2 of 156) demonstrated findings consistent with obstructive disease at their three-year re-screen exam when the initial screening result was normal.
- Changes in reporting requirements and a subsequent re-evaluation of all medical records resulted in a lower percentage of findings on pulmonary function tests. This program now determines findings based on Hankinson.

Beryllium Lymphocyte Proliferation Tests (BeLPT):

- 1.1% (8 of 740) had at least one abnormal BeLPT on initial exam.
- 1.2% (2 of 161) had at least one abnormal BeLPT on re-screen when their initial exam was normal.

Audiometry: This test is not performed by this project.

Toll-free number:

1-888-378-8939

Medical Exam Program for Former Workers from Los Alamos and Sandia (NM) National Laboratories

Implementing organizations:

- Johns Hopkins Bloomberg School of Public Health (JHBSPH)
- Los Alamos National Laboratory (LANL)
- University of New Mexico

DOE sites/worker populations being screened:

All former workers from LANL and Sandia National Laboratories (SNL) are eligible to participate in the Medical Exam Program.

Unique features:

- The JHBSPH Medical Exam Program is one of several unique programs within the DOE FWP.
- Examination sessions are scheduled over a two-day period two to three times per year. Physicians, health care providers, and occupational health professionals travel from Baltimore, MD; Espanola, NM; and Albuquerque, NM, to the examination site to conduct physical examinations.
- During examination sessions, former workers have the opportunity to meet with the program occupational medicine physician to discuss their examination results and to ask questions.
- Due to JHBSPH FWP funding and staffing shortfalls at LANL, the project was not able to offer physical exams and testing this year, as it has in the past, to former workers who would prefer to have their exams done through the LANL Occupational Medicine Group. In the future, the project anticipates offering exams through the LANL Occupational Medicine Group to those workers who would prefer this option. All test results are analyzed by JHBSPH FWP, and the findings are sent directly to the participant by the project.

Achievements:

- Each participant has a detailed exposure and medical history interview prior to their initial examination and a short medical history interview before their re-examination. These interviews are conducted by former workers from LANL and SNL.
- The program staff assists former workers with workers' compensation claims and, when appropriate, writes letters in support of claims for Federal compensation for former workers from both sites.
- The project has completed 3,372 examinations of former workers since the program began in 2000. Of these exams, 3,006 were new exams, and 366 were re-examinations of former LANL workers for past exposures to asbestos, beryllium, and radiation and of former SNL workers for past exposures to asbestos, beryllium, radiation, and silica.
- On exit surveys, over 97% of program participants stated that they were satisfied with all components of the program, and 97% would recommend the program to other former workers.
- The program works with the Joint Outreach Task Group to develop outreach strategies to recruit former workers who are eligible for the FWP and the Energy Employees Occupational Illness Compensation Program.

- Program staff recently participated in a Department of Labor town hall meeting in Albuquerque, NM, where they spoke with former workers and invited them to participate in the program.
- In April, program staff members were invited to participate in a Cold War Patriots Resource Meeting where they spoke with former workers and invited them to participate in the program.

Medical findings through September 30, 2011:

- Chest x-rays: 12% have findings consistent with work-related lung disease.
- Pulmonary function tests: 23% demonstrated findings consistent with obstructive disease.
- Beryllium Lymphocyte Proliferation Tests (BeLPT): 2% had at least 1 abnormal BeLPT.
- Audiometry: 56% demonstrated hearing loss for normal speech tones.

Toll-free number:

1-877-500-8615

Website:

<http://www.jhsph.edu/lanlfw/>

National Supplemental Screening Program (NSSP)

Implementing organizations:

The NSSP is managed by Oak Ridge Associated Universities and a team from National Jewish Health, the University of Colorado Denver Health Sciences Center, Comprehensive Health Services, and Axion Health.

DOE sites/worker populations being screened:

The NSSP provides medical examinations to former DOE workers from Argonne National Laboratory, Fermi National Accelerator Laboratory, Hanford Site, Kansas City Plant, Princeton Plasma Physics Laboratory, Pinellas, Rocky Flats Plant, Savannah River Site, and DOE sites where no site-specific FWP has been assigned. The NSSP also accepts referrals (production, building trades) from the other FWPs whose participants may live outside of their respective medical screening coverage areas.

Unique features:

- The NSSP began in 2005, as the result of a competitive bid process, with responsibility for five primary DOE sites. During the past six years, the number of NSSP primary DOE sites has increased to eight, and the NSSP has maintained its ability to accept changes in responsibilities and mission.
- The NSSP provides a nationwide web-based medical examination and secure electronic records system, compliant with Federal Information System Management Act regulations (refer to NSSP – Nationwide Scope map).
- Any former DOE worker can be assured that regardless of where they live, the NSSP will be able to provide a quality medical examination in accordance with the DOE Medical Protocol.
- When identified, NSSP participants are notified of urgent medical conditions within 24 hours of their medical examination.

Achievements:

- Through September 30, 2011, the NSSP has used the services of more than 1,350 medical centers representing the 50 states, as well as countries outside the U.S.
- As the direct result of NSSP medical screenings and participant follow-up through private physicians, the NSSP has identified many previously undiagnosed conditions, including 18 cases of lung cancer, 8 cases of colon cancer, 48 cases of diabetes, and 284 cases of beryllium sensitivity in former workers representing 23 different DOE sites.
- Number of initial exams conducted: 8,820 (through 09/30/2011).
- Number of re-screening exams conducted: 795 (through 09/30/2011).
- Average NSSP participant satisfaction rate: 98.9% satisfaction approval.
- Fiscal Year 2011 average time from date of enrollment to date of examination: 37 days.

Medical findings through September 30, 2011:

NSSP Site-Specific (8 sites) and DOE sites with no FWP (n=5,901)

- Chest x-rays: 18.7% demonstrated findings consistent with work-related lung disease.
- Pulmonary function tests (PFT): 27.2% demonstrated findings consistent with obstructive disease.
- Beryllium Lymphocyte Proliferation Tests (BeLPT): 3.9% had at least one abnormal BeLPT.
- Audiometry: 44.7% demonstrated hearing loss in the normal speech frequencies.

NSSP FWP Referrals (n=2,919)

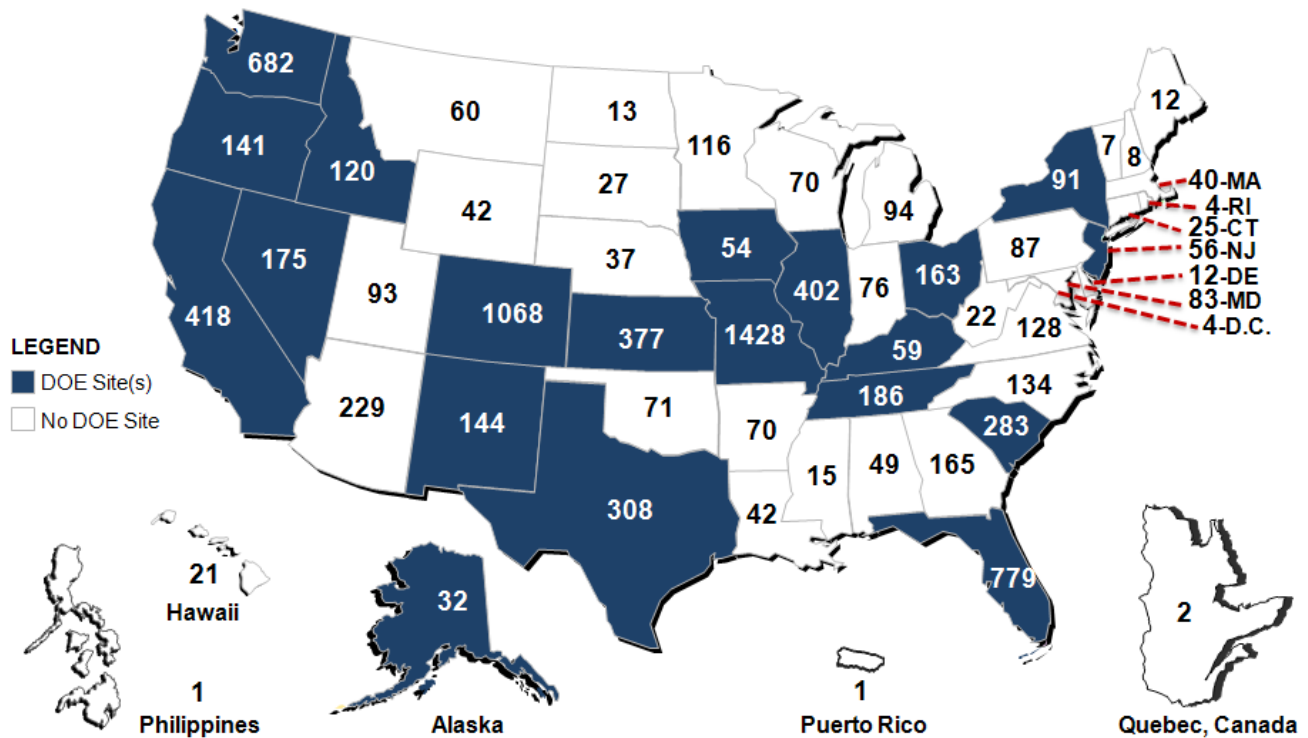
- Chest x-rays: 16.7% demonstrated findings consistent with work-related lung disease.
- PFTs: 21.4% demonstrated findings consistent with obstructive disease.
- BeLPTs: 5.4% had at least one abnormal BeLPT.
- Audiometry: 38.2% demonstrated hearing loss in the normal speech frequencies.

Toll-free number:

1-866-812-6703

Website:

<http://www.ornl.gov/nssp>



NSSP – Nationwide Scope Participants through September 2011



Worker Health Protection Program (WHPP)

Implementing organizations:

WHPP is administered by Queens College of the City University of New York in conjunction with the United Steelworkers, the Atomic Trades and Labor Council in Oak Ridge, and the Fernald Medical Screening Program. The consortium utilizes expert occupational medicine physicians and support staff to provide independent medical screening to DOE workers who are at risk of illnesses related to their work. The primary goals of the program are to detect illnesses at an early stage when medical intervention may be helpful and to determine if these illnesses are occupational in origin.

DOE sites/worker populations being screened:

WHPP is one of the largest FWPs and has conducted screening for DOE workers since 1999. WHPP serves former workers (non-construction) from the following DOE sites: Brookhaven National Laboratory in New York; the Paducah Gaseous Diffusion Plant (GDP) in Kentucky; the Portsmouth GDP and the Fernald and Mound closure sites in Ohio; the Idaho National Laboratory in Idaho; and the K-25 GDP, Y-12 National Security Complex, and Oak Ridge National Laboratory in Tennessee. Beginning in February 2012, Boston University's FWPs for the Nevada Test Site (now known as the Nevada National Security Site) and three national laboratories in northern California (Lawrence Livermore National Laboratory, Lawrence Berkeley National Laboratory, and Sandia National Laboratories in California) will become part of WHPP.

Unique features:

- **Union Worker Advocates:** Success of WHPP stems from the involvement of former DOE workers in the design, implementation, operation, and improvement of the screening program. These worker advocates, or "local site coordinators," serve as the face of the program and perform a multitude of functions, including: identifying, locating, and enrolling participants in the program; hosting and participating in Joint Outreach Task Group meetings or other community events; reaching out to local media; administering the program's satisfaction surveys; and serving as a resource to workers and their families on issues relating to Energy Employees Occupational Illness Compensation Program and state workers' compensation programs. The worker advocates provide valuable local visibility for WHPP and inspire trust and credibility among participants.
- **Early Lung Cancer Detection:** WHPP is one of only two projects that provide a low-dose CT scan of the chest for the early detection of lung cancer for eligible DOE workers. WHPP offers this screening at seven DOE sites. Details about the WHPP Early Lung Cancer Detection program can be found in the next section.

Achievements:

- WHPP has performed 21,078 initial examinations, 6,668 three-year follow-up examinations, and 443 six-year follow-up examinations as of September 30, 2011.
- Approximately 50% of all WHPP participants in 2011 were first-time participants, demonstrating a sustained demand 12 years after initiating medical screening.
- In conjunction with the Joint Outreach Task Group, WHPP hosted two town hall meetings in Oak Ridge, TN, on April 13, 2011, to provide information and answer questions from former workers about services available to them.
- WHPP has achieved a 98% program approval rating from participants based on anonymous follow-up satisfaction surveys.

Medical findings through September 30, 2011:

- Chest x-rays (n=29,740): 5.93% demonstrated findings consistent with work-related lung disease.
- Pulmonary function tests (n=29,214): 20.72% demonstrated findings consistent with obstructive disease.
- Beryllium Lymphocyte Proliferation Tests (BeLPT) (n=23,357): 3.4% had at least one abnormal BeLPT.
- Audiometry (n=21,360): 50.9% demonstrated hearing loss for normal speech tones.

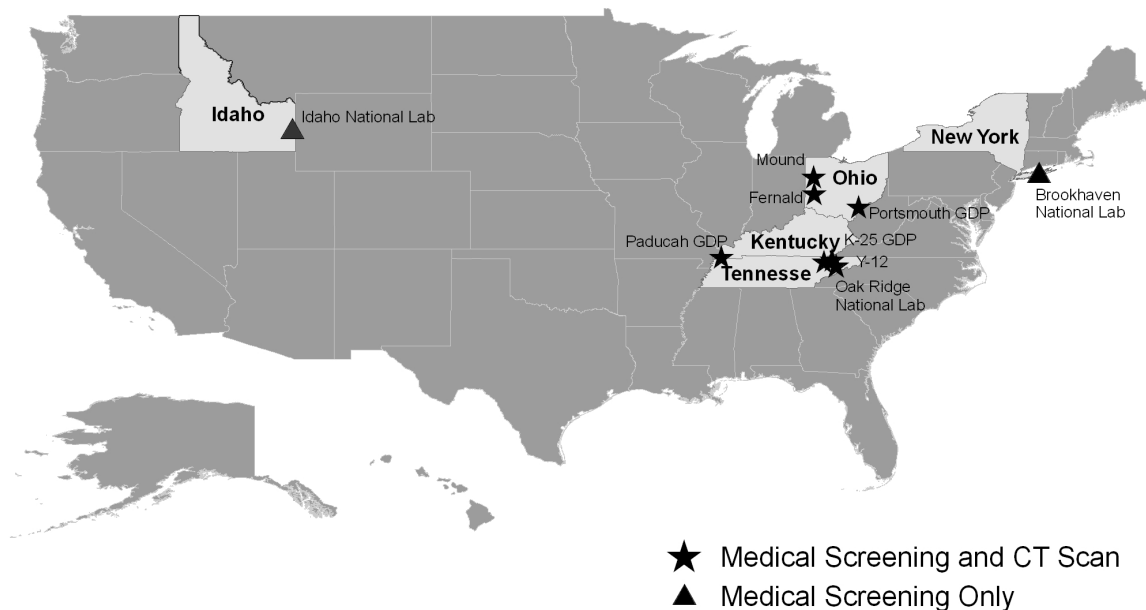
Toll-free Number:

1-888-241-1199

Website:

<http://www.worker-health.org>

WHPP Screening Sites





Worker Health Protection Program (WHPP) Early Lung Cancer Detection Program

In addition to the standard FWP medical screening, WHPP administers an early lung cancer screening at seven DOE sites. State-of-the-art low-dose chest CT scans are currently offered through the WHPP Early Lung Cancer Detection (ELCD) program at the Paducah, Portsmouth, and K-25 GDPs (2000-2006, 2009-present); Y-12 National Security Complex and the Oak Ridge National Laboratory (2006-present); and the Mound and Fernald closure sites (2009-present).

In August 2011, the National Cancer Institute (NCI) published results from their National Lung Screening Trial in the *New England Journal of Medicine*, finding a 20% reduction in lung cancer mortality for those screened with low-dose CT scans as compared to standard chest x-rays. The study, a randomized national trial of over 53,000 current and former smokers, utilized the same technology for lung cancer detection that the ELCD program has been using since 2000. The significant findings from the NCI study corroborate the findings from previous studies that indicated early detection of lung cancer leads to improved long-term survival rates.

Although smoking causes most lung cancers, many DOE workers have been exposed to known lung carcinogens, such as asbestos, radiation, nickel compounds, and beryllium. The WHPP ELCD program is offered to workers who have an elevated risk of lung cancer as a result of a combination of occupational exposures, age, and/or tobacco use.

Low-dose CT scanning for lung cancer involves limited radiation exposure with an average estimated effective dose of 120 mrem per scan, which is much lower than a diagnostic chest CT scan and is within the range that is used for other types of cancer screening. WHPP currently maintains two dedicated CT scanners: one housed in a semi-permanent trailer in Oak Ridge and a second mobile unit that serves multiple sites in Ohio and Kentucky. An expert pulmonary specialist based at Queens College of the City University of New York oversees the screening and the follow-up of suspect findings, working closely with the workers' physicians and specialists in their communities.

The ELCD program has demonstrated that DOE workers have a high degree of interest in lung cancer screening, that such screening across DOE sites and appropriate medical follow-up are feasible, and that a state-of-the-art program of low-dose CT screening for lung cancer can affordably be provided to large numbers of workers in rural areas.

The WHPP anticipates expanding the ELCD program to include eligible former workers from the Nevada National Security Site (previously the Nevada Test Site) and Idaho National Laboratory beginning in 2012.

Unique features:

- WHPP was the first FWP to offer low-dose CT scans to screen for early lung cancer in DOE workers.
- This program is the largest occupational lung cancer detection program in the country.
- The WHPP ELCD program developed, implemented, and published a CT scan dose tracking system and CT technologist guidelines that have successfully minimized participant radiation exposure from low-dose CT lung cancer screening.

Achievements:

- From 2000 through September 30, 2011, WHPP performed chest CT scans on 11,286 workers.
- The total number of CT scans that have been performed in the program, including repeat scans for indeterminate nodules, is 29,443.
- ELCD has attained 97% adherence with recommended three- and six-month follow-up of indeterminate nodules.
- 93% of participants enrolled have returned for their first annual CT scan.
- ELCD has maintained a 99% program approval rating from participants based on anonymous follow-up satisfaction surveys.
- Published the results of our successful initiative to minimize radiation exposure from low-dose CT scanning through estimated dose tracking and simple body mass index (BMI)-based CT technologist guidelines for increasing tube current. (Manowitz A., Sedlar M., Miller A., Miller J., Markowitz S. Use of BMI guidelines and individual dose tracking to minimize radiation exposure from lowdose helical chest CT scanning in a lung cancer screening program. *Academic Radiology*, 19(1):84-88 2012.)

Medical findings through September 30, 2011:

- 77 ELCD program participants have been identified as having primary lung cancer. See Table 7 for a breakdown of results by DOE site.
- 51 of the 72 (71%) individuals whose lung cancers have been staged to date (5 are pending) had an early stage lung cancer (Stage I or II non-small cell or limited small cell) at the time of diagnosis.
- Lung cancer was detected in one of approximately 146 DOE workers tested.
- Other diseases detected through low-dose CT scans include thyroid cancer (4), kidney cancer (4), aortic aneurysms (19), and pneumonia (25).

Table 7. Stage of Lung Cancers Detected by the WHPP ELCD Program through September 30, 2011¹⁴

Site of ELCD Program	Number of Participants Screened	Number of Lung Cancers Detected	Number of Detected Lung Cancers That Were Staged	Number (%) of Stage I or II Non-Small Cell or Limited Small Cell Cancers Detected
Paducah	1,872	12	8	7 (88%)
Portsmouth	2,163	19	19	15 (79%)
K-25	2,700	23	22	18 (82%)
ORNL	1,133	8	8	2 (25%)
Y-12 National Security Complex	2,598	14	14	9 (64%)
Mound Plant	486	1	1	0
Fernald Plant (or FMPC)	334	0	0	0
Total	11,286	77	72	51 (71%)

Toll-free Number:

1-866-228-7226

Website:

<http://www.worker-health.org>

¹⁴ Early cancer is defined as Stage I or II non-small cell or limited small cell.



Former Worker Medical Screening Program for Line 1/Iowa Army Ammunition Plant and Ames Laboratory



Implementing organization:

The University of Iowa College of Public Health

DOE sites/worker populations being screened:

Line 1/Division B from the Iowa Army Ammunition Plant (IAAP), Burlington, Iowa, and Ames Laboratory, Ames, Iowa

Program history:

- The Line 1/IAAP-FWP arose out of a classroom assignment written by a former Guard Lieutenant who worked at the IAAP from 1968 through 1973. Upon hearing from colleagues who had transferred to the Pantex Plant about the Energy Employees Occupational Illness Compensation Program Act legislation, the former IAAP Guard wrote a letter to Senator Harkin's office in 2000 as part of a non-fiction writing class to inquire why the IAAP did not have DOE medical screenings. Senator Harkin was initially told that there was no DOE site in Burlington, despite the IAAP prominently identified on various DOE maps of facilities across the nation.

From this initial letter and subsequent town hall meetings by Senator Harkin and DOE Assistant Secretary David Michaels, a strong alliance developed between the community of former DOE workers, the IAAP administration, and The University of Iowa College of Public Health to implement FWP medical screenings.

Due to the secrecy of the Atomic Energy Commission operations and transfer of production to the Pantex Plant in 1975, a complete Line 1/Division B employee roster did not exist. In order to identify the Line 1 cohort for FWP screenings, a roster was created of all individuals employed at the IAAP since 1949 by obtaining copies of the main contractor's employment records (3x5 employment cards with job codes and hire and termination dates) and job titles from the local labor unions. DOE employment was confirmed using contract-specific job codes and job titles supported by information from radiation monitoring dosimetry badge records and lists of workers involved in accidents on DOE lines.



Photo of Senator Harkin; Dr. Merchant, former Dean of the College of Public Health; and Dr. Fuortes at a town hall meeting in Burlington in 2000 announcing the start of the IAAP FWP.

- In 2005, The University of Iowa College of Public Health was tasked by DOE to implement a needs assessment and FWP activities for former employees at the Ames Laboratory, which involved cohort identification, education, risk stratification, targeted screenings, and claims assistance.

Unique features:

- For the former workers living in Iowa, the medical screenings are conducted by the Principal Investigator (an occupational medicine doctor), the FWP staff at The University of Iowa, and collaborating medical centers in four locations in Iowa, as well as home visits for those housebound. This in-person interaction leads to a comprehensive understanding of the former worker’s health status and occupational and general health concerns. Assistance with EEOICPA claims is also offered by providing claim forms and guidance on completing them and accessing and interpreting medical records.
- As much as possible, the FWP staff at The University of Iowa assists with coordinating former workers’ health and wellbeing issues arising from their work and/or detected through the medical screenings, ranging from referrals for pulmonary treatment and rehabilitation, cancer diagnoses and referrals for cancer treatment, smoking cessation, hypertension, diabetes, counseling on medical follow-up or care, recommended preventive services such as vaccinations, and assistance with relevant social services as needed.

Achievements:

- As of September 2011, a total of 2,887 initial exams have been completed: 1,884 initial exams were performed by The University of Iowa, and 1,003 initial exams were performed by the NSSP.
- As of September 2011, a total of 1,221 re-screen exams have been completed: 1,075 re-screen exams were performed by The University of Iowa, and 146 re-screen exams were performed by the NSSP.
- The FY 2011 satisfaction rating was 99%.
- In 2011, two commemoration events were held to recognize the Line 1 and Ames Laboratory former workers, with visitors from the DOL Denver Resource Center, Ames Laboratory (Director, Medical Administrator, and Health and Safety Office), staffers from Senator Harkin and Senator Grassley’s state



Photo from Line 1 IAAP medical screening.



Commemorative event held for former Ames Laboratory workers.

offices, Professional Case Management, and Cold War Patriots. Approximately 180 Line 1 former workers and 100 Ames Laboratory former workers were in attendance, many of whom scheduled a medical screening and received assistance with EEOICPA claims.

- One success of the collaborations with the Ames Laboratory Health and Safety staff has been the mapping of areas where beryllium-sensitized former employees worked. The Ames Laboratory Industrial Hygiene staff has systematically performed beryllium swipe testing of horizontal surfaces (i.e., top of doorway/door jamb) and documented several areas with existing residual beryllium contamination. These areas have been sanctioned off for containment and/or remediation.
- On November 17, 2011, a new class of former employees from the Ames Laboratory was added to the EEOICPA Special Exposure Cohort, which includes all those who worked at the Ames Laboratory from 1942 through 1970.
- In 2011, two peer-reviewed journal articles on the Line 1-FWP medical screening results were published, and four posters were presented on the Line 1 and Ames Laboratory-FWP medical screening results at the American Public Health Association 139th Annual Meeting in Washington, DC.

Medical findings through September 30, 2011:

- Of the 3,621 former workers who received a chest x-ray, 13% demonstrated findings consistent with work-related lung disease.
- Of the 3,525 former workers who received a pulmonary function test, 32% demonstrated findings consistent with abnormal lung functions: 17% with restrictive pattern, 7% with obstructive pattern, and 8% with mixed pattern (based on the Hankinson Lower Limits of Normal definitions).
- Of the 3,962 former workers who received a Beryllium Lymphocyte Proliferation Test (BeLPT), 2.5% had at least one abnormal BeLPT.
- Of the 4,108 total screenings completed, 3,260 recommendations for follow-up medical care were made: 503 recommendations were for occupational-related follow-up (such as occupational lung disease), and 2,757 recommendations were for non-occupational-related follow-up (such as chronic diseases).

Toll-free number:

1-866-282-5818

Website:

<http://www.iowafwp.org>

Appendix C: Exams Conducted through the FWP

Number of Former Workers Screened and Re-screened by DOE Site (through September 2011)

State	Sites	Initial Screenings	Re-screens ¹⁵
AK	Amchitka Island Test Site	1,342	479
CA	Lawrence Berkeley National Laboratory	467	3
CA	Lawrence Livermore National Laboratory	1,739	169
CA	Sandia National Laboratories, CA	203	13
CO	Rocky Flats Plant (Construction Workers)	639	146
CO	Rocky Flats Plant (Production Workers)	2,874	412
FL	Pinellas (Production Workers)	597	75
IA	Ames Laboratory	1,581	343
IA	Iowa Army Ammunition Plant	1,306	878
ID	Idaho National Laboratory (Construction Workers)	923	146
ID	Idaho National Laboratory (Production Workers)	4,344	1,549
IL	Argonne National Laboratory	418	14
KY	Paducah GDP (Construction Workers)	843	277
KY	Paducah GDP (Production Workers)	3,185	1,161
MO	Kansas City Plant (Construction Workers)	611	124
MO	Kansas City Plant (Production Workers)	1,861	300
NM	Los Alamos National Laboratory	2,657	312
NM	Sandia National Laboratories, NM	339	1
NV	Nevada National Security Site	4,076	1,389
NY	Brookhaven National Laboratory (Construction Workers)	568	173
NY	Brookhaven National Laboratory (Production Workers)	176	0
OH	Feed Materials Production Center (Construction Workers)	1,633	494

15 Re-screen exams not yet being offered at Brookhaven National Laboratory for production workers.

OH	Feed Materials Production Center (Production Workers)	1,166	268
OH	Mound Plant (Construction Workers)	337	80
OH	Mound Plant (Production Workers)	1,339	493
OH	Portsmouth GDP (Construction Workers)	1,032	321
OH	Portsmouth GDP (Production Workers)	3,474	1,536
SC	Savannah River Site (Construction Workers)	3,847	1,129
SC	Savannah River Site (Production Workers)	3,974	8
TN	Oak Ridge K-25 (Production Workers)	4,430	1,269
TN	Oak Ridge National Laboratory (Production Workers)	1,386	398
TN	Oak Ridge Reservation (Construction Workers) ¹⁶	2,826	928
TN	Y-12 National Security Complex (Production Workers)	3,028	783
TX	Pantex Plant	814	164
WA	Hanford Site (Construction Workers)	2,876	877
WA	Hanford Site (Production Workers)	3,785	645
	Other Sites ¹⁷ (Construction Workers)	1,209	138
	Other Sites ¹⁸ (Production Workers)	177	9
Grand Total		68,082	17,504

16 Includes Oak Ridge K-25, Oak Ridge National Laboratory, and Y-12 National Security Complex.

17 Sites where the number of individuals screened by the Building Trades National Medical Screening Program to date is less than 100.

18 Sites where the number of individuals screened by the National Supplemental Screening Program to date is less than 100.

Appendix D: Program Elements

Several program elements are briefly described below.

Chest X-ray B-Reading

A B-reading is a special reading of a standard chest x-ray film performed by a physician certified by the National Institute for Occupational Safety and Health (NIOSH). The reading looks for changes on the chest x-ray that may indicate exposure and disease caused by agents, such as asbestos or silica.

A B-reading is considered a special reading because doctors who are certified by NIOSH to perform B-readings use a specific protocol to read and record the findings as developed by the International Labour Organization (ILO). The ILO's protocol provides standards (rules) for systematically describing (to examine the x-ray in a step-by-step method found in the rules) and recording certain abnormalities (changes) on a chest x-ray that can be attributable to (related to or caused by) the inhalation of dusts and fibers, such as silica and asbestos.

Former Worker Program (FWP) participants who consent to have a chest x-ray will also receive a B-reading. Each FWP project has a physician on staff who is trained to perform this special reading for the detection of possible dust-related diseases.

Table 8 illustrates chest x-ray findings on initial exams to date, and Table 9 provides findings on re-screens.

**Table 8. Chest X-ray Findings on Initial Screening
(through September 2011)**

State	Sites	Workers Screened	Asbestos-related Lung Disease	Silicosis	Other Dust-related Disease	Lung Nodules, Nodes, or Lesions
AK	Amchitka Island Test Site	1,035	148 (14.3%)	1 (0.1%)	0 (0.0%)	54 (5.2%)
CA	Lawrence Berkeley National Laboratory	445	12 (2.7%)	0 (0.0%)	5 (1.1%)	25 (5.6%)
CA	Lawrence Livermore National Laboratory	1,653	38 (2.3%)	0 (0.0%)	11 (0.7%)	112 (6.8%)
CA	Sandia National Laboratories, CA	192	5 (2.6%)	0 (0.0%)	1 (0.5%)	14 (7.3%)
CO	Rocky Flats Plant (Construction Workers)	571	195 (34.2%)	5 (0.9%)	12 (2.1%)	23 (4.0%)
CO	Rocky Flats Plant (Production Workers)	2,477	624 (25.2%)	4 (0.2%)	94 (3.8%)	82 (3.3%)
FL	Pinellas (Production Workers)	580	38 (6.6%)	6 (1.0%)	33 (5.7%)	31 (5.3%)
IA	Ames Laboratory	1,520	83 (5.5%)	1 (0.1%)	63 (4.1%)	39 (2.6%)
IA	Iowa Army Ammunition Plant	1,169	140 (12.0%)	0 (0.0%)	81 (6.9%)	25 (2.1%)
ID	Idaho National Laboratory (Construction Workers)	747	85 (11.4%)	0 (0.0%)	2 (0.3%)	24 (3.2%)

ID	Idaho National Laboratory (Production Workers)	4,272	323 (7.6%)	1 (0.0%)	31 (0.7%)	84 (2.0%)
IL	Argonne National Laboratory	388	46 (11.9%)	0 (0.0%)	25 (6.4%)	17 (4.4%)
KY	Paducah GDP (Construction Workers)	770	138 (17.9%)	7 (0.9%)	12 (1.6%)	44 (5.7%)
KY	Paducah GDP (Production Workers)	3,178	185 (5.8%)	26 (0.8%)	16 (0.5%)	53 (1.7%)
MO	Kansas City Plant (Construction Workers)	549	77 (14.0%)	0 (0.0%)	1 (0.2%)	28 (5.1%)
MO	Kansas City Plant (Production Workers)	1,824	159 (8.7%)	3 (0.2%)	144 (7.9%)	81 (4.4%)
NM	Los Alamos National Laboratory	2,437	158 (6.5%)	0 (0.0%)	83 (3.4%)	52 (2.1%)
NM	Sandia National Laboratories, NM	321	21 (6.5%)	1 (0.3%)	15 (4.7%)	5 (1.6%)
NV	Nevada National Security Site	4,040	488 (12.1%)	38 (0.9%)	80 (2.0%)	297 (7.4%)
NY	Brookhaven National Laboratory (Construction Workers)	458	86 (18.8%)	0 (0.0%)	0 (0.0%)	9 (2.0%)
NY	Brookhaven National Laboratory (Production Workers)	164	10 (6.1%)	0 (0.0%)	5 (3.0%)	2 (1.2%)
OH	Feed Materials Production Center (Construction Workers)	1,440	184 (12.8%)	3 (0.2%)	0 (0.0%)	31 (2.2%)
OH	Feed Materials Production Center (Production Workers)	1,146	38 (3.3%)	0 (0.0%)	0 (0.0%)	17 (1.5%)
OH	Mound Plant (Construction Workers)	275	59 (21.5%)	0 (0.0%)	3 (1.1%)	6 (2.2%)
OH	Mound Plant (Production Workers)	1,320	68 (5.2%)	2 (0.2%)	5 (0.4%)	23 (1.7%)
OH	Portsmouth GDP (Construction Workers)	917	176 (19.2%)	2 (0.2%)	3 (0.3%)	35 (3.8%)
OH	Portsmouth GDP (Production Workers)	3,467	204 (5.9%)	9 (0.3%)	13 (0.4%)	56 (1.6%)
SC	Savannah River Site (Construction Workers)	3,375	362 (10.7%)	3 (0.1%)	1 (0.0%)	121 (3.6%)
SC	Savannah River Site (Production Workers)	2,339	807 (34.5%)	56 (2.4%)	329 (14.1%)	13 (0.6%)
TN	Oak Ridge K-25 (Production Workers)	4,427	263 (5.9%)	9 (0.2%)	26 (0.6%)	56 (1.3%)
TN	Oak Ridge National Laboratory (Production Workers)	1,380	82 (5.9%)	4 (0.3%)	2 (0.1%)	15 (1.1%)

TN	Oak Ridge Reservation (Construction Workers) ¹⁹	2,317	477 (20.6%)	6 (0.3%)	6 (0.3%)	90 (3.9%)
TN	Y-12 National Security Complex (Production Workers)	3,014	168 (5.6%)	4 (0.1%)	12 (0.4%)	42 (1.4%)
TX	Pantex Plant	799	39 (4.9%)	1 (0.1%)	7 (0.9%)	31 (3.9%)
WA	Hanford Site (Construction Workers)	2,264	670 (29.6%)	3 (0.1%)	2 (0.1%)	132 (5.8%)
WA	Hanford Site (Production Workers)	3,356	812 (24.2%)	1 (0.0%)	65 (1.9%)	198 (5.9%)
	Other Sites ²⁰ (Construction Workers)	967	150 (15.5%)	4 (0.4%)	0 (0.0%)	21 (2.2%)
	Other Sites ²¹ (Production Workers)	165	15 (9.1%)	0 (0.0%)	18 (10.9%)	4 (2.4%)
Grand Total		60,723	7,485 (12.3%)	199 (0.3%)	1,206 (2.0%)	1,928 (3.2%)

19 Includes Oak Ridge K-25, Oak Ridge National Laboratory, and Y-12 National Security Complex.

20 Sites where the number of individuals screened by the Building Trades National Medical Screening Program is less than 100.

21 Sites where the number of individuals screened by the National Supplemental Screening Program is less than 100.

**Table 9. Chest X-ray Findings on Re-screening
(through September 2011)**

State	Sites	Workers Screened	Asbestos-related Lung Disease	Silicosis	Other Dust-related Disease	Lung Nodules, Nodes, or Lesions
AK	Amchitka Island Test Site	382	18 (4.7%)	1 (0.3%)	0 (0.0%)	10 (2.6%)
CA	Lawrence Berkeley National Laboratory	1	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
CA	Lawrence Livermore National Laboratory	137	0 (0.0%)	0 (0.0%)	0 (0.0%)	7 (5.1%)
CA	Sandia National Laboratories, CA	9	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
CO	Rocky Flats Plant (Construction Workers)	141	7 (5.0%)	0 (0.0%)	1 (0.7%)	2 (1.4%)
CO	Rocky Flats Plant (Production Workers)	406	171 (42.1%)	0 (0.0%)	2 (0.5%)	1 (0.2%)
FL	Pinellas (Production Workers)	71	1 (1.4%)	0 (0.0%)	6 (8.5%)	0 (0.0%)
IA	Ames Laboratory	331	7 (2.1%)	0 (0.0%)	1 (0.3%)	4 (1.2%)
IA	Iowa Army Ammunition Plant	380	18 (4.7%)	0 (0.0%)	14 (3.7%)	2 (0.5%)
ID	Idaho National Laboratory (Construction Workers)	137	10 (7.3%)	0 (0.0%)	0 (0.0%)	2 (1.5%)
ID	Idaho National Laboratory (Production Workers)	1,281	55 (4.3%)	1 (0.1%)	1 (0.1%)	3 (0.2%)
IL	Argonne National Laboratory	11	1 (9.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
KY	Paducah GDP (Construction Workers)	261	20 (7.7%)	0 (0.0%)	0 (0.0%)	18 (6.9%)
KY	Paducah GDP (Production Workers)	1,095	32 (2.9%)	1 (0.1%)	0 (0.0%)	8 (0.7%)
MO	Kansas City Plant (Construction Workers)	117	5 (4.3%)	0 (0.0%)	0 (0.0%)	1 (0.9%)
MO	Kansas City Plant (Production Workers)	289	9 (3.1%)	0 (0.0%)	7 (2.4%)	3 (1.0%)
NM	Los Alamos National Laboratory	308	37 (12.0%)	0 (0.0%)	28 (9.1%)	2 (0.6%)
NM	Sandia National Laboratories, NM	1	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
NV	Nevada National Security Site	1,021	89 (8.7%)	10 (1.0%)	39 (3.8%)	70 (6.9%)
NY	Brookhaven National Laboratory (Construction Workers)	158	8 (5.1%)	0 (0.0%)	0 (0.0%)	2 (1.3%)
OH	Feed Materials Production Center (Construction Workers)	472	30 (6.4%)	0 (0.0%)	0 (0.0%)	1 (0.2%)

OH	Feed Materials Production Center (Production Workers)	266	4 (1.5%)	0 (0.0%)	0 (0.0%)	4 (1.5%)
OH	Mound Plant (Construction Workers)	76	5 (6.6%)	0 (0.0%)	1 (1.3%)	1 (1.3%)
OH	Mound Plant (Production Workers)	469	12 (2.6%)	0 (0.0%)	0 (0.0%)	2 (0.4%)
OH	Portsmouth GDP (Construction Workers)	308	38 (12.3%)	0 (0.0%)	0 (0.0%)	4 (1.3%)
OH	Portsmouth GDP (Production Workers)	1,358	68 (5.0%)	1 (0.1%)	1 (0.1%)	14 (1.0%)
SC	Savannah River Site (Construction Workers)	928	93 (10.0%)	1 (0.1%)	0 (0.0%)	40 (4.3%)
SC	Savannah River Site (Production Workers)	7	1 (14.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
TN	Oak Ridge K-25 (Production Workers)	1,224	30 (2.5%)	0 (0.0%)	1 (0.1%)	9 (0.7%)
TN	Oak Ridge National Laboratory (Production Workers)	396	11 (2.8%)	0 (0.0%)	1 (0.3%)	1 (0.3%)
TN	Oak Ridge Reservation (Construction Workers) ²²	786	103 (13.1%)	0 (0.0%)	0 (0.0%)	30 (3.8%)
TN	Y-12 National Security Complex (Production Workers)	783	35 (4.5%)	1 (0.1%)	2 (0.3%)	2 (0.3%)
TX	Pantex Plant	164	7 (4.3%)	0 (0.0%)	0 (0.0%)	7 (4.3%)
WA	Hanford Site (Construction Workers)	736	57 (7.7%)	0 (0.0%)	1 (0.1%)	26 (3.5%)
WA	Hanford Site (Production Workers)	532	71 (13.3%)	0 (0.0%)	13 (2.4%)	20 (3.8%)
	Other Sites ²³ (Construction Workers)	131	4 (3.1%)	0 (0.0%)	0 (0.0%)	1 (0.8%)
	Other Sites ²⁴ (Production Workers)	7	2 (28.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Grand Total		14,797	1,041 (7.0%)	15 (0.1%)	119 (0.8%)	287 (1.9%)

Spirometry

Spirometry, which is also known as pulmonary function testing, is a tool for measuring lung function. Specifically, the test measures the volume (amount) and/or flow (speed) of air that can be inhaled or exhaled. Spirometry testing is a vital component for diagnosing occupational lung diseases and for assessing and monitoring such conditions as asthma and chronic obstructive pulmonary disease.

22 Includes Oak Ridge K-25, Oak Ridge National Laboratory, and Y-12 National Security Complex.

23 Sites where the number of individuals screened by the Building Trades National Medical Screening Program to date is less than 100.

24 Sites where the number of individuals screened by the National Supplemental Screening Program to date is less than 100.

The lung diseases detected by spirometry are mostly caused by smoking, respiratory infections, and breathing in hazardous dusts, fumes, or vapors. For DOE workers, the spirometry test is used to measure lung function in individuals who have symptoms such as chronic cough, shortness of breath, and/or wheezing to help determine whether they have lung diseases that may have resulted from occupational exposures during work at DOE facilities. Workers with abnormal spirometry results are referred to their primary care physicians for further evaluation.

The test is performed by deeply inhaling and then forcefully exhaling into a spirometer (the machine that records the measurements). There are two measurements that are crucial in the interpretation of spirometry results.

The first measurement is the forced vital capacity (FVC). FVC is the total amount of air that can forcibly be blown out after a deep breath. The second measurement is the forced expiratory volume-one second (FEV1). FEV1 is the amount of air that an individual can forcibly blow out in one second. Another common value reported in a spirometry test is the ratio of FEV1 to FVC. In healthy middle-aged adults, the ratio should be above 70%; the normal value decreases with age. The table below shows normal and abnormal spirometry readings.

A reduction in FVC can be caused by restrictive lung disease (such as asbestosis). Abnormalities in the FEV1 and the FEV1/FVC result from a decrease in the air flow out of the lung. This decrease may be caused by obstructive lung diseases, such as silicosis, emphysema, and asthma. Figure 3 provides an interpretation of spirometry results.

Spirometry Test	Normal	Abnormal
FVC and FEV1	Equal to or greater than 80%, or above the lower limit of normal using statistical testing	Mild 70-79% Moderate 60-69% Severe less than 50%
FEV1/FVC	Equal to or greater than 70%, or above the lower limit of normal using statistical testing	Mild 60-69% Moderate 50-59% Severe less than 50%

Figure 3. Interpretation of Spirometry Results

Table 10 illustrates spirometry findings to date on initial exams, and Table 11 provides findings on re-screening.

Table 10. Spirometry Findings on Initial Screening (through September 2011)

State	Sites	Workers Screened	Obstructive Airways Dysfunction Detected
AK	Amchitka Island Test Site	1,029	159 (15.5%)
CA	Lawrence Berkeley National Laboratory	450	46 (10.2%)
CA	Lawrence Livermore National Laboratory	1,654	211 (12.8%)
CA	Sandia National Laboratories, CA	189	21 (11.1%)
CO	Rocky Flats Plant (Construction Workers)	551	174 (31.6%)
CO	Rocky Flats Plant (Production Workers)	2,803	729 (26.0%)
FL	Pinellas (Production Workers)	574	157 (27.4%)
IA	Ames Laboratory	1,549	180 (11.6%)
IA	Iowa Army Ammunition Plant	1,290	247 (19.1%)

ID	Idaho National Laboratory (Construction Workers)	715	195 (27.3%)
ID	Idaho National Laboratory (Production Workers)	4,228	764 (18.1%)
IL	Argonne National Laboratory	392	36 (9.2%)
KY	Paducah GDP (Construction Workers)	754	204 (27.1%)
KY	Paducah GDP (Production Workers)	3,134	484 (15.4%)
MO	Kansas City Plant (Construction Workers)	543	131 (24.1%)
MO	Kansas City Plant (Production Workers)	1,821	401 (22.0%)
NM	Los Alamos National Laboratory	1,568	524 (33.4%)
NM	Sandia National Laboratories, NM	294	38 (12.9%)
NV	Nevada National Security Site	3,961	1,181 (29.8%)
NY	Brookhaven National Laboratory (Construction Workers)	469	60 (12.8%)
NY	Brookhaven National Laboratory (Production Workers)	172	21 (12.2%)
OH	Feed Materials Production Center (Construction Workers)	1,413	303 (21.4%)
OH	Feed Materials Production Center (Production Workers)	1,126	158 (14.0%)
OH	Mound Plant (Construction Workers)	277	72 (26.0%)
OH	Mound Plant (Production Workers)	1,273	294 (23.1%)
OH	Portsmouth GDP (Construction Workers)	906	233 (25.7%)
OH	Portsmouth GDP (Production Workers)	3,431	731 (21.3%)
SC	Savannah River Site (Construction Workers)	3,385	620 (18.3%)
SC	Savannah River Site (Production Workers)	1,699	224 (13.2%)
TN	Oak Ridge K-25 (Production Workers)	4,301	913 (21.2%)
TN	Oak Ridge National Laboratory (Production Workers)	1,349	300 (22.2%)
TN	Oak Ridge Reservation ²⁵ (Construction Workers)	2,297	465 (20.2%)
TN	Y-12 National Security Complex (Production Workers)	2,944	718 (24.4%)
TX	Pantex Plant	797	313 (39.3%)
WA	Hanford Site (Construction Workers)	2,268	608 (26.8%)
WA	Hanford Site (Production Workers)	3,713	787 (21.2%)
	Other Sites ²⁶ (Construction Workers)	958	183 (19.1%)
	Other Sites ²⁷ (Production Workers)	164	29 (17.7%)
Grand Total		60,441	12,914 (21.4%)

25 Includes Oak Ridge K-25, Oak Ridge National Laboratory, and Y-12 National Security Complex.

26 Sites where the number of individuals screened by the Building Trades National Medical Screening Program to date is less than 100.

27 Sites where the number of individuals screened by the National Supplemental Screening Program to date is less than 100.

**Table 11. Spirometry Findings on Re-screening
(through September 2011)**

State	Sites	Workers Screened	Obstructive Airways Dysfunction Detected
AK	Amchitka Island Test Site	355	26 (7.3%)
CA	Lawrence Berkeley National Laboratory	1	0 (0.0%)
CA	Lawrence Livermore National Laboratory	141	5 (3.5%)
CA	Sandia National Laboratories, CA	9	0 (0.0%)
CO	Rocky Flats Plant (Construction Workers)	140	9 (6.4%)
CO	Rocky Flats Plant (Production Workers)	403	83 (20.6%)
FL	Pinellas (Production Workers)	72	22 (30.6%)
IA	Ames Laboratory	334	24 (7.2%)
IA	Iowa Army Ammunition Plant	301	59 (19.6%)
ID	Idaho National Laboratory (Construction Workers)	129	9 (7.0%)
ID	Idaho National Laboratory (Production Workers)	1,273	414 (32.5)
IL	Argonne National Laboratory	12	0 (0.0%)
KY	Paducah GDP (Construction Workers)	255	13 (5.1%)
KY	Paducah GDP (Production Workers)	1,080	220 (20.4%)
MO	Kansas City Plant (Construction Workers)	115	1 (0.9%)
MO	Kansas City Plant (Production Workers)	284	36 (12.7%)
NM	Los Alamos National Laboratory	278	41 (14.7%)
NM	Sandia National Laboratories, NM	1	0 (0.0%)
NV	Nevada National Security Site	327	201 (61.5%)
NY	Brookhaven National Laboratory (Construction Workers)	167	3 (1.8%)
OH	Feed Materials Production Center (Construction Workers)	454	19 (4.2%)
OH	Feed Materials Production Center (Production Workers)	251	42 (16.7%)
OH	Mound Plant (Construction Workers)	72	4 (5.6%)
OH	Mound Plant (Production Workers)	477	128 (26.8%)
OH	Portsmouth GDP (Construction Workers)	301	24 (8.0%)
OH	Portsmouth GDP (Production Workers)	1,342	405 (30.2%)
SC	Savannah River Site (Construction Workers)	893	50 (5.6%)
SC	Savannah River Site (Production Workers)	6	0 (0.0%)
TN	Oak Ridge K-25 (Production Workers)	1,179	230 (19.5%)
TN	Oak Ridge National Laboratory (Production Workers)	392	80 (20.4%)

TN	Oak Ridge Reservation ²⁸ (Construction Workers)	745	73 (9.8%)
TN	Y-12 National Security Complex (Production Workers)	767	151 (19.7%)
TX	Pantex Plant	159	4 (2.5%)
WA	Hanford Site (Construction Workers)	709	57 (8.0%)
WA	Hanford Site (Production Workers)	524	114 (21.8%)
	Other Sites ²⁹ (Construction Workers)	128	4 (3.1%)
	Other Sites ³⁰ (Production Workers)	9	0 (0.0%)
Grand Total		14,085	2,551 (18.1%)

Beryllium, Beryllium Sensitization, and Chronic Beryllium Disease

Beryllium is a naturally occurring metal and is not radioactive. Because of its properties, beryllium has been part of the atomic energy and nuclear weapons industries since the 1940s. Exposure to beryllium and certain beryllium compounds can result in beryllium sensitization, which may develop into a disease of the lungs called chronic beryllium disease (CBD). Beryllium sensitization is an “allergic” condition to beryllium that can develop primarily after a person breathes air containing beryllium mists, dusts, and fumes. Even brief or small exposures to beryllium can lead to sensitization and/or CBD. However, most people exposed to beryllium will NOT get the disease. Other beryllium-related disorders can affect the skin, liver, spleen, heart, eye, or kidney. These disorders often occur in the presence of CBD.

Medical screening for beryllium sensitization and CBD usually begins with a Beryllium Lymphocyte Proliferation Test (BeLPT). The BeLPT is a laboratory blood test that examines how a type of disease-fighting blood cells that are normally found in the body, called lymphocytes, reacts to beryllium. In general terms, the BeLPT is performed by culturing lymphocytes from peripheral blood. If these lymphocytes react to the beryllium in a specific way, the test results are “abnormal.” Individuals with an abnormal BeLPT are encouraged to file a claim with the Department of Labor Energy Employees Occupational Illness Compensation Program Act. If they do not react to beryllium, the test is “normal.” The results are reviewed by a certified doctor (M.D. or Ph.D.) and are then mailed to the individual.

An abnormal BeLPT result indicates that the immune system has responded to beryllium and the individual being tested may have beryllium sensitization. As with other medical diagnostic tests, an abnormal test result should be confirmed. Beryllium sensitization is diagnosed by an occupational medicine physician based on abnormal BeLPT results.

Depending on numerous factors, including the frequency and amount of beryllium exposure and the type of exposure (metal, metal oxides, salts), 2 to 6% of beryllium-exposed people will develop beryllium sensitization and/or beryllium disease. However, certain work tasks with direct exposure (machining, welding) have been associated with beryllium sensitization rates as high as 20%. Even very small amounts of exposure to beryllium can cause disease in some people. Individuals still remain at risk of developing beryllium sensitization and CBD after exposure to beryllium has stopped, even if a normal BeLPT result was identified. Therefore, re-testing for beryllium sensitization is recommended approximately every three years, unless unexplained pulmonary symptoms

28 Includes Oak Ridge K-25, Oak Ridge National Laboratory, and Y-12 National Security Complex.

29 Sites where the number of individuals screened by the Building Trades National Medical Screening Program to date is less than 100.

30 Sites where the number of individuals screened by the National Supplemental Screening Program to date is less than 100.

develop, which would suggest that immediate re-testing is necessary. Re-testing is no longer necessary after four consecutively normal BeLPT results and no additional opportunity for beryllium exposure has occurred.

If beryllium sensitization is identified, physicians who specialize in the diagnosis and treatment of CBD should be consulted with regard to a diagnosis of beryllium sensitization and/or CBD. Specialized treatment can be very effective in controlling CBD; however, a complete cure with or without treatment is rare. Individuals who have beryllium sensitization, but do not yet have the disease, do not need treatment. Beryllium has been shown to cause cancer in humans and in many species of animals, although the studies suggesting the human association are limited. Regardless of the limitations of the studies performed, beryllium has been classified as a human carcinogen by the International Agency for Research on Cancer.

Table 12 illustrates beryllium testing findings on initial exams to date, and Table 13 provides findings on re-screens.

**Table 12. Results of Beryllium Lymphocyte Proliferation Tests
by DOE Site on Initial Screening
(through September 2011)**

State	Sites	Workers Screened	1 Abnormal	2 Abnormal	1 Abnormal and 1+ borderline
AK	Amchitka Island Test Site	57	2 (3.5%)	0 (0.0%)	0 (0.0%)
CA	Lawrence Berkeley National Laboratory	212	4 (1.9%)	4 (1.9%)	0 (0.0%)
CA	Lawrence Livermore National Laboratory	1,028	10 (1.0%)	29 (2.8%)	5 (0.5%)
CA	Sandia National Laboratories, CA	128	0 (0.0%)	3 (2.3%)	2 (1.6%)
CO	Rocky Flats Plant (Construction Workers)	570	4 (0.7%)	3 (0.5%)	0 (0.0%)
CO	Rocky Flats Plant (Production Workers)	1,486	24 (1.6%)	12 (0.8%)	7 (0.5%)
FL	Pinellas (Production Workers)	570	9 (1.6%)	21 (3.7%)	2 (0.4%)
IA	Ames Laboratory	1,550	29 (1.9%)	21 (1.4%)	4 (0.3%)
IA	Iowa Army Ammunition Plant	1,266	16 (1.3%)	11 (0.9%)	7 (0.6%)
ID	Idaho National Laboratory (Construction Workers)	724	11 (1.5%)	4 (0.6%)	5 (0.7%)
ID	Idaho National Laboratory (Production Workers)	3,970	42 (1.1%)	29 (0.7%)	14 (0.4%)
IL	Argonne National Laboratory	216	6 (2.8%)	2 (0.9%)	1 (0.5%)
KY	Paducah GDP (Construction Workers)	770	15 (1.9%)	8 (1.0%)	1 (0.1%)
KY	Paducah GDP (Production Workers)	2,708	45 (1.7%)	18 (0.7%)	7 (0.3%)
MO	Kansas City Plant (Construction Workers)	541	2 (0.4%)	11 (2.0%)	3 (0.6%)
MO	Kansas City Plant (Production Workers)	1,770	41 (2.3%)	19 (1.1%)	8 (0.5%)
NM	Los Alamos National Laboratory	2,430	38 (1.6%)	30 (1.2%)	20 (0.8%)

NM	Sandia National Laboratories, NM	316	12 (3.8%)	3 (0.9%)	3 (0.9%)
NV	Nevada National Security Site	2,274	29 (1.3%)	22 (1.0%)	12 (0.5%)
NY	Brookhaven National Laboratory (Construction Workers)	463	5 (1.1%)	23 (5.0%)	0 (0.0%)
NY	Brookhaven National Laboratory (Production Workers)	171	2 (1.2%)	9 (5.3%)	2 (1.2%)
OH	Feed Materials Production Center (Construction Workers)	1,416	3 (0.2%)	12 (0.8%)	3 (0.2%)
OH	Feed Materials Production Center (Production Workers)	960	8 (0.8%)	6 (0.6%)	2 (0.2%)
OH	Mound Plant (Construction Workers)	276	0 (0.0%)	2 (0.7%)	0 (0.0%)
OH	Mound Plant (Production Workers)	1,267	23 (1.8%)	12 (0.9%)	4 (0.3%)
OH	Portsmouth GDP (Construction Workers)	912	13 (1.4%)	2 (0.2%)	0 (0.0%)
OH	Portsmouth GDP (Production Workers)	3,079	23 (0.7%)	9 (0.3%)	5 (0.2%)
SC	Savannah River Site (Construction Workers)	3,382	22 (0.7%)	31 (0.9%)	10 (0.3%)
SC	Savannah River Site (Production Workers)	1,279	44 (3.4%)	4 (0.3%)	2 (0.2%)
TN	Oak Ridge K-25 (Production Workers)	4,372	108 (2.5%)	91 (2.1%)	25 (0.6%)
TN	Oak Ridge National Laboratory (Production Workers)	1,219	25 (2.1%)	12 (1.0%)	5 (0.4%)
TN	Oak Ridge Reservation ³¹ (Construction Workers)	2,602	20 (0.8%)	18 (0.7%)	10 (0.4%)
TN	Y-12 National Security Complex (Production Workers)	2,417	55 (2.3%)	41 (1.7%)	5 (0.2%)
TX	Pantex Plant ³²	781	9 (1.2%)	0 (0.0%)	0 (0.0%)
WA	Hanford Site (Construction Workers)	2,276	28 (1.2%)	24 (1.1%)	4 (0.2%)
WA	Hanford Site (Production Workers)	3,095	102 (3.3%)	25 (0.8%)	16 (0.5%)
	Other Sites ³³ (Construction)	549	2 (0.4%)	2 (0.4%)	0 (0.0%)
	Other Sites ³⁴ (Production)	126	0 (0.0%)	2 (1.6%)	0 (0.0%)
Grand Total		46,695	784 (1.7%)	524 (1.1%)	187 (0.4%)

31 Includes Oak Ridge K-25, Oak Ridge National Laboratory, and Y-12 National Security Complex.

32 The site-specific project does not offer confirmatory tests for participants with an abnormal test. Those workers are referred to the Energy Employees Occupational Illness Compensation Program for further testing. However, workers referred to the National Supplemental Screening Program for exams are provided confirmatory tests.

33 Sites where the number of individuals screened by BTMed to date is less than 100.

34 Sites where the number of individuals screened by the National Supplemental Screening Program to date is less than 100.

Table 13. Results of Beryllium Lymphocyte Proliferation Tests by DOE Site on Re-screening (through September 2011)

State	Sites	Workers Screened	1 Abnormal ³⁵	2 Abnormal ³⁶	1 Abnormal and 1+ borderline ³⁶
AK	Amchitka Island Test Site	19	0 (0.0%)	0 (0.0%)	0 (0.0%)
CA	Lawrence Berkeley National Laboratory	1	0 (0.0%)	0 (0.0%)	0 (0.0%)
CA	Lawrence Livermore National Laboratory	119	0 (0.0%)	0 (0.0%)	0 (0.0%)
CA	Sandia National Laboratories, CA	8	0 (0.0%)	0 (0.0%)	0 (0.0%)
CO	Rocky Flats Plant (Construction Workers)	143	0 (0.0%)	0 (0.0%)	0 (0.0%)
CO	Rocky Flats Plant (Production Workers)	149	3 (2.0%)	0 (0.0%)	1 (0.7%)
FL	Pinellas (Production Workers)	71	1 (1.4%)	0 (0.0%)	1 (1.4%)
IA	Ames Laboratory	328	0 (0.0%)	0 (0.0%)	0 (0.0%)
IA	Iowa Army Ammunition Plant	610	10 (1.6%)	2 (0.3%)	0 (0.0%)
ID	Idaho National Laboratory (Construction Workers)	138	2 (1.4%)	0 (0.0%)	0 (0.0%)
ID	Idaho National Laboratory (Production Workers)	1,280	3 (0.2%)	9 (0.7%)	4 (0.3%)
IL	Argonne National Laboratory	12	1 (8.3%)	0 (0.0%)	0 (0.0%)
KY	Paducah GDP (Construction Workers)	250	0 (0.0%)	2 (0.8%)	0 (0.0%)
KY	Paducah GDP (Production Workers)	1,067	7 (0.7%)	2 (0.2%)	4 (0.4%)
MO	Kansas City Plant (Construction Workers)	112	2 (1.8%)	1 (0.9%)	0 (0.0%)
MO	Kansas City Plant (Production Workers)	285	1 (0.4%)	1 (0.4%)	1 (0.4%)
NM	Los Alamos National Laboratory	305	4 (1.3%)	0 (0.0%)	0 (0.0%)
NM	Sandia National Laboratories, NM	1	0 (0.0%)	0 (0.0%)	0 (0.0%)
NV	Nevada National Security Site	302	4 (1.3%)	8 (2.6%)	1 (0.3%)
NY	Brookhaven National Laboratory (Construction Workers)	153	4 (2.6%)	1 (0.7%)	1 (0.7%)
OH	Feed Materials Production Center (Construction Workers)	465	3 (0.6%)	0 (0.0%)	0 (0.0%)
OH	Feed Materials Production Center (Production Workers)	262	0 (0.0%)	2 (0.8%)	1 (0.4%)
OH	Mound Plant (Construction Workers)	76	0 (0.0%)	0 (0.0%)	0 (0.0%)

35 May include individuals who did not receive a BeLPT at the time of their initial screening or who had a normal result on their initial screening and a single abnormal result on their re-screening.

36 May include individuals who did not receive a BeLPT at the time of their initial screening, had a normal result on the initial screening, or had a single abnormal or borderline result on their initial screening that was confirmed on their re-screening.

OH	Mound Plant (Production Workers)	481	1 (0.2%)	8 (1.7%)	3 (0.6%)
OH	Portsmouth GDP (Construction Workers)	304	0 (0.0%)	0 (0.0%)	0 (0.0%)
OH	Portsmouth GDP (Production Workers)	1,365	3 (0.2%)	4 (0.3%)	3 (0.2%)
SC	Savannah River Site (Construction Workers)	882	10 (1.1%)	3 (0.3%)	2 (0.2%)
SC	Savannah River Site (Production Workers)	5	0 (0.0%)	0 (0.0%)	0 (0.0%)
TN	Oak Ridge K-25 (Production Workers)	1,181	11 (0.9%)	10 (0.8%)	4 (0.3%)
TN	Oak Ridge National Laboratory (Production Workers)	378	2 (0.5%)	8 (2.1%)	5 (1.3%)
TN	Oak Ridge Reservation ³⁷ (Construction Workers)	747	5 (0.7%)	6 (0.8%)	2 (0.3%)
TN	Y-12 National Security Complex (Production Workers)	747	8 (1.1%)	20 (2.7%)	6 (0.8%)
TX	Pantex Plant ³⁸	164	2 (1.2%)	2 (1.2%)	0 (0.0%)
WA	Hanford Site (Construction Workers)	664	4 (0.6%)	3 (0.5%)	0 (0.0%)
WA	Hanford Site (Production Workers)	459	6 (1.3%)	0 (0.0%)	2 (0.4%)
	Other Sites ³⁹ (Construction Workers)	82	2 (2.4%)	1 (1.2%)	0 (0.0%)
	Other Sites ⁴⁰ (Production Workers)	8	0 (0.0%)	0 (0.0%)	0 (0.0%)
Grand Total		12,922	151 (1.2%)	137 (1.1%)	43 (0.3%)

The Audiogram

The audiogram is an evaluation of how well an individual can hear. Sounds are presented to the individual through earphones during the test. These sounds are presented at different levels of frequency and intensity. The human ear responds to the frequency or pitch of a sound and the intensity or loudness of the sound. The frequency of the sound is measured in Hertz (Hz), and the loudness of the sound is measured in decibels (dB). During the procedure, the responses of the individual are recorded on a graph. An individual has no impairment in hearing if he or she detects the sound that is presented through the earphones in the range of 0 to 25 decibels. The audiogram indicates how much louder (in decibels) the pure tone frequency must be for the tested subject to hear it compared to what the normal, general population needs to hear it.

There are two primary types of hearing loss. **Conductive** hearing loss occurs when there is an obstruction or breakdown in the system that transmits sound through the ear, including the ear canal, the ear drum (called the tympanic membrane), and the three small bones on the inner side of the ear drum. Ear wax, infections, and damage to the eardrum are common causes of conductive hearing loss. Conductive hearing loss is often reversible with

37 Includes Oak Ridge K-25, Oak Ridge National Laboratory, and Y-12 National Security Complex.

38 The site-specific project does not offer confirmatory tests for participants with an abnormal test. Those workers are referred to the Energy Employees Occupational Illness Compensation Program for further testing. However, workers referred to the National Supplemental Screening Program for exams are provided confirmatory tests.

39 Sites where the number of individuals screened by BTMed to date is less than 100.

40 Sites where the number of individuals screened by the National Supplemental Screening Program to date is less than 100.

treatment (Council for Accreditation in Occupational Hearing Conservation [CAOHC], 1993). **Sensorineural** hearing loss is caused by damage to the hair cells of the inner ear (called the cochlea) or to the nerves that carry sound to the brain (CAOHC, 1993). Sensorineural hearing loss is usually permanent. The two most common causes of sensorineural hearing loss are aging and noise of an occupational or non-occupational nature. It is thought that some workplace chemicals can also contribute to sensorineural hearing loss. The National Institute on Deafness and other Communication Disorders has developed a reference chart (Figure 4) that provides examples of everyday sounds, along with the measure of their loudness in decibels.

Decibels	Sound Source
150	Firecracker, rock concert
120	Ambulance siren
110	Chain Saw
100	Snowmobile
95	Motorcycle
90	Lawn mower
80	City traffic noise
60	Normal conversation
40	Refrigerator humming
20	Whispered voice
0	Threshold of normal hearing

Figure 4. Everyday Sounds Measured in Decibels

The Occupational Safety and Health Administration estimates that 30 million people in the United States are exposed to hazardous noise in the workplace. Even though it is one of the most common occupational illnesses, noise-induced hearing loss (NIHL) often goes unrecognized because there are no visible effects, it usually develops gradually and over a long period of time, and there is often no pain associated with it (<http://www.osha.gov/SLTC/noisehearingconservation/index.html>, accessed November 8, 2010).

NIHL is considered an occupational illness rather than an injury because it usually progresses over time (CAOHC, 1993). While it is possible that hearing loss can occur from a single event, such as an explosion, most occupational NIHL results from exposure to continuous noise above a certain level (CAOHC, 1993). There is also evidence that exposure to industrial chemicals, such as heavy metals and solvents, is toxic to the nervous system and may cause hearing loss. Research has shown that the combination of exposure to these substances with noise may work together to increase the risk of hearing loss (CAOHC, 1993).

ringing in the ears (called tinnitus) often accompanies hearing loss, and is a sign of irritation to the sensory cells of the inner ear and may be a warning sign for NIHL (CAOHC, 1993). Another important cause of sensorineural hearing loss is aging. As people get older, many of our special senses, such as sight, smell, hearing, or taste, decline in their abilities. Age-related hearing loss is called presbycusis. The onset of presbycusis varies between individuals, and the onset and the magnitude of hearing loss associated with the aging process may begin as early as age 50 years (CAOHC, 1993). Presbycusis is often greater in the higher pitched levels of sound (that is, for the higher frequencies of 4,000 or more Hertz).

References:

Council for Accreditation in Occupational Hearing Conservation. 1993. Hearing Conservation Manual (3rd edition). A. Suter (Ed.) Milwaukee, Wi: CAOHC.

U.S. Department of Health and Human Services. National Institutes of Health. National Institute on Deafness and Other Communication Disorders (NIDCD). How Loud is Too Loud? <http://www.nidcd.nih.gov/health/hearing/ruler.html> downloaded November 24, 2010.

Table 14 illustrates audiometry findings on initial exams to date.

Table 14. Audiometry Findings on Initial Screening (through September 2011)

State	Sites	Workers Screened	Noise Induced Hearing Loss (NIHL)
AK	Amchitka Island Test Site	1,048	693 (66.1%)
CA	Lawrence Berkeley National Laboratory	236	97 (41.1%)
CA	Lawrence Livermore National Laboratory	832	370 (44.5)
CA	Sandia National Laboratories, CA	92	43 (46.7%)
CO	Rocky Flats Plant (Construction Workers)	540	352 (65.2%)
CO	Rocky Flats Plant (Production Workers)	2,766	1,770 (64.0%)
FL	Pinellas (Production Workers)	574	211 (36.8%)
IA	Ames Laboratory ⁴¹	129	38 (29.5%)
IA	Iowa Army Ammunition Plant ⁴²	101	84 (83.2%)
ID	Idaho National Laboratory (Construction Workers)	696	443 (63.6%)
ID	Idaho National Laboratory (Production Workers)	4,057	2,215 (54.6%)
IL	Argonne National Laboratory	394	159 (40.4%)
KY	Paducah GDP (Construction Workers)	711	557 (78.3%)
KY	Paducah GDP (Production Workers)	3,105	1,791 (57.7%)
MO	Kansas City Plant (Construction Workers)	514	297 (57.8%)
MO	Kansas City Plant (Production Workers)	1,818	805 (44.3%)
NM	Los Alamos National Laboratory	2,181	1,318 (60.4%)
NM	Sandia National Laboratories, NM	279	160 (57.3%)
NV	Nevada National Security Site	3,641	2,922 (80.3%)
NY	Brookhaven National Laboratory (Construction Workers)	476	304 (63.9%)

41 The site-specific project does not offer audiograms. However, workers referred to the National Supplemental Screening Program are provided audiograms.

42 The site-specific project does not offer audiograms. However, workers referred to the National Supplemental Screening Program are provided audiograms.

NY	Brookhaven National Laboratory (Production Workers)	170	110 (64.7%)
OH	Feed Materials Production Center (Construction Workers)	1,402	689 (49.1%)
OH	Feed Materials Production Center (Production Workers)	1,118	386 (34.5%)
OH	Mound Plant (Construction Workers)	268	176 (65.7%)
OH	Mound Plant (Production Workers)	1,291	649 (50.3%)
OH	Portsmouth GDP (Construction Workers)	941	677 (71.9%)
OH	Portsmouth GDP (Production Workers)	3,384	1,774 (52.4%)
SC	Savannah River Site (Construction Workers)	3,460	2,047 (59.2%)
SC	Savannah River Site (Production Workers)	1,722	1,198 (69.6%)
TN	Oak Ridge K-25 (Production Workers)	3,960	2,606 (65.8%)
TN	Oak Ridge National Laboratory (Production Workers)	1,340	933 (69.6%)
TN	Oak Ridge Reservation ⁴³ (Construction Workers)	2,253	1,627 (72.2%)
TN	Y-12 National Security Complex (Production Workers)	2,935	2,160 (73.6%)
TX	Pantex Plant ⁴⁴	26	7 (26.9%)
WA	Hanford Site (Construction Workers)	1,638	1,162 (70.9%)
WA	Hanford Site (Production Workers)	2,869	1,425 (49.7%)
	Other Sites ⁴⁵ (Construction Workers)	642	404 (62.9%)
	Other Sites ⁴⁶ (Production Workers)	173	79 (45.7%)
Grand Total		53,782	32,738 (60.9%)

43 Includes Oak Ridge K-25, Oak Ridge National Laboratory, and Y-12 National Security Complex.

44 The site-specific project does not offer audiograms. However, workers referred to the National Supplemental Screening Program are provided audiograms.

45 Sites where the number of individuals screened by BTMed to date is less than 100.

46 Sites where the number of individuals screened by the National Supplemental Screening Program to date is less than 100.

Low-dose Spiral CT Scans for Early Lung Cancer Detection

Low-dose spiral computed tomography (CT) scanning is a noninvasive medical imaging test that has been used for the early detection of lung cancer for over 16 years (Sone et al. 1998; Henschke et.al. 1999). A low-dose spiral chest CT differs from a full-dose conventional chest CT scan primarily in the amount of radiation emitted during CT scans. Chest CT, in general, requires less radiation exposure than other CT procedures because the air-filled tissues of the lungs are not as dense as the tissues of other organs (i.e., less x-ray radiation is needed to penetrate the lung). Radiation dose can be further reduced with lung cancer screening due to the naturally high contrast between low-density, normal lung tissue and lung nodules that could be suspicious for lung cancer (International Commission on Radiological Protection [ICRP] 2007, Naidich et.al. 1990). The amount of radiation of the low-dose chest CT scan (an estimated average of 1.5 mSv, for the majority of former worker participants) is over five times *lower* than that absorbed during a full-dose diagnostic chest CT scan (an estimated average of 8 mSv). As further comparison, the estimated average annual radiation exposure from natural sources is 3.1 mSv.

The low-dose spiral chest CT scan is offered only to those workers who are determined to be at elevated risk for lung cancer. In addition, a participant must also be medically eligible to be enrolled in the lung cancer screening program (i.e., having sufficient lung function to withstand chest surgery).

The low-dose spiral chest CT scanning procedure requires that the patient lie down on an exam table as it moves through a sophisticated x-ray machine. The x-ray equipment is housed inside a doughnut-shaped tube. As the table moves through the “doughnut,” the x-ray beam inside the tube rotates around the patient, taking more than 100 pictures in sequence. Because the continuous movement of the x-ray tube within the doughnut is combined with continuous movement of the table throughout the scan, the x-ray beam forms a spiral path – hence, the term “spiral” or “helical” CT. A special computer program processes this large volume of data and produces two-dimensional cross-sectional views of the chest, which are then displayed on a monitor. If needed, three-dimensional images of internal structures or abnormalities within the lung can also be created. During the procedure, the patient is asked to be as still as possible and to hold his or her breath for about 11 seconds.

Any screening test may detect some abnormalities that may appear to represent early signs of possible illness, but studies show that most of these abnormalities turn out to be false alarms. This is also true of screening for lung cancer. The initial low-dose CT scan may show a white spot in the lung, called a nodule. Most nodules detected in the Early Lung Cancer Detection (ELCD) program are actually small areas of scar tissue or healed infection. In most cases, this can be determined on the initial low-dose CT scan.

However, in other cases, the nodules are indeterminate; that is, it is not immediately clear whether the spot is benign or something of concern. For this type of nodule, the best course of action is to look for any changes over time. Therefore, if an indeterminate nodule is found, the patient will be invited back for a second low-dose CT scan three or six months after the initial scan.

If a nodule increases in size, the patient will be advised to follow up immediately with his/her personal doctor, because this nodule would now be considered suspicious for lung cancer. In this case, his/her personal doctor will arrange for the necessary consultations and procedures to find out whether or not the nodule is a lung cancer and, if so, to treat it appropriately. The most common follow-up procedures are further imaging studies, such as a positron emission tomography (PET) scan. Some people may undergo a lung tissue biopsy, which involves removing a piece of lung tissue from the lung and examining it under a microscope.

Most of the nodules followed as part of the ELCD program do not increase in size and are not cancerous. Many nodules may actually shrink on follow-up scans. If the nodule is unchanged or smaller, it is unlikely to be malignant, and the patient will be invited to return for an annual repeat low-dose CT scan one year from his/her baseline CT scan.

The annual scan is offered to everyone except those diagnosed with either lung cancer or a major illness (including other cancers) after enrolling in the ELCD program (that is, after completing the initial CT scan). The program offers the initial and annual CT scan and follow-up CT scans at no cost to the participant. The ELCD program does not provide or pay for any diagnostic evaluation and treatment of abnormalities discovered on CT scan, but these costs are normally covered by health insurance policies.

References:

Henschke CI, McCauley DI, Yankelevitz DF, et al. Early Lung Cancer Action Project: overall design and findings from baseline screening. *Lancet* 1999; 354(9173):99-105.

ICRP, 2007. Managing Patient Dose in Multi-Detector Computed Tomography (MDCT). ICRP Publication 102. Ann. ICRP 37 (1).

Naidich DP, Marshall CH, Gribbin C, Arams RS, McCauley DI. Low-dose CT of the lungs: preliminary observations. *Radiology* 1990; 175(3):729-31.

Sone S, Takashima S, Li F, et al. Mass screening for lung cancer with mobile spiral computed tomography scanner. *Lancet* 1998; 351(9111):1242-5.

Appendix E: Summary of FWP Scientific Publications

Scientific publications either directly studying former workers in the context of the screening program or recruiting former workers in the program as research participants for scientific studies funded by the National Institutes of Health or other research funding sources are summarized below according to publication date.

Manowitz A., Sedlar M., Griffon M., Miller A., Miller J., Markowitz S. Use of BMI guidelines and individual dose tracking to minimize radiation exposure from low-dose helical chest CT scanning in a lung cancer screening program. *Academic Radiology*, 19(1): 84-88, 2012.

The increasing use of computed tomography (CT) has been accompanied by rising concerns over potential radiation-related health risks, especially cancer, and a need to minimize such risks. The authors conducted 2,186 low-dose helical chest CT scans among 1,235 nuclear weapons workers at elevated risk of lung cancer, setting the CT scanner tube current at 30 mAs for all participants with Body Mass Index (BMI) <35 kg/m² and permitting technologists to raise mAs levels for participants with BMI ≥35 kg/m². Dose-length product (DLP) was recorded from the CT scanner, permitting calculation of effective dose. Phantom-based estimates of effective dose were also made. A chest radiologist recorded acceptability of image quality. The study population was significantly overweight. Nearly 90% of CT scans were performed using a tube current setting of 30 mAs and had a mean DLP-based effective dose of 1.3 mSv. The phantom-based estimate of effective dose was lower at 1.1 mSv. Among participants with a BMI ≥35 kg/m², 92% were scanned at 40 or 50 mAs, which was associated with a DLP-based effective dose of 1.6 and 2.0 mSv, respectively. Image quality was satisfactory in 99.8% of scans. Application of simple BMI-based guidelines and DLP tracking of low-dose helical chest CT scans in a lung cancer screening program minimizes radiation dose, even in a largely overweight population.

Leavey A., Frank A., Pinson B., Shepherd S., and Burstyn I. Hypothyroidism among former workers of a nuclear weapons facility. *American Journal of Industrial Medicine*, 54(12):955-964, 2011.

Hypothyroid status was determined for 622 former workers of a nuclear weapons facility located in Texas, using a combination of measured thyroid stimulating hormone (TSH) levels and thyroid medication history, as part of an on-going health surveillance program. The authors classified 916 unique job titles into 35 job categories. According to the most stringent TSH definition used in this study (0.3–3.0 IU/ml), 174 (28.0%) former workers were considered to be hypothyroid; of these, 66 (41.8%) were females and 108 (23.3%) were males. In logistic regression analysis adjusted for age, gender, and smoking status, only having worked as a material handler (n = 18) exhibited an elevated risk of developing hypothyroidism compared to other jobs (OR 3.88, 95% CI 1.43–11.07). Material handlers perform a job that has suspected exposure to radiation. No excess risk of hypothyroidism was observed for any of the other job categories. There is suggestive evidence that only material handlers at this nuclear weapons facility may have elevated risk of hypothyroidism; further evaluation of thyroid health in this population is warranted.

Mikulski M., Hartley P., Sprince N., Sanderson W., Lourens S., Worden N., Wang K., and Fuortes L. Risk and significance of chest radiograph and pulmonary function abnormalities in an elderly cohort of former nuclear weapons workers. *Journal of Occupational and Environmental Medicine*, 53(9):1046-53, 2011.

A study to estimate prevalence and risk factors for International Labour Organization radiographic abnormalities and assess relationship of these abnormalities with spirometry results in former U.S. Department of Energy (DOE) nuclear weapons workers was undertaken. Participants were offered chest x-ray and lung function testing. Three occupational medicine physicians read the chest x-rays. Forty-five (5.9%) of the 757 screened

workers were found to have isolated parenchymal abnormalities on chest x-ray; this rate is higher than that in many DOE studies. Parenchymal and pleural abnormalities and isolated pleural abnormalities were found in 19 (2.5%) and 37 (4.9%) workers, respectively, and these rates are lower than those in other DOE studies to date. Lung function impairment was associated with radiographic abnormalities. This study found an elevated rate of parenchymal abnormalities compared to other DOE populations, but the effect of age or other causes could not be ruled out.

Mikulski M., Leonard S., Sanderson W., Hartley P., Sprince N., and Fuortes L. Risk of beryllium sensitization in a low-exposed former nuclear weapons cohort from the cold war era. *American Journal of Industrial Medicine*; 2010 October 28. [E-published ahead of print]

The nuclear weapons industry has long been known as a source of beryllium exposure. A total of 1,004 former workers from a nuclear weapons assembly site at the Iowa Army Ammunition Plant were screened for sensitization to beryllium. Twenty-three (2.3%) workers were found sensitized to beryllium, and this prevalence was comparable to other U.S. Department of Energy sites. Occasional, direct exposure to beryllium through machining and grinding of copper–beryllium 2% alloy tools was found to increase the risk of sensitization compared to background exposure (OR=3.83; 95% CI: 1.04–14.03) with a statistically significant trend (P=0.03) revealing that particular jobs are associated with sensitization. Exposure potential in this study was estimated based on job titles and not personal exposure information.

Dement J., Welch L., Ringen K., Bingham E., and Quinn P. Airways obstruction among older construction and trade workers at Department of Energy nuclear sites. *American Journal of Industrial Medicine*, 53:224-240, 2010.

A study of chronic obstructive pulmonary disease (COPD) among 7,579 current and former workers participating in medical screening programs at U.S. Department of Energy (DOE) nuclear weapons facilities through September 2008 was undertaken. Participants provided a detailed work and exposure history and underwent a respiratory examination that included a respiratory history, respiratory symptoms, a posterior-anterior chest radiograph classified by International Labour Organization criteria, and spirometry. The study of construction workers employed at DOE sites demonstrated increased COPD risk due to occupational exposures and was able to identify specific exposures increasing risk.

Dement J., Ringen K., Welch L., Bingham E., and Quinn P. Mortality among older construction and craft workers employed at Department of Energy (DOE) sites. *American Journal of Industrial Medicine*, 52:671-682, 2009.

A cohort of 8,976 former construction workers from Hanford Site, Savannah River Site, Oak Ridge, and Amchitka was followed using the National Death Index through December 31, 2004, to ascertain vital status and causes of death. DOE construction workers at these four sites were found to have significantly excess risk for combined cancer sites included in the Department of Labor Energy Employees Occupational Illness Compensation Program. Asbestos-related cancers were significantly elevated.

Dobis D.R., Sawyer R.T., Gillespie M.M., Huang J., Newman L.S., Maier L.A., Day B.J. Modulation of lymphocyte proliferation by antioxidants in chronic beryllium disease. *American Journal of Respiratory and Critical Care Medicine*, 177(9):1002-11, 2008.

Occupational exposure to beryllium can result in chronic granulomatous inflammation characterized by the presence of beryllium-specific CD4+ T cells. Studies show that oxidative stress plays a role in the pathogenesis of chronic inflammatory disorders. Thirty-three subjects with chronic beryllium disease (CBD), 15 subjects with beryllium sensitization, and 28 healthy normal control subjects were consecutively enrolled from the Occupational and Environmental Health Clinic of National Jewish Health. The authors concluded that beryllium can mediate a thiol imbalance leading to oxidative stress that may modulate the proliferation and

clonal expansion of beryllium-specific blood CD4+ T cells. These data suggest that beryllium-induced oxidative stress plays a role in the pathogenesis of granulomatous inflammation in CBD.

Rodrigues E., McClean M., Weinberg J., and Pepper L. Beryllium sensitization and lung function among former workers at the Nevada Test Site. *American Journal of Industrial Medicine*, 51:512-523, 2008.

Beryllium use at the Nevada Test Site was not acknowledged until the late 1990s. An observational study was conducted to identify work-related factors associated with the odds of having beryllium sensitization (BeS). Among the 1,786 former workers tested for BeS, the prevalence of BeS was 1.3%. An increased risk of BeS was found among workers who performed cleanup (OR = 2.68, 95% confidence interval [CI]: 1.10, 6.56) and those who worked in Building B where beryllium parts were machined (OR = 2.52, 95% CI: 1.02, 6.19).

Markowitz S.B., Miller A., Miller J., Manowitz A., Kieding S., Sider L., and Morabia A. Ability of low-dose helical computed tomography to distinguish between benign and malignant non-calcified lung nodules. *Chest*, 131:1028-1034, 2007.

Low-dose helical computed tomography (CT) scanning identifies early stage lung malignancies and also a large proportion of lung nodules of uncertain diagnostic and prognostic significance (i.e., indeterminate nodules). In this study, a total of 4,401 participants were CT scanned for lung cancer with an initial full-chest low-dose CT scan; interval CT scans at 3, 6, and 12 months for indeterminate lung nodules (e.g., nodules not immediately suspicious for lung cancer); and an 18-month, full-chest, low-dose incidence CT scan. Only 3 of 727 indeterminate nodules were identified as being malignant during the subsequent 18 months. The radiologist's designation of a nodule as suspicious had a sensitivity of 84.2% and a specificity of 96.6%. Overall, the authors detected 33 primary lung cancers, including 19 stage I cancers, 5 stage II cancers, 7 stage III-IV cancers, and 3 limited-stage small cell cancers.

Sato H., Spagnolo P., Silveira L., Welsh K.I., du Bois R.M., Newman L.S., Maier L.A. BTNL2 allele associations with chronic beryllium disease in HLA-DPB1*Glu69-negative individuals. *Tissue Antigens*, 70(6):480-6, 2007.

Butyrophilin-like 2 (BTNL2) polymorphisms have been associated with sarcoidosis. Genomic DNA was obtained from chronic beryllium disease (CBD, n= 88), beryllium sensitized (BeS, n= 86), and beryllium exposed nondiseased control subjects (Be-exp, n= 173). The authors concluded that both DRB1*13 and rs3117099TT homozygosity are associated with CBD in *Glu69-negative subjects, while DPB1*Glu69 is associated with CBD and BeS compared with Be-exp. As a result of the small sample size and strong linkage disequilibrium between DRB1*13-DQB1*0603/4/9 and the BTNL2 rs3117099T allele, it is difficult to assess the primary association in DPB1*Glu69-negative CBD cases.

Sawyer R.T., Fontenot A.P., Barnes T.A., Parsons C.E., Tooker B.C., Maier L.A., Gillespie M.M., Gottschall E.B., Silveira L., Hagman J., and Newman L.S. Beryllium-induced TNF-alpha production is transcription-dependent in chronic beryllium disease. *American Journal of Respiratory Cell and Molecular Biology*, 36(2):191-200, 2007.

Beryllium-antigen presentation to beryllium-specific CD4(+) T cells from the lungs of patients with chronic beryllium disease (CBD) results in T cell proliferation and TNF-alpha secretion. The authors tested the hypothesis that beryllium-induced, CBD bronchoalveolar lavage T cell, transcription-dependent, TNF-alpha secretion was accompanied by specific transcription factor upregulation. The data suggest that beryllium exposure induces transcription-dependent TNF-alpha production, potentially due to upregulation of specific transcription factors.

Bingham E., Ringen K., Dement J., Cameron, W., McGowan W., Welch, L., and Quinn, P. Frequency and quality of radiation monitoring at two gaseous diffusion plants. *Annals of the New York Academy of Sciences*, 1076:394-404, 2006.

Since World War II, large numbers of construction workers were employed at U.S. Department of Energy nuclear weapons sites, performing tasks during new construction and maintenance, repair, renovation, and demolition of existing facilities. Such tasks may have involved emergency situations and may have entailed opportunities for significant radiation exposures. This paper provides data from interviews with more than 750 construction workers at two gaseous diffusion plants at Paducah, Kentucky, and Portsmouth, Ohio, regarding radiation monitoring practices.

Dement J., Ringen K., Welch L., Bingham E., and Quinn P. Surveillance of hearing loss among construction and trade workers at Department of Energy nuclear sites. *American Journal of Industrial Medicine*, 48:348-358, 2005.

Medical screening programs for construction workers at Hanford Site, Oak Ridge, and Savannah River Site have included audiometric testing since approximately 1996. Hearing thresholds among U.S. Department of Energy workers examined before 3/31/03 were much higher than observed in a comparison population of industrial workers with low noise exposures. Overall, 59.7% of workers examined were found to have material hearing impairment by National Institute for Occupational Safety and Health criteria. Age, duration of construction work, smoking, and self-reported noise exposure increased the risk of hearing loss.

Fontenot A.P., Palmer B.E., Sullivan A.K., Joslin F.G., Wilson C.C., Maier L.A., Newman L.S., and Kotzin B.L. Frequency of beryllium-specific, central memory CD4+ T cells in blood determines proliferative response. *The Journal of Clinical Investigation*, 115(10):2886-93, 2005.

Beryllium exposure can lead to the development of beryllium-specific CD4+ T cells and chronic beryllium disease (CBD), which is characterized by the presence of lung granulomas and a CD4+ T cell alveolitis. Studies have documented the presence of proliferating and cytokine-secreting CD4+ T cells in blood of CBD patients after beryllium stimulation. However, some patients were noted to have cytokine-secreting CD4 T cells in blood in the absence of beryllium-induced proliferation, and overall, the correlation between the two types of responses was poor. The authors hypothesized that the relative proportion of memory T cell subsets determined antigen-specific proliferation. In most CBD patients, the majority of beryllium-specific CD4+ T cells in blood expressed an effector memory T cell maturation phenotype. However, the ability of blood cells to proliferate in the presence of beryllium strongly correlated with the fraction expressing a central memory T cell phenotype. In addition, the authors found a direct correlation between the percentage of beryllium-specific CD4+ T(EM) cells in blood and T cell lymphocytosis in the lung. Together, these findings indicate that the functional capability of antigen-specific CD4+ T cells is determined by the relative proportion of memory T cell subsets, which may reflect internal organ involvement.

Makie T., Adcoc D., Lackland D., and Hoel D.G. Pulmonary abnormalities associated with occupational exposures at the Savannah River Site. *American Journal of Industrial Medicine*, 48:365-372, 2005.

This study includes data from 1,368 former Savannah River Site (SRS) workers aged 45 years or older who were assessed regarding work history and exposures to industrial agents. Chest radiographs were evaluated by a single radiologist, and the results were compared with the National Health and Nutrition Examination Survey (NHANES) II results. The odds ratio of the SRS male aged 45-75 compared to NHANES was 2.4 for pleura abnormalities and 0.8 for parenchymal abnormalities. The highest-risk worker division was construction (OR = 2.76). Asbestos and possibly other exposures were related to pulmonary disease in this population.

Newman L.S., Mroz M.M., and Ruttenger A.J. Lung fibrosis in plutonium workers. *Radiation Research*, 164(2):123-31, 2005.

There have been few systematic studies of the non-malignant health effects of alpha-particle radiation in humans. Animal studies and a report on plutonium-exposed workers from Russia suggest an association between high doses to the lung from plutonium exposure and the development of fibrotic lung disease. Prompted by a case of lung fibrosis in a retired plutonium worker, the authors tested the hypothesis that plutonium inhalation increases the risk for developing chest radiograph abnormalities consistent with pulmonary fibrosis. A retrospective study of nuclear weapons workers was conducted that included estimating absorbed doses to the lung with an internal dosimetry model. The study population consisted of 326 plutonium-exposed workers with absorbed lung doses from 0 to 28 Sv and 194 unexposed workers. This study shows that plutonium may cause lung fibrosis in humans at absorbed lung doses above 10 Sv.

Newman L.S., Mroz M.M., Balkissoon R., and Maier L.A. Beryllium sensitization progresses to chronic beryllium disease: a longitudinal study of disease risk. *American Journal of Respiratory Cell and Molecular Biology*, 171(1):54-60, 2005.

The blood beryllium lymphocyte proliferation test is used in medical surveillance to identify both beryllium sensitization (BeS) and chronic beryllium disease (CBD). Approximately 50% of individuals with BeS have CBD at the time of their initial clinical evaluation; however, the rate of progression from BeS to CBD is unknown. The authors monitored a cohort of beryllium-sensitized patients at 2-year intervals, using bronchoalveolar lavage and repeated transbronchial lung biopsies to determine progression to CBD as evidenced by granulomatous inflammation in lung tissue. No difference was found in average age, sex, race or ethnicity, smoking status, or beryllium exposure time between those who progressed to CBD and those who remained sensitized without disease. The authors concluded that BeS is an adverse health effect in beryllium-exposed workers and merits medical follow-up.

Pott G.B., Palmer B.E., Sullivan A.K., Silveira L., Maier L.A., Newman L.S., Kotzin B.L., and Fontenot A.P. Frequency of beryllium-specific, TH1-type cytokine-expressing CD4+ T cells in patients with beryllium-induced disease. *Journal of Allergy and Clinical Immunology*, 115(5):1036-42, 2005.

Beryllium sensitization is caused by exposure to beryllium in the workplace. A subset of beryllium-sensitized (BeS) subjects progress to chronic beryllium disease (CBD), a disorder characterized by a CD4+ T-cell alveolitis and granulomatous inflammation. The aim of this study was to determine whether the quantity of beryllium-specific T cells in blood of patients with CBD differs from that found in BeS subjects. Beryllium-induced T-cell proliferation and TH1-type cytokine secretion were determined in blood cells from 33 patients with CBD and 18 BeS subjects. The study concluded that the frequency of beryllium-specific T cells in the blood of beryllium-exposed subjects may be a useful biomarker that helps discriminate between beryllium sensitization and progression to CBD.

Miller A., Markowitz S., Manowitz A., and Miller J.A. Lung cancer screening using low-dose high-resolution CT scanning in a high-risk workforce: 3500 nuclear fuel workers in three US states. *Chest*, 125(5 Suppl):152S-3S, 2004.

Past and present nuclear fuel workers with demonstrated or potential exposure to lung carcinogens (e.g., asbestos, radiation, and/or beryllium) have been screened for early lung cancer with a low-dose mobile CT scanner at three sites in the states of Kentucky, Ohio, and Tennessee. Indeterminate nodules on low-dose CT scans were re-scanned using a full-dose high-resolution technique. Patients with nodules that remained indeterminate were re-scanned at 3, 6, 12, and 18 months. Incidence screens were performed 18 months after the initial scan. The authors demonstrated the practicality of lung cancer screening using low-dose CT scanning in a large occupationally defined population in three states. The overall lung cancer rate was 20 of 3,598 subjects; 0.7%.

Sackett H.M., Maier L.A., Silveira L.J., Mroz M.M., Ogden L.G., Murphy J.R., and Newman L.S. Beryllium medical surveillance at a former nuclear weapons facility during cleanup operations. *Journal of Occupational and Environmental Medicine*, 46(9):953-61, 2004.

Despite the increasing need to remediate beryllium-contaminated buildings in industry, little is known about the magnitude of risk associated with beryllium abatement or the merits of beryllium medical surveillance for cleanup workers. The authors examined beryllium lymphocyte proliferation tests (BeLPTs) and reviewed medical evaluations of workers at a nuclear weapons facility during the process of decontamination and decommissioning. Of 2,221 workers, 19 (0.8%) were beryllium sensitized based on two or more abnormal BeLPTs. Eight of 19 sensitized individuals underwent full clinical evaluation, of whom two were diagnosed with chronic beryllium disease (CBD). Notably, seven beryllium sensitized and CBD cases were hired after the start of cleanup operations. Beryllium medical surveillance detects sensitization and CBD in cleanup workers. Exposure controls and medical surveillance need to be 'broad-based' to include all cleanup workers involved in beryllium-contaminated building remediation.

Sawyer R.T., Parsons C.E., Fontenot A.P., Maier L.A., Gillespie M.M., Gottschall E.B., Silveira L., and Newman L.S. Beryllium-induced tumor necrosis factor-alpha production by CD4+ T cells is mediated by HLA-DP. *American Journal of Respiratory Cell and Molecular Biology*, 31(1):122-30, 2004.

Beryllium presentation to CD4+ T cells from patients with chronic beryllium disease (CBD) results in T cell activation, and these beryllium-specific CD4+ T cells undergo clonal proliferation and T-helper 1-type cytokine production. In exposed workers, genetic susceptibility to this granulomatous disorder is associated with particular HLA-DPB1 alleles. The authors hypothesized that these HLA-DP molecules could mediate beryllium-stimulated tumor necrosis factor-alpha (TNF-alpha) messenger RNA (mRNA) and protein production. Using intracellular cytokine staining, the researchers found that treatment with an anti-HLA-DP, but not anti-HLA-DR, monoclonal antibody inhibited beryllium-stimulated TNF-alpha expression in lung CD3+ CD4+ T cells. This monoclonal antibody also blocked beryllium-specific T cell proliferation, increased production of TNF-alpha mature-mRNA transcripts, and increased TNF-alpha protein production by beryllium-stimulated CBD peripheral blood mononuclear cells and bronchoalveolar lavage (BAL) cells. The beryllium-stimulated upregulation of TNF-alpha mature-mRNA levels with TNF-alpha protein production was a unique property of CBD BAL cells, and did not occur in BAL cells from beryllium-sensitized patients without CBD, or sarcoidosis BAL cells. This study identifies HLA-DP as a regulatory component in the activation of T cell receptors on beryllium-specific CD4+ T cells from CBD patients resulting in proliferation and proinflammatory cytokine production.

Welch L., Ringen K., Bingham E., Dement J., Takaro T., McGowan W., Chen A., and Quinn P. Screening for beryllium disease among construction trade workers at Department of Energy nuclear sites. *American Journal of Industrial Medicine*, 46: 207-218, 2004.

Screening programs for construction workers were undertaken at the Hanford Site, Oak Ridge, and Savannah River Site. Of the 3,842 workers screened at and included in this study, 34% reported exposure to beryllium. Overall, 2.2% of workers had at least one abnormal beryllium lymphocyte proliferation test (BeLPT), and 1.4% were also abnormal on a second test. Regression analyses demonstrated increased risk of having at least one abnormal BeLPT to be associated with ever working in a site building where beryllium activities had taken place. The findings demonstrate that some of these workers had significant exposure, most likely during maintenance, repair, renovation, or demolition in facilities where beryllium was used.

Dement J., Welch L., Bingham E., Cameron B., Rice C., Quinn P., Ringen K. Surveillance of respiratory diseases among construction and trade workers at Department of Energy nuclear sites. *American Journal of Industrial Medicine*, 43:559-573, 2003.

Medical screening programs were begun in 1996 and 1997 at Hanford Site, Oak Ridge, and Savannah River Site to evaluate whether current and former construction workers are at significant risk for occupational illnesses. Of the 2,602 workers examined before 9/30/01, 25.2% showed one or more chest x-ray changes by International Labour Organization criteria and 42.7% demonstrated one or more pulmonary function defects. Although the observed respiratory disease patterns are largely reflective of past exposures, these findings suggest that DOE needs to continue to review industrial hygiene control programs for work tasks involving maintenance, repair, renovation, and demolition.

Stefaniak A.B., Weaver V.M., Cadorette M., Puckett L.G., Schwartz B.S., Wiggs L.D., Jankowski M.D., and Breyse P.N. Summary of historical beryllium uses and airborne concentration levels at Los Alamos National Laboratory. *Applied Occupational and Environmental Hygiene*. 18(9):708-15, 2003.

Beryllium operations and accompanying medical screening of workers at Los Alamos National Laboratory began in the 1940s. In 1999, a Former Worker Medical Screening Program (FWP) that includes screening for chronic beryllium disease was initiated. As part of this program, historical beryllium exposure conditions were reconstructed from archived paper and electronic industrial hygiene data sources to improve understanding of past beryllium uses and airborne concentration levels. A total of 4,528 personal breathing zone and area air samples for beryllium, combined for purposes of calculating summary statistics, were identified during the records review phase. The geometric mean airborne beryllium concentration for the period 1949-1989 for all technical areas was 0.04 $\mu\text{g Be}/\text{m}^3$ with 97 % of all samples below the 2.0 $\mu\text{g Be}/\text{m}^3$ occupational exposure limit. These data can be used to more effectively identify former worker populations at potential risk for chronic beryllium disease and to offer these workers screening as part of the FWP, and, in the event that a case is diagnosed, help to understand historical exposure conditions.

Breyse P., Weaver V., Cadorette M., Wiggs L., Curbow B., Stefaniak A., Melius J., Newman L., Smith H., and Schwartz B. Development of a medical examination program for former workers at a Department of Energy national laboratory. *American Journal of Industrial Medicine*, 42:443-454, 2002.

A needs assessment was conducted at Los Alamos National Laboratory (LANL) in order to identify former LANL employees who may be at significant risk for occupational disease and to determine whether a medical examination program could reduce morbidity or mortality. The algorithm approach that was developed documented that six chemical and physical agents should be included in the medical examination program.

Miller A., Markowitz S., Dahlgren J., Levin S., Swarcberg J., and Warshaw R. Early lung cancer detection using low dose high resolution CT in high risk workers occupationally exposed to asbestos: An overview of 3 studies. *European Journal of Oncology*, 6, 2001.

Lung cancer is the main cause of cancer mortality in both sexes, and its incidence continues to increase. Mortality is high due to the diffusion of disease at the time of diagnosis. Low-dose high-resolution computed tomography allowing the diagnosis of lesions <10 mm in diameter may bring about improvement of results. The authors present some studies and the results available with the use of this new technique.

Appendix F: Resources

DOE Former Worker Medical Screening Program Website
<http://www.hss.energy.gov/HealthSafety/FWSP/formerworkermed/>

FWP Medical Protocol
http://www.hss.energy.gov/HealthSafety/FWSP/formerworkermed/Medical_Protocol.pdf

A Basic Overview of the Former Worker Medical Screening Program (Brochure)
http://www.hss.energy.gov/HealthSafety/FWSP/formerworkermed/FWP_pamphlet.pdf

A Basic Overview of the Energy Employees Occupational Illness Compensation Program (Brochure)
http://www.hss.energy.gov/HealthSafety/FWSP/advocacy/EEOICP_pamphlet.pdf

A Basic Overview of the Worker Safety and Health Program (10 CFR 851) (Brochure)
http://www.hss.doe.gov/healthsafety/wshp/rule851/851_pamphlet_MAY22%202009_UPDATED.pdf

Outreach Event Calendar for DOE Workers
http://www.hss.energy.gov/healthsafety/FWSP/Formerworkermed/events_calendars.html

Building Trades National Medical Screening Program
<http://www.btmed.org/default.cfm>
1-800-866-9663

Former Worker Medical Screening Program for Burlington Atomic Energy Commission Plant (otherwise known as the Iowa Army Ammunition Plant) and Ames Laboratory
<http://cph.uiowa.edu/IowaFWP/index.php>
1-866-282-5818

Medical Exam Program for Los Alamos National Laboratory Former Workers
<http://www.jhsph.edu/LANLFW/index.html>
1-877-500-8615

Medical Screening Program for Former Workers of Lawrence Berkeley, Lawrence Livermore, and Sandia National Laboratories
<http://www.bu.edu/formerworker/>
1-866-460-0628

National Supplemental Screening Program
<http://www.ornl.gov/nssp/>
1-866-812-6703

Pantex Former Worker Medical Screening Program
1-888-378-8939

Worker Health Protection Program
<http://www.worker-health.org/>
1-888-241-1199

DOL Energy Employees Occupational Illness Compensation Program

<http://www.dol.gov/owcp/energy/index.htm>

DOL Resource Centers

<http://www.dol.gov/owcp/energy/regs/compliance/ResourceMeetings/ResourceCenters.htm>

NIOSH Dose Reconstruction

<http://www.cdc.gov/niosh/ocas/ocasdose.html>

DOL Office of the Ombudsman for Part E of EEOICPA

<http://www.dol.gov/eeombd/>

DOE Beryllium Affected Workers Web Resources

<http://www.hss.energy.gov/healthsafety/berylliumaffectedworkers/>

DOE Human Subjects Protection Program

<http://humansubjects.energy.gov/>

CBD Information-National Jewish Health

<http://www.nationaljewish.org/healthinfo/conditions/beryllium-disease/index.aspx>

Beryllium Information Oak Ridge Institute for Science and Education

<http://orise.orau.gov/worker-health-studies/capabilities/beryllium-exposure-studies-testing/default.aspx>

Medical Facilities with Experience Evaluating CBD

http://www.hss.energy.gov/HealthSafety/FWSP/formerworkermed/Medical_Facilities.pdf

Classification of Chest Radiographs: Practices for Worker monitoring and surveillance

<http://www.cdc.gov/niosh/topics/chestradiography/worker-monitoring.html>

Pneumoconioses defined:

<http://www.cdc.gov/niosh/topics/pneumoconioses/>

What is asbestos:

<http://www.cdc.gov/niosh/topics/asbestos/default.html>

What is silica:

<http://www.cdc.gov/niosh/topics/silica/>

Chest Radiography: NIOSH B-reader Program

<http://www.cdc.gov/niosh/topics/chestradiography/breader.html>

What is the International Labour Organization (ILO)?

<http://www.ilo.org/global/lang--en/index.htm>

"I appreciate the commitment to our health due to the work environment we were exposed to. Thank you for continuing this program."

- *Chiquita Wilson, Kansas*

"I was really lucky to have had the opportunity to participate in the Worker Health Protection Program. I probably wouldn't have been alive without it. I'm truly happy the program exists and would recommend everyone take advantage of it." - *Gary Bacon, Kentucky*

"The facility and all the procedures were excellent. I was very satisfied with the doctor and very pleased with the NSSP office people also." - *Raymond Gantke, Louisiana*

"I appreciate my exam as a former worker and the assistance I received regarding the DOL program for beryllium sensitivity." - *C. Brock, Maine*

"I appreciate the NSSP expediting my exam and test results before I deployed to Iraq." - *NSSP participant, Maryland*

"I'm very pleased with the exam and the letter. The VA stepped right up after your letter, I was seen by specialists. I had 6 melanomas removed and am being followed up by a specialist for my abnormal liver function tests. The reason they are taking such good care of me is because of your result letter." - *Lawrence Edwards, Massachusetts*

"The exam process ran incredibly smoothly." - *Elaine Robbins, Michigan*

"After receiving the results from my exam, I went to my physician and was put on a pace maker. I am glad they referred me to my doctor for follow-up care." - *NSSP participant, Minnesota*

"I did a follow-up with my personal physician after the screening and was grateful that the NSSP notified me of the abnormal hemocult and lab test results." - *Walter Butler, Mississippi*

"I knew I'd been affected by some of the materials I came into contact with out there. So

when I received a pamphlet from my union about this program, I signed up right away."

- *Charles Reed, Missouri*

"I previously participated in the program when I lived in Nevada. I have moved to Montana, and I appreciate being able to be tested near my home and not having to travel to Nevada." - *NSSP participant, Montana*

"I wanted to thank you all and have a great day also. I am very happy with the way you handled this exam. I would welcome any future involvement in this program. Thank you again." - *Joel Linn, Nebraska*

"This is good for all Nevada Test Site workers to see how their health is doing, especially with problems in later years. Many not having insurance, this is beneficial for those not having out of pocket money. Just knowing that someone cares is the main thing and not forgotten." - *Oscar C. Foger, Nevada*

"I do not have a personal physician and appreciate the opportunity for medical screening as a former DOE worker." - *NSSP participant, New Hampshire*

"The NSSP was very organized, and it seemed like they had it all together. The medical examination process went very smoothly!" - *NSSP participant, New Jersey*

"The program sure helped me out. I got a physical and a tumor was found. I'm fortunate that I'm still around." - *Joseph Carter, New Mexico*

"My exam with the Worker Health Protection Program was very professional and thorough. Through the screening, it was determined I had beryllium sensitization, significant hearing loss, asbestosis, and Grave's disease as a result of my work as a plumber at Brookhaven National Laboratory. I would definitely recommend the program." - *Louis A. Graziano, New York*

"Thank you for caring." - *Gerald Hamilton, North Carolina*

"I was very happy with the clinic provided by the N SSP. The staff at the clinic were very friendly and helped me through the process regarding my examination." - *N SSP participant, North Dakota*

"I did not have any symptoms at the time my lung cancer was detected through the low-dose CT scan given by the Worker Health Protection Program. The surgeon who provided my treatment told me that the screening definitely saved my life, and I agree! I urge any worker who is eligible for this program to participate." - *Philip Creech, Ohio*

"From my exam findings I received an urgent notification from the N SSP physician. I had to have 2 liters of fluid drained from my left lung." - *N SSP participant, Oklahoma*

"I feel I received a good exam; I think this program is very helpful for workers' health needs." - *BTMed participant, Oregon*

"The program is very professional and organized. I was quite impressed with the whole process." - *Dian Schloder, Pennsylvania*

"The program was professional and organized. I appreciate the follow-up and helpfulness." - *N SSP participant, Rhode Island*

"The exam is remarkably thorough, and the information I received was very helpful. It definitely made me more aware of all the hazards that were out there." - *Gordon Rowe, South Carolina*

"I appreciate being informed within days of my exam that my chest x-ray was abnormal. I was able to share the x-ray and the results with my physician within a few days." - *N SSP participant, South Dakota*

"You may feel like you have never been sick and you may have never had any symptoms, but you may be a ticking time bomb. There is no doubt that I was heading for a catastrophic end when a cancerous growth was found on my thyroid and an aortic aneurism was detected through a low-dose CT scan provided by the Worker Health

Protection Program. It could not have been easier to participate, and there is no excuse not to, it could very well save your life." - *WHPP participant, Tennessee*

"The letter from Dr. Frank after my first screening exam stated that my kidney problems might be related to work exposures. This was dismissed by my primary care doctor. After my second screening, Dr. Frank's letter suggested pursuing compensation. Dr. Pinson was so helpful answering questions and providing information. When I took the site exposure information to my doctors, they agreed to sign a statement that my work exposures could have contributed to my kidney disease and COPD. One reason I have stuck with the process is because of the screening program and how they communicate with the former workers." - *Donald Lamar, Texas*

"The N SSP is a great program. I was treated well by everyone." - *N SSP participant, Utah*

"After discussing the benefits of the exam and how it is different from what my physician does for me, I decided to participate. The exam was very thorough." - *N SSP participant, Vermont*

"Do not recommend any changes, the N SSP works well as it is! I am still working with my physician regarding my abnormal x-ray and appreciate you notifying me of the abnormal x-ray." - *James Hurst, Virginia*

"The BTMed has assisted not only me but also many of my co-workers in understanding medical concerns we were not aware of. Knowing you have a problem and knowing what that problem is are two different things." - *Robert Hagans, Washington*

"Thank you for protecting the workers." - *Grover Sheets, West Virginia*

"The N SSP was very helpful and explained the beryllium testing process and CBD very well. They helped us understand why the testing was being offered and what our options were based upon the test results." - *Bernard Seul, Wisconsin*

"This was the best medical exam I have ever had!" - *N SSP participant, Wyoming*