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Dr. John P. Holdren
Assistant to the President for Science and Technology

Dear Dr. Holdren:

We, a number of University of California, San Francisco faculty, are writing—see attached memo--to call your attention to our concerns about the potential serious health risks of the recently adopted whole body back scatter X-ray airport security scanners. This is an urgent situation as these X-ray scanners are rapidly being implemented as a primary screening step for all air travel passengers.

By way of introduction one of us (John Sedat) met you recently when he and his wife Dr. Elizabeth Blackburn, a 2009 Nobel Laureate, talked with President Obama last December. Dr. Sedat is Professor Emeritus in Biochemistry and Biophysics at the University of California, San Francisco, with expertise in imaging. He is also a member of the National Academy of Sciences. The other cosigners include Dr. Marc Shuman, an internationally well known and respected cancer expert and UCSF professor, as well as Drs. David Agard and Robert Stroud, who are UCSF Professors, X-ray crystallographers, imaging experts and NAS members.

Sincerely yours,

John Sedat, Ph.D

David Agard , Ph.D.

Marc Shuman, M.D.

Robert Stroud, PhD

LETTER OF CONCERN

We are writing to call your attention to serious concerns about the potential health risks of the recently adopted whole body backscatter X-ray airport security scanners. This is an urgent situation as these X-ray scanners are rapidly being implemented as a primary screening step for all air travel passengers.

Our overriding concern is the extent to which the safety of this scanning device has been adequately demonstrated. This can only be determined by a meeting of an impartial panel of experts that would include medical physicists and radiation biologists at which all of the available relevant data is reviewed.

An important consideration is that a large fraction of the population will be subject to the new X-ray scanners and be at potential risk, as discussed below. This raises a number of 'red flags'. Can we have an urgent second independent evaluation?

The Red Flags

The physics of these X-rays is very telling: the X-rays are Compton-Scattering off outer molecule bonding electrons and thus inelastic (likely breaking bonds).

Unlike other scanners, these new devices operate at relatively low beam energies (28keV). The majority of their energy is delivered to the skin and the underlying tissue. Thus, while the dose would be safe if it were distributed throughout the volume of the entire body, the dose to the skin may be dangerously high.

The X-ray dose from these devices has often been compared in the media to the cosmic ray exposure inherent to airplane travel or that of a chest X-ray. However, this comparison is very misleading: both the air travel cosmic ray exposure and chest X-rays have much higher X-ray energies and the health consequences are appropriately understood in terms of the whole body volume dose. In contrast, these new airport scanners are largely depositing their energy into the skin and immediately adjacent tissue, and since this is such a small fraction of body weight/vol, possibly by one to two orders of magnitude, the real dose to the skin is now high.

In addition, it appears that real independent safety data do not exist. A search, ultimately finding top FDA radiation physics staff, suggests that the relevant radiation quantity, the Flux [photons per unit area and time (because this is a scanning device)] has not been characterized. Instead an indirect test (Air Kerma) was made that emphasized the whole body exposure value, and thus it appears that the danger is low when compared to cosmic rays during airplane travel and a chest X-ray dose.

In summary, if the key data (flux-integrated photons per unit values) were available, it would be straightforward to accurately model the dose being deposited in the skin and

adjacent tissues using available computer codes, which would resolve the potential concerns over radiation damage.

Our colleagues at UCSF, dermatologists and cancer experts, raise specific important concerns:

- A) The large population of older travelers, >65 years of age, is particularly at risk from the mutagenic effects of the X-rays based on the known biology of melanocyte aging.

- B) A fraction of the female population is especially sensitive to mutagenesis-provoking radiation leading to breast cancer. Notably, because these women, who have defects in DNA repair mechanisms, are particularly prone to cancer, X-ray mammograms are not performed on them. The dose to breast tissue beneath the skin represents a similar risk.

- C) Blood (white blood cells) perfusing the skin is also at risk.

- D) The population of immunocompromised individuals--HIV and cancer patients (see above) is likely to be at risk for cancer induction by the high skin dose.

- E) The risk of radiation emission to children and adolescents does not appear to have been fully evaluated.

- F) The policy towards pregnant women needs to be defined once the theoretical risks to the fetus are determined.

- G) Because of the proximity of the testicles to skin, this tissue is at risk for sperm mutagenesis.

- H) Have the effects of the radiation on the cornea and thymus been determined?

Moreover, there are a number of 'red flags' related to the hardware itself. Because this device can scan a human in a few seconds, the X-ray beam is very intense. Any glitch in power at any point in the hardware (or more importantly in software) that stops the device could cause an intense radiation dose to a single spot on the skin. Who will oversee problems with overall dose after repair or software problems? The TSA is already complaining about resolution limitations; who will keep the manufacturers and/or TSA from just raising the dose, an easy way to improve signal-to-noise and get higher resolution? Lastly, given the recent incident (on December 25th), how do we know whether the manufacturer or TSA, seeking higher resolution, will scan the groin area more slowly leading to a much higher total dose?

After review of the available data we have already obtained, we suggest that additional critical information be obtained, with the goal to minimize the potential health risks of

total body scanning. One can study the relevant X-ray dose effects with modern molecular tools. Once a small team of appropriate experts is assembled, an experimental plan can be designed and implemented with the objective of obtaining information relevant to our concerns expressed above, with attention paid to completing the information gathering and formulating recommendations in a timely fashion.

We would like to put our current concerns into perspective. As longstanding UCSF scientists and physicians, we have witnessed critical errors in decisions that have seriously affected the health of thousands of people in the United States. These unfortunate errors were made because of the failure to recognize potential adverse outcomes of decisions made at the federal level. Crises create a sense of urgency that frequently leads to hasty decisions where unintended consequences are not recognized. Examples include the failure of the CDC to recognize the risk of blood transfusions in the early stages of the AIDS epidemic, approval of drugs and devices by the FDA without sufficient review, and improper standards set by the EPA, to name a few. Similarly, there has not been sufficient review of the intermediate and long-term effects of radiation exposure associated with airport scanners. There is good reason to believe that these scanners will increase the risk of cancer to children and other vulnerable populations. We are unanimous in believing that the potential health consequences need to be rigorously studied before these scanners are adopted. Modifications that reduce radiation exposure need to be explored as soon as possible.

In summary we urge you to empower an impartial panel of experts to reevaluate the potential health issues we have raised before there are irrevocable long-term consequences to the health of our country. These negative effects may on balance far outweigh the potential benefit of increased detection of terrorists.