CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

February 1999

QUESTIONS & ANSWERS
SAVANNAH RIVER SITE (SRS)
Phase II of the SRS Dose Reconstruction Project

SRS BACKGROUND

Q WHAT DID THE SAVANNAH RIVER SITE (SRS) DO?

A The Savannah River Site produced mainly tritium and plutonium for national defense and some civilian purposes. It operated from 1954-1992.

Q HOW DID THE SRS FIT INTO THE PRODUCTION OF NUCLEAR WEAPONS BY THE UNITED STATES?

A It received reactor fuel produced at other facilities in the country and operated reactors to produce plutonium and tritium. It shipped the plutonium and tritium to other sites that manufactured the nuclear weapon parts and assembled the completed bombs.

Q WHAT IS TRITIUM?

A Tritium (^{3}H) is a radioactive form of hydrogen that has 2 neutrons in addition to the proton of regular hydrogen, so the total mass is tripled (atomic mass = 3).

Q WHAT IS PLUTONIUM?

A Plutonium (Pu) is a silvery, white radioactive metal used to make nuclear weapons. Its most important form is plutonium-239, which is made by irradiating uranium-238 with neutrons. Plutonium-239 decays by emitting alpha particles (2 protons and 2 electrons) and has a 24,065-year half-life (the amount of time that it takes for a radionuclide to lose half of it's activity)

Q ARE THERE STILL RADIONUCLIDES BEING RELEASED FROM THE PLANT?

A Yes. The five production reactors that were used to make plutonium and tritium have been shut down, but some processing and support waste management, and environmental remediation facilities are still operating. These changes have reduced the amount of releases from the plant from previous levels. Other agencies, for example, the Agency for Toxic Substances and Disease Registry (ATSDR), are currently evaluating both present and potential exposure due to clean up efforts.

Q: AM I EXPOSED TO RADIATION OTHER THAN THAT FROM THE SAVANNAH RIVER SITE?

A Radiation is natural part of our environment. The air, soil, and water all emit natural radiation. Small amounts of radioactive material are present in all living things. Cosmic radiation, which originates from the sun and from sources outside our solar system, bombards the earth continuously. The amount of natural radiation a person receives varies from place to place in the United States. However, the average person in the U.S. receives a dose of about 300 millirem per year from natural radiation. On the average, about two-thirds of this dose is due to radon and its decay products. In addition to naturally occurring radiation, a person may be exposed to radiation as a result of certain medical procedures. For example, an average diagnostic x-ray of the upper gastrointestinal system in the U.S. results of a dose of approximately 244 millirem. Persons may also be exposed to radioactive fallout from past nuclear weapons tests.

BACKGROUND OF CDC ACTIVITIES AT SRS

Q: WHAT PROMPTED THIS STUDY?

A In December 1990, the Secretaries of the Department of Energy (DOE) and the Department of Health and Human Services (DHHS) signed a Memorandum of Understanding transferring to DHHS the responsibility for conducting and managing epidemiologic research (which includes dose reconstruction) at designated DOE facilities, including SRS, and for studying other energy-related health issues. In turn, DHHS made the Centers for Disease Control and Prevention (CDC) its lead agency for these activities.

Q WHO SPONSORED THIS STUDY?

A The Centers for Disease Control and Prevention (CDC) sponsored this study and contracted Phase II of this study to the Radiological Assessments Corporation (RAC).

Q WHAT IS A DOSE RECONSTRUCTION?

A Dose Reconstruction is a study process in which historical information is used to estimate the amounts of toxic materials released from a facility, how the materials could have moved offsite, the exposure of the public to those materials, and the resulting doses. Dose reconstruction is done in phases, including a search for records at SRS and other areas, an estimate of the amount of radioactive materials and chemicals released off site from SRS from 1954-1992, how the radionuclides and chemicals move through the environment (pathway analysis), and an estimate off site doses to the exposed population. Dose

reconstruction involves past releases, not present or future releases. The results of a dose reconstruction will be used to estimate the potential health risks of the exposed population and for other health studies. The releases evaluated in this Savannah River Site dose reconstruction occurred between 1954-1992.

Q: WHAT IS THE GOAL OF THE SRS DOSE RECONSTRUCTION PROJECT?

A To estimate the offsite doses to people exposed to radioactive materials and chemicals released to the environment from the SRS from 1954-1992.

Q: WHAT IS THE GOAL OF PHASE II OF THE SRS DOSE RECONSTRUCTION PROJECT?

A To estimate the source term or the amount of radioactive materials and chemicals released offsite from the SRS from 1954-1992.

Q WHAT IS THE SOURCE TERM?

A Source term refers to the quantity, the chemical and physical form, and the time period of contaminants released to the environment from a facility.

Q WHY ARE YOU FOCUSING ON 1954-1992?

A Although the site began doing environmental monitoring as early as 1951 to establish background measurements for radionuclides, the first reactor did not begin operation until 1954 and the last reactor shut down in 1988 with the exception a brief startup of one reactor in 1991. Therefore the measurement of releases from the site due to tritium and plutonium production did not begin until 1954.

Q THIS IS PHASE II OF CDC'S STUDY. WHAT ARE THE OTHER PHASES?

A Phase I of the Dose Reconstruction was a search for historical records at SRS and other areas that would assist in determining what materials were released from the site. This Phase was completed in June of 1995. Phase II (this Phase) estimated the amount of radioactive materials and chemicals released off site from SRS from 1954-1992. Future phases will assess how the radionuclides and chemicals moved through the environment (pathway analysis) and estimate doses to the exposed population.

ABOUT THE SRS PHASE II STUDY

Q: WHAT PATHWAYS OF RELEASE WERE CONSIDERED?

A Airborne and surface water.

Q WHY DIDN'T THE STUDY INCLUDE GROUNDWATER?

A The issue of contaminated groundwater has been intensely investigated by the site and numerous state and federal agencies through a groundwater monitoring system. Approximately 200 groundwater monitoring wells are now located on and around the site. The SRS has identified a 330 million-gallon plum of contaminated groundwater. However, studies indicate that the plume of contaminated groundwater has not moved offsite. The Department of Energy is currently cleaning up this plume of contaminated groundwater.

Q: WERE SOURCE TERM ESTIMATES ESTIMATED FOR ALL RADIONUCLIDES AND CHEMICALS? IF NOT, WHY?

A No. The study reviewed documents about all radionuclides and chemicals potentially released, however not all were selected for source term estimation. A screening process was used to focus the efforts and resources available on the radionuclides and chemicals most important to public health. Screening is a method of prioritizing radionuclides and chemicals of greatest significance by identifying potentially important contaminants and exposure pathways.

If the site did not produce or use a radionuclide or chemical in sufficient quantity, or if the chemical is not likely to be hazardous to people, then that material was not included in the source term estimation. The Phase II report describes the details of the screening techniques used.

Q: FOR WHICH RADIONUCLIDES DID YOU ESTIMATE SOURCE TERMS?

A We estimated airborne radionuclide releases for americium-241, argon-41, tritium, iodine-129, iodine-131, plutonium-238, plutonium-239, and plutonium-240. (See the Community Summary for the estimates)

We estimated waterborne radionuclide releases for cesium-137, cobalt-60, tritium, iodine-131, phosphorous-32, strontium-90, sulfur-35, zinc-65, uranium-235, and uranium-238. (See the Community Summary for the estimates)

Q: FOR WHICH CHEMICALS DID YOU ESTIMATE SOURCE TERMS?

A We estimated a chemical source term for benzene, manganese, nickel, nitric acid, coal ash, nitrogen dioxide, sulfur dioxide, arsenic, beryllium, cadmium, chromium, trichloroethylene, tetrachloroethylene, trichloroethane for releases to air. We estimated a chemical source term for surface water releases for cadmium, hydrogen sulfide, lead, mercury, nickel and nitrate. (See the report for the estimates)

QUESTIONS ABOUT THE PHASE II RESULTS
(See the Community Summary for a summary of the results)

Q: HOW HAVE THESE RADIONUCLIDE AND CHEMICAL RELEASES AFFECTED THE HEALTH OF THE COMMUNITIES NEARBY?

A We cannot answer this question. The first two phases of the Savannah River Site Dose Reconstruction project estimated the quantity and the types of chemicals and radionuclides released between 1954-1992. Future phases of the project will result in an estimate of potential health risks that may have resulted from these releases.

Q WHY DON'T YOU JUST REPORT THE MEASUREMENTS OF WHAT WAS RELEASED FROM THE SITE?

A Measurement data are not available for every release. Therefore, some releases had to be estimated. The uncertainty in the estimate of these releases was accounted for by giving a range of release values.

Q WHY ARE YOU PROVIDING A RANGE OF NUMBERS INSTEAD OF JUST ONE NUMBER FOR AN ESTIMATE?

A Because estimates are model-based, information used in this analysis may be incomplete, and simplifying assumptions were made in estimating releases. The ranges represent the scientific uncertainty in the estimates due to assumptions made for simplification or due to incomplete information.

Q: WHAT IS UNCERTAINTY ANALYSIS?

A Uncertainty analysis is a way to look at the effect of missing information on the study results. For example, in assessing the source term at the Savannah River Site there is uncertainty in the measurements of the releases during the early years of operation when they were using older measurement equipment.

Q: WHAT IS MEANT BY DISTRIBUTIONS IN RADIATION RELEASES?

A The distribution of releases is the range of possible values for the amount of material that could have been released given the uncertainties associated with making these estimates.

Q WHAT IS A MEDIAN ESTIMATE?

A The median is defined as the central point of a distribution. Half of the values are larger than the median value and half are smaller. This is also referred to as the 50th percentile. It divides the data (approximately) into halves.

Q WHAT DOES THE 5TH TO 95TH % UNCERTAINTY RANGE MEAN?

A Because we did not have exact measurement of the amount of material released from the SRS, we had to use the best available science to estimate these amounts. Therefore, we have some degree of uncertainty about the true amount of radioactive materials and chemicals that were released from the site. However, we are 90 percent certain that the true but unknown release values fall between the numbers we refer to in the report as the 5^{th} and 95^{th} percent uncertainty range.

Q: WHAT IS THE DIFFERENCE BETWEEN THE RESULTS OF THIS REPORT AND THE RESULTS FROM PHASE I?

A Phase I produced a database containing those documents that were examined and are relevant to the study. The Phase II results used the information provided in Phase I to estimate the source term for radionuclides and chemicals.

Q THIS IS A DRAFT REPORT. WHEN WILL WE RECEIVE THE FINAL REPORT?

A We plan to publish the final report later in 1999 after this draft report has undergone review by CDC staff, other scientists, members of the SRS Health Effects Subcommittee, and other interested members of the community.

FUTURE WORK

Q: WHAT IS THE NEXT STEP IN THE PROJECT?

A The next step in this dose reconstruction is conduct further screening analyses using the results from Phase II and SRS site-specific exposure pathway information for both chemicals and radionuclides.

Q WHAT IS THE DIFFERENCE BETWEEN THE SCREENING THAT WAS DONE TO SELECT RADIONUCLIDES OF CONCERN IN THIS PHASE OF THE PROJECT AND THE NEXT STEP IN THE PROJECT?

A The screening conducted in Phases I and II of the project was done to select which radionuclides should be the focus for the source term estimation. This screening was done using values supplied in the screening model guidelines for parameters such as breathing rate and food consumption used in the screening models. The screening in the next phase will be done using the estimated source term from Phase II and SRS site-specific parameters values in the screening models to select which radionuclides and chemicals should be the focus for a detailed pathway analysis and dose estimation in Phases IV and V of the dose reconstruction.

Q: HOW CAN WE INFLUENCE WHAT KINDS OF STUDIES ARE DONE NEXT?

A The Savannah River Site Health Effects Subcommittee (SRSHES) advises CDC and ATSDR on the community's perspective of work that is needed for the Savannah River Site. Subcommittee meetings provide a forum for community members to share their concerns with subcommittee, and CDC and ATSDR. Each year, CDC develops a research agenda that provides the framework for funding new projects. Advice obtained from SRSHES is taken into account in the development of this agenda and the funding of the new work

Q WHAT IS THE HEALTH EFFECTS SUBCOMMITTEE?

A An advisory committee comprised of citizens diverse according to geography, ethnicity and special interest. This committee is governed by the Federal Advisory Committee Act and focuses on Health Effects of Workers and the Community.

Q HOW DOES THIS COMPARE TO THE OTHER NUCLEAR WEAPONS PRODUCTION SITES THAT CDC IS INVESTIGATING?

A That's a tough question to answer. There are only a few sites where source term estimates have been completed. All of the sites serve different purposes in the nuclear weapons complex and each of these studies was therefore very different in terms of the type of radioactive material released. Different sites performed different duties in the

nuclear weapons production complex. Therefore, different radionuclides and chemicals were released from different sites making any comparisons very difficult. However, I-131 was released at Hanford as well as at SRS. For example, the Hanford I-131 releases are estimated to be 13 times larger than the amount of I-131 released at SRS as reported in this draft Phase II Report.

ANNOUNCEMENTS/NOTIFICATION

Q DOES THE DEPARTMENT OF ENERGY KNOW ABOUT THESE RESULTS? WHEN DID YOU TELL THEM?

A We briefed key DOE officials the day before the public meeting.

Q HAVE YOU TOLD THE STATE HEALTH DEPARTMENT ABOUT THESE RESULTS?

A The State Health Department is represented on the Health Effects Subcommittee and is being informed as a member of this committee.

Q WILL THE PUBLIC GET AN OPPORTUNITY TO COMMENT ON THIS REPORT? WILL OUR COMMENTS REALLY MAKE A DIFFERENCE?

A Yes. We are asking for public review and comment on this draft report (Source Term Calculation and Ingestion Pathway Data Retrieval Evaluation of Materials Released from the Savannah River Site). Your review and comments will help us ensure that we have captured and addressed community health concerns and questions-- in the results provided in this document and also in our planning for future work at the Savannah River Site. All public and scientific reviews and comments will be considered in the final version of this report, due out by fall 1999. All comments are due to CDC by May 1, 1999. We will take your comments in any form-- in writing (by mail, facsimile or electronic mail) or by telephone. All public comments may be sent to Mr. Paul Renard at the Centers for Disease Control and Prevention, Mail Stop F-35, 4770 Buford Highway, NE, Atlanta, GA 30341-3714, (770) 488-7040 (telephone), (770) 488-7044 (facsimile), pgr1@cdc.gov (e-mail)

Public involvement is critical to this project-- as it is to all CDC's work in the community surrounding the Savannah River Site. We encourage your input and attendance at the quarterly meetings of the Savannah River Site Health Effects Subcommittee, public meetings and through telephone calls. All public meetings are held in the local area near the Savannah River Site and are announced through public and CDC's Savannah River Site mailing list (to get on the mailing list, contact Mr. Paul Renard at the address shown at the top of this page.) Please feel free to ask questions or provide public comment at

any time on any activity we are conducting or plan to conduct in the Savannah River Site area.

Q WILL THE DRAFT REPORT BE POSTED ON THE INTERNET?

A CDC will post the 1400 page report on the Internet in late spring. ***Copies of the community summary and the fact sheets are available on the Internet at http:/www.cdc.gov/nceh.*** Copies of all materials can be requested from CDC from Mr. Paul Renard at the Centers for Disease Control and Prevention, Mail Stop F-35, 4770 Buford Highway, NE, Atlanta, GA 30341-3714, (770) 488-7040 (telephone), (770) 488-7044 (facsimile), pgr1@cdc.gov (e-mail).