

**Hearing on Department of Energy's
Management of Health and Safety Issues
At the Gaseous Diffusion Plants at
Oak Ridge, Tennessee, and Portsmouth Ohio**

**Committee on Governmental Affairs
United States Senate**

**Testimony of Steven B. Markowitz, M.D.
Center for the Biology of Natural Systems
Queens College
March 22, 2000**

My name is Steven Markowitz, MD. I am a physician specializing in occupational medicine, that is, identifying and reducing workplace exposures that impair or threaten human health. After receiving my undergraduate degree from Yale University and my medical degree from Columbia University, I completed five years of training in internal medicine and occupational medicine in New York City. I had the excellent fortune of training under the late Dr. Irving Selikoff, the noted asbestos researcher at Mount Sinai School of Medicine. I currently serve as Professor and Director of the Center for the Biology of Natural Systems of Queens College and Adjunct Professor of Mount Sinai School of Medicine, both in New York City.

My research interests center on the surveillance and identification of occupational and environmental disease. I recently completed a study commissioned by the National Institute for Occupational Safety and Health concerning the extent and costs of occupational disease and injury in the United States (Attachment A).

I thank you for the opportunity to speak before this committee today. I wish briefly to highlight two central problems in occupational health at the gaseous diffusion plants of the Department of Energy (DOE), at Oak Ridge, Tennessee; Portsmouth, Ohio; and Paducah, Kentucky. Furthermore, I will discuss our response to those problems through the initiation of the Worker Health Protection Program. I will start first with our response and then briefly elucidate the core problems.

A. The Worker Health Protection Program

In 1996, we initiated the Worker Health Protection Program (WHPP) at the three Department of Energy gaseous diffusion plants. It is a medical screening and education program established as collaboration between Queens College of the City University of New York and the Paper Allied-Industrial Chemical and Energy (PACE) International Union with the full cooperation of the employers at the plants. This program developed as a result of Congressional passage of Section 3162 of the National Reauthorization Defense Act of 1993. Section 3162 required that the Department of Energy to conduct a medical surveillance program for former DOE workers who a) were at significant risk for work-related illness as a result of prior occupational exposures at DOE facilities, and b) would benefit from early medical intervention to alter the course of those work-related illnesses. We received a contract from the DOE through a competitive, merit-based review process and conducted a careful needs assessment and planning process (Attachment B). We then instituted the Worker Health Protection Program at the three gaseous diffusion plants in Paducah, Portsmouth, and Oak Ridge as well as the Idaho National Engineering and Environmental Laboratory.

The goal of the Worker Health Protection Program is to detect selected work-related illnesses at an early stage when medical intervention can be helpful. At a broader level, the goal of our program is to help former DOE workers understand whether they have had exposures in the past that might threaten

their health and to ascertain whether, in fact, an injury has resulted from these exposures. For the first time, former workers of the DOE gaseous diffusion plants have the opportunity to obtain an independent, objective assessment of their health in relation to their prior workplace exposures by a physician who is expert in occupational medicine. We screen for chronic lung diseases, such as asbestosis and emphysema, hearing loss, and kidney and liver disease. We have not heretofore emphasized cancer screening, because the screening tests available to date for the cancers of concern have been inadequate, and because the gaseous diffusion plants have not historically been considered sites of high radiation exposure. We implement the program based on a common medical protocol through local clinical facilities in Oak Ridge, Portsmouth and Paducah. This is not a research activity, but a clinical service program, intended to be of direct and immediate benefit to participants.

In addition, we provide a two hour educational workshop during which former DOE workers have the opportunity to learn about past exposures and their possible impact on present health. These workshops are run by current and former DOE workers, because they have credibility and expertise. We also believe that a participatory model of education is in and of itself health-promoting. The direct and full involvement of current and former DOE workers in designing and conducting our program has been a key to its success.

A. Results of the Worker Health Protection Program

The single most important result of the Worker Health Protection Program to date is the outstanding response that we have received from former gaseous diffusion plant workers. Since beginning the screening program only 10 months ago, we have received nearly 2,000 telephone calls from former and current workers to our national toll-free number to request participation in the Worker Health Protection Program. We have medically evaluated approximately 1,000 former gaseous diffusion plant workers during the past 10 months. All of these participants volunteered for the screening program. We have not publicized our program, except for a single initial press conference in each community. We have not conducted any significant outreach, nor have we pro-actively invited individual workers for screening. Former gaseous diffusion plant workers evidently feel the need for this program, and they are calling us in droves to ask to participate.

Why have we received such a positive response? Without question, the newspaper coverage of the contamination of the Portsmouth and Paducah gaseous diffusion facilities by transuranic materials has helped. More fundamentally, though, the chord that we have struck relates to our mission. Workers in the Department of Energy complex want an answer to a simple set of questions: Have my years of work for the Department of Energy affected my health? Has my exposure to radiation and chemicals at the gaseous diffusion plant, which I performed as a service to my country, caused any illness or injury that I might have? If so, what can I do about this illness or injury? This is a simple yet powerful set of questions, and they deserve a truthful and appropriate response.

Our Worker Health Protection Program is providing such a response to these questions, albeit the response is only partial. Only preliminary screening results are available at present, because our data analysis system is not fully in place. We have seen limited rates of potentially work-related disease. Approximately 10% of participants show scarring of the chest that is consistent with significant occupational exposure to asbestos. 20% to 25% of former gaseous diffusion plant workers have chronic bronchitis and/or emphysema, to which their exposure to hydrofluoric acid and other powerful lung irritants in the gaseous diffusion process played a significant contributing role. Eight of the first 245 former Oak Ridge K-25 workers, or 3.3%, have confirmed beryllium sensitivity based on repeat lymphocyte proliferation testing. There is nearly universal hearing loss, mostly moderate or severe, which is hardly surprising, given high occupational noise levels at the gaseous diffusion plants. We have seen minimal rates of clinically significant kidney and liver disease among the workers tested to date, but most is readily explained by the presence of other disease such as hypertension or diabetes. We have also detected several cases of cancer, specifically of the lung and bladder.

In addition, the educational arm of our program has also been enormously successful. Our current and former worker educational coordinators have conducted 55 two hour workshops in 8 months, through which 780 former workers actively participated.

It is essential to understand that the Worker Health Protection Program is not a comprehensive screening program for all potentially work-related conditions of former DOE workers. Section 3162, which established the Former Worker Medical Surveillance Program, directed the Department of Energy to establish a medical screening program for potentially work-related health conditions for which early diagnosis and intervention would be beneficial. Despite medical advances in screening, however, many health problems are not amenable to screening on a population basis and do not necessarily lead to medically beneficial interventions. Neurologic symptoms, for example, are usually complex and require a careful in-depth diagnostic work-up to provide insight into the nature of the illness. Screening techniques for selected cancers, such as leukemia or lymphoma, have not yet been developed. Thus, for reasons of program design, limited budget, and current medical science, the Worker Health Protection Program does not address all health conditions about which former gaseous diffusion plant workers may be concerned.

There is an important caveat in interpreting our current program results. It is still relatively early in the project to aggregate and interpret results. The former gaseous diffusion plant worker population is large, numbering in the tens of thousands. The first screening program participants are a self-selected group and may not reflect the broader health or exposure experience of the former DOE workforce. They may be more or less ill than the former worker population as a whole. We expect to develop an improved sense of the health of this larger population as we screen additional workers in the coming years.

A. Enhancing the Worker Health Protection Program

Until now, the Worker Health Protection Program has been severely limited by available funding. During the 1999-2000 program year, the DOE provided sufficient funds to screen 1,200 former gaseous diffusion workers, or 400 at each site. Since we estimate that there are at least 15,000 living former gaseous diffusion plant workers who are eligible for our program, we would have needed over 12 years at the current rate of funding to screen each person one time. Clearly, this was inadequate and undermined the intent of Section 3162.

In August, 1999, in response to the newly acquired knowledge that gaseous diffusion plant workers were exposed to transuranic materials with associated heightened health risks, Dr. David Michaels, Assistant DOE Secretary for Environmental Health and Safety, invited the Worker Health Protection Program to rapidly expand our medical testing and education program.

We responded by proposing three significant improvements:

1. Adding current workers to the screening and education program,
2. Accelerating the pace of testing from 1,200 to 5,750 workers per year,
3. Initiating screening for the early detection of lung cancer through the use of a low-dose computerized tomography (CT) scanning protocol.

We requested a total of \$6.8 million dollars this year to conduct this program.

The Department of Energy has informed us that they will provide \$3.5 million dollars this year and has requested supplemental funds of \$3.3 million (fiscal year 2000) from Congress to fund the remainder of the program. My understanding is that these supplemental funds have been approved by the House Appropriations Committee and will be reviewed this week by the Senate Appropriations Committee

I would like to describe briefly the rationale for and numeric estimates of eligible workers that underlie the enhanced form of the Worker Health Protection Program. We also provide some insight into the ability of an accelerated program to meet the needs of workers, both current and former, at these three facilities in the coming years.

1. Adding Current Workers

Workers presently employed at the three gaseous diffusion plants do not currently receive the benefits of a medical screening and education program that is (a) specifically designed for early detection of work-related disease, and (b) provided by independent, credible physicians and other professionals with expertise in occupational medicine. They do not universally have access to such a program. Yet they clearly deserve it, based on their many years of service to the nation and the occupational risks that they have encountered during this service.

We estimate that the numbers of current workers at the gaseous diffusion plants are: 1,800 at Paducah; 2,000 at Portsmouth; and 1,700 at Oak Ridge K-25 (Table 1). During the next 12 months, we propose screening one-half of current workers, or 900 at Paducah; 1,000 at Portsmouth; and 875 at Oak Ridge K-25. This totals 2,750. Workers with the longest duration at the plant (especially from the mid-1950's to the mid-1970's), or who are deemed to have worked in the highest risk areas will be offered screening first. This program capacity, assuming full funding, will allow all current workers to be screened within two years.

2. Accelerating the Medical Screening of Former Workers

The Worker Health Protection Program currently screens former gaseous diffusion plant workers at the rate of 400 per year per plant. This rate of testing reflects only budget limitations, not real and expressed need. The estimated number of former workers at the three sites, over 15,000 (7,000+ at Oak Ridge K-25; 5,000+ at Portsmouth; and 3000+ at Paducah), is quite high, indeed much higher than the number of current workers. The above-proposed screening rate for current workers will outstrip the present rate for screening former workers. This is inequitable and contrary to our knowledge of risk, since former workers are at no less risk than are current workers for work-related health problems from having worked at gaseous diffusion plants. We therefore propose to speed up the rate of screening former workers to 1,000 per year at each of the three sites. This totals 3,000 workers per year (Table 1). Since we are currently budgeted to screen 400 per year per site, the requested funds will allow screening of 1,800 additional former workers in the next 12 months. This accelerated screening capacity will enable a higher proportion of former workers to be screened within a reasonable number of years.

Table 1

Estimated Numbers of Current and Former Workers at Gaseous Diffusion Plants:

Proposed Accelerated Medical Screening Schedule

Site

No. Current Workers (CW)

Proposed No. CW Screened in Next 12 months

Estimated No. Former Workers (FW) "At Risk"

Proposed No. FW Screened in Next 12 months

Total Proposed No. Screened in Next 12 months

Paducah

1800

900

7000+

1000*

1900

Portsmouth

2000

1000

5000+

1000*

2000

K-25

1700

850

3000+

1000*

1850

TOTAL

5500

2750

15000+

3000*

5750*

* We are currently funded to screen 400 of these 1,000 at each site, or 1200 workers in total.

3. Early Detection of Lung Cancer

Lung cancer is the most important specific cancer risk for workers at the gaseous diffusion plants of the Department of Energy. Occupational exposure to lung carcinogens at the gaseous diffusion plants, including asbestos, uranium, and possibly plutonium and beryllium produce excess risk of lung cancer. If early detection of lung cancer is achievable as a result of medical screening, its implementation should be accorded the highest priority among gaseous diffusion plant workers, especially for those at the highest risk of lung cancer. We do not currently offer such screening in the Worker Health Protection Program. In the enhanced program, we will offer such screening.

An effective and feasible method for the early detection of lung cancer now exists. The *Early Lung Cancer Action Project*, undertaken at Cornell University and New York University Medical Schools, decisively and affirmatively answers the question of whether computerized axial tomography (CT) scans of the chest can identify small malignant lung nodules at a sufficiently early stage that surgery can successfully remove the cancer with the expectation of cure. Henschke and colleagues, who undertook the *Early Lung Cancer Action Project*, published the results of their landmark study in Lancet on July 10, 1999.

Undertaken with the support of the National Institutes of Health, this study began in the early 1990's. It enrolled 1,000 people, aged 60 or over, who had a tobacco use history and were sufficiently healthy to undergo chest surgery, if required. All participants underwent a chest x-ray and a low-dose rapid chest CT scan. Lung nodules were identified, and the affected participants were subject to a protocol of conventional chest CT scan and, if relevant, diagnostic work-up.

The study results were remarkable. Low dose chest CT scans detected lung cancer in 27 people (2.7%), or in 1 of every 37 study participants. By contrast, malignant lung nodules were seen on conventional chest x-ray in only 7 participants (0.7%). Thus, low dose CT scans detected nearly 4 times as many lung cancers as did routine chest radiography.

More importantly, low dose CT scanning nearly always detected lung cancers at an early stage that is usually highly curable. Of the 27 CT-detected cancers, 26 (96%) were resectable, and 23 (85%) were in the initial stage (Stage I) of lung cancer. By contrast, only about one-half, or 4 of the 7 (57%) malignant nodules identified by the chest x-ray were Stage I disease. We know that Stage I lung cancer normally has a 70% to 80% 5 year survival compared to an overall 5 year survival of 12% for all cases of lung cancer combined.

In addition, only 1 study participant underwent a biopsy that was specifically recommended by the study protocol and had benign disease. Thus, low-dose CT scanning, when followed by a proper work-up, will result in few people needlessly undergoing the pain and expense of biopsy for benign nodules. The authors conclude: "Low-dose CT can greatly improve the likelihood of detection of small non-calcified nodules, and thus of lung cancer at an earlier and potentially more curable stage."

The results of this study have been confirmed by other similar studies. Investigators undertaking these studies recently met at the *Second International Conference on Screening for Lung Cancer* at Cornell University Medical School in New York on February 25-27, 2000 and presented current screening program data. The seven studies reviewed were undertaken in 4 different countries and have screened over 13,000 people for lung cancer. Approximately 75% of the cancers identified through screening were Stage I cancers and, therefore, amenable to surgery and presumably cure.

The results of the *Early Lung Cancer Action Project* and similar studies, in combination with current knowledge about the biology, radiology, and epidemiology of lung cancer, are sufficiently convincing to justify the inclusion of low-dose chest CT scanning and an associated follow-up protocol in the medical screening program for gaseous diffusion plant workers. The new lung cancer screening protocol will be offered to gaseous diffusion plant workers who are at highest risk for lung cancer as a result of the occupational exposures to asbestos and uranium and possibly plutonium and beryllium.

We will offer such an early lung cancer detection program to screening participants of the Worker Health Protection Program at the gaseous diffusion plants of the Department of Energy. We will lease a state of the art CT scanner placed in a mobile unit and transport it between Portsmouth, Oak Ridge, and Paducah on a regular basis. The exact number of people we will be able to scan depends on the level of funding that we receive. This component will be offered to individuals, both current and former workers, who meet pre-determined criteria for lung cancer risk, as constituted by age, duration and likelihood of exposure to occupational lung carcinogens, and history of cigarette smoking. This program component will be integrated into the existing protocol of the Worker Health Protection Program and, thereby, achieve considerable efficiency and costs savings, especially in participant recruitment, baseline testing, follow-up, and overall program administration.

Medical advances typically benefit metropolitan areas of the United States first, since large cities are often the home to the leading medical schools and major medical centers. Lung cancer screening is being rapidly established in New York, San Francisco, and Chicago. Later and perhaps slowly, it will diffuse to rural areas, where DOE facilities are typically located. Through integrating the proposed lung cancer screening method into our Worker Health Protection Program, we have the opportunity to reverse this pattern and make Paducah, Portsmouth and Oak Ridge among the first communities in the nation to receive the potentially enormous benefits of this life-saving screening technique. The United States Congress and the Department of Energy will accrue enormous gratitude from the current and former gaseous diffusion plant workers as a result of literally saving the lives of a significant number of such workers through supporting lung cancer screening and the Worker Health Protection Program.

A. Lack of Access to Occupational Health Care: A Core Problem for Gaseous Diffusion

Plant Workers

The first core problem in occupational health at the gaseous diffusion plants of the Department of Energy problem is the lack of access of former and current DOE workers to objective, expert, independent care in occupational medicine. When any of us develop a heart arrhythmia, a neurologic syndrome, or cancer, we fully expect to see a physician who will bestow upon us his or her candid, specific, expert opinion that is the distillation of many years of specialized training and clinical experience. We further expect that this opinion will be unencumbered by any conflict of interest of the physician, such as a financial interest in a particular medical tool or laboratory, which would influence the opinion of that physician, sometimes to our detriment. These conditions frame a basic standard of care that we have come to expect in our country.

These conditions, however, do not currently exist, and indeed have never existed, for the workers at the three gaseous diffusion plants of the Department of Energy, or probably throughout much of the DOE complex. Such workers have never as a rule had an opportunity for this simple encounter: to

have a potentially work-related illness evaluated by a physician who has the knowledge to determine whether the illness is work-related and is free to make that determination without concern about ramifications to the employer. Instead, workers in Paducah, Portsmouth, and Oak Ridge raise their health concerns with their primary care providers who do not ask about or know about occupational hazards. Or their health concerns arise with physicians who are employed by or under the influence of DOE contractors and thereby have dual loyalties. It is little wonder, therefore, that workers, who are very proud of the service that they have performed for the past 5 decades, nonetheless feel that they have been treated unfairly with reference to occupational illness.

Two immediate consequences result from this failure to provide a basic standard of occupational health care. First, occupational illness is not properly diagnosed and treated. This harms the individual. It also harms co-workers and future workers, because it prevents the return of vital information to the workplace, information that could be used to prevent other workers from becoming ill. The second consequence is that workers and their families will form their own opinions about whether the workplace is the source of their ills. In the absence of external expert knowledge, workers will use their own expertise to decide about the work-relatedness of their problems. Often they will be correct. Indeed, the history of occupational medicine is replete with examples of occupational diseases first identified by workers and later confirmed by physicians. Sometimes, however, workers will not be correct in attributing their symptoms to the workplace. The result of this error is that the DOE facility may be falsely targeted as the source of a spectrum of diverse and quite unrelated illnesses. We cannot blame people who make this judgment: they do so in a vacuum. The underlying problem is the structural lack of a system that can authoritatively and credibly confirm or refute workers' suspicions about workplace exposures as the source of their ill health.

A. Lack of Accurate Exposure Characterization: A Core Problem for Gaseous Diffusion Plant Workers

Let me turn to a second core problem in occupational health at the gaseous diffusion plants: the lack of proper, accurate information about exposures that have occurred at the gaseous diffusion plants over the past four or five decades. Ultimately, in occupational medicine, we are called upon to make a judgment about whether a health problem of a particular individual is work-related. The equation that rules this decision is quite simple. On the one side is information about the exposure or workplace factor. On the other side of the equation is the delineation of the illness. The latter is usually straightforward given the armamentarium of medical tools that we now have to conduct medical investigations.

The weak link in this equation is often the level and quality of knowledge about the workplace exposures. Chronic occupational illness today results from exposures that occurred in the past. We are therefore subject to whatever actions that people who were responsible for the workplace did or did not take to measure those exposures. In 1996-1997, as part of the Worker Health Protection Program, we conducted a one year needs assessment of workplace exposures and the rationale for medical screening at the gaseous diffusion plants (Executive Summary in Attachment B). We concluded, as have others, that workplace exposures have been poorly documented in general at the gaseous diffusion plants, either through failure to measure properly, or through failure to document measurements in a manner that can be properly interpreted. This applies to radiation measurements, but even more so to assessment of hazardous chemical agents such as asbestos, silica, and beryllium.

One important consequence of this failure is that it makes the decision-making about causality between workplace exposures and health problems that occur many years later difficult and complex. When a gaseous diffusion plant worker, or more likely, retiree, develops lung cancer, the likelihood that his prior occupational exposures to asbestos contributed to the development of the lung cancer depends very much on the intensity, duration, and timing of his exposures to asbestos. If information on this exposure does not exist, the amount of judgment that must be used to decide on work-relatedness of that lung cancer increases. And, so too does room for disagreement in formulating that judgment.

A cynical means to "eliminate" occupational disease now becomes apparent. First, on a prospective basis, fail to document exposures in a thorough, reliable, and interpretable manner. Second, overlook communicating meaningful information about those exposures to workers. Finally, decades later, when chronic occupational diseases of long latency appear, claim retrospectively that insufficient data on exposure preclude proper assessment of the causal role of such exposures in the development of the extant illnesses. Note that the premature deaths and diseases suffered by workers do not disappear under such a scheme. But the occupational attribution vanishes.

Let me provide an example relevant to the "discovery" of plutonium, neptunium, and other transuranics at the Paducah gaseous diffusion plant. The same lesson applies to the Oak Ridge and Portsmouth gaseous diffusion plants. A memorandum from 1960 has been recently discovered, entitled "*Neptunium²³⁷ Contamination Problem, Paducah, Kentucky, February 4, 1960.*" (Attachment C) It was written by Dr. C. L. Dunham, a physician who directed the Division of Biology and Medicine of the Atomic Energy Commission (AEC), the predecessor to DOE, and a physician colleague from the same Division. Dr. Dunham was therefore the chief physician of the AEC and presumably took the same Hippocratic Oath that every physician takes upon entering the profession. In this memo, they discuss in some detail how neptunium arrives in Paducah, how it deposits on the inner barrier tubes that are the central component of the gaseous diffusion process, and how workers are exposed to the neptunium. They then refer to urine neptunium levels taken in some workers. These physicians further specify that up to 300 Paducah workers should be tested but that, referring to management personnel "they hesitate to proceed to intensive studies because of the union's use of this as an excuse for hazard pay (p. 3)." Dr. Dunham and colleague further argue in favor of the need to obtain post mortem tissue samples, but state that this was difficult due to "unfavorable public relations." Dr. Dunham and colleague conclude: "Thus, it appears that Paducah has a neptunium problem but we don't have the data to tell them how serious it is." There is a striking absence of any formulation of a plan of how to collect those data and how to reduce neptunium exposure at Paducah.

And now, forty years later, we are asked to judge how significant that exposure might have been, who was the population at risk, and whether a retiree's cancer was caused by that unquantified and, presumably, uninvestigated exposure to neptunium, plutonium, and other materials. And at the end of the current spate of urgent investigations, news reports and hearings, there will be some who will conclude ruefully that "we simply do not have the data to tell them how serious it is" and will thereby be paralyzed by this ignorance. I cannot think of a better way to make occupational disease "disappear."

A. Conclusion

Clearly, our present obligations to workers who built and maintained our nuclear weapons stockpile require that we move beyond paralysis. Towards this end, we have developed a concrete plan to enhance the Worker Health Protection Program. The Worker Health Protection Program already in place will be expanded next month as an immediate response to the need of its gaseous diffusion plant workers for appropriate and timely medical screening for work-related disease. For \$6.8 million dollars this year, the scope and coverage of the medical testing and education program can be significantly expanded in a well-targeted and clearly justified manner. With complete funding, we will provide targeted screening for 5,750 current and former gaseous diffusion plant workers. We will bring the most important advance in cancer screening since the advent of mammography. And this will be accomplished at a fraction of the estimated \$1 billion dollar cost that it will take to clean-up the environment at the Paducah gaseous diffusion plant site alone.

In conclusion, our program expansion will allow Congress and the Department of Energy to address the concrete and heightened concerns of former and current gaseous diffusion plant workers. Moreover, and most importantly, the advent of a radiographic screening technique for lung cancer will allow Congress and the Department of Energy, through an enhanced Worker Health Protection Program, to save lives.

