Occupational Energy Research Program Ongoing Research

Public Meeting
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Outline

- Review of OERP research goals
- Overview of ongoing NIOSH epidemiologic studies
- Overview of HEDS Database
- NIOSH Chronic Lymphocytic Leukemia (CLL) research initiative

Epidemiologic Research Goals

- **Evaluate possible relationships** between workplace **exposures** and **injury or disease** using the best available methodologies
- **Analyze combined populations** to assess whether certain rare cancers are related to past occupational exposures
- **Examine** the relationships of **mixed exposures** and worker health
- **Provide** research findings which enhance the **understanding** of the effects of **low-level protracted exposure** to ionizing radiation in DoE workers and others

Exposure Assessment Research Goals

- **Improve exposure assessment methods** to reduce uncertainty in mortality and morbidity studies
- **Characterize** the **combined exposures** experienced by Department of Energy workers for use in epidemiologic analyses
- **Emphasize quantitative** (vs. qualitative) **relationships** between exposure and health outcomes
- **Evaluate** the **quality and validity** of the available worker exposure **data**

Ongoing NIOSH Studies

Title	*Completion*
Leukemia and ionizing radiation multi-site case-control study (LANL, SRS, ORNL, Hanford, PNS)	Early 2006
Chemical laboratory workers cohort mortality study (ORNL, Y12, K25, SRS)	Early 2006
Portsmouth Naval Shipyard (PNS) workers lung cancer case-control study	Early 2006
K-25 Site workers multiple myeloma case-control study	2007
Fernald workers cohort mortality study	2007

NIOSH Research Status

Title	Exposure Assessment	Epi Analyses	Publish Results
Leukemia and ionizing radiation multi-site case-control study (2006)	✓	✓	40%
Chemical laboratory workers cohort mortality study (2006)	✓	✓	
PNS workers lung cancer case-control study (2006)	✓	20%	
K-25 Site workers multiple myeloma case-control study (2007)	70%		
Fernald workers cohort mortality study (2007)	40%		

Ongoing Extramural Studies

Title and Grantee	*Research*	*Completion*
Radon, cigarette smoking and lung cancer at Fernald (Univ. of Cincinnati)	Exposure Assessment	2006
Susceptibility & occupational radiation risks (Univ. of North Carolina)	Cohort Mortality Study (SRS)	2006
Paducah Gaseous Diffusion Plant Worker Cohort Mortality Study (Univ. of Kentucky and Univ. of Louisville)	Cohort Mortality Study	2007
Stochastic Models for Radiation Carcinogenesis: Temporal Factors and Dose-Rate Effects (Univ. Washington)	Pooled Analyses	2006

Ongoing Study Details

Leukemia & Ionizing Radiation Multi-site Case-Control Study (LCCS)

- Estimate to completion: Early 2006
- Case-control study:
  - Workers (*n*=1,269) from a cohort (*n*=94,517) with employment at one of five nuclear facilities

LCCS Study Sites

Acronyms

LANL: Los Alamos National Laboratory
ORNL: Oak Ridge National Laboratory
PNS: Portsmouth Naval Shipyard (Non-DoE site)
SRS: Savannah River Site

LCCS Study Sites

LANL

Acronyms

LANL:	**Los Alamos National Laboratory**
ORNL:	**Oak Ridge National Laboratory**
PNS:	**Portsmouth Naval Shipyard (Non-DoE site)**
SRS:	**Savannah River Site**

LCCS Study Sites

ORNL

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LCCS Study Sites

SRS

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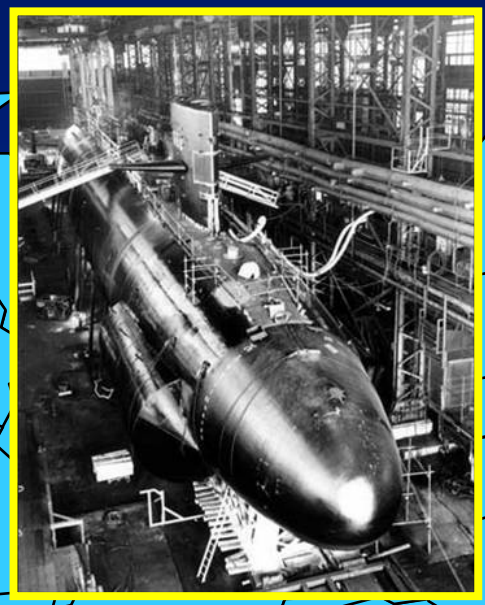
LCCS Study Sites



PNS

Acronyms

LANL:	**Los Alamos National Laboratory**
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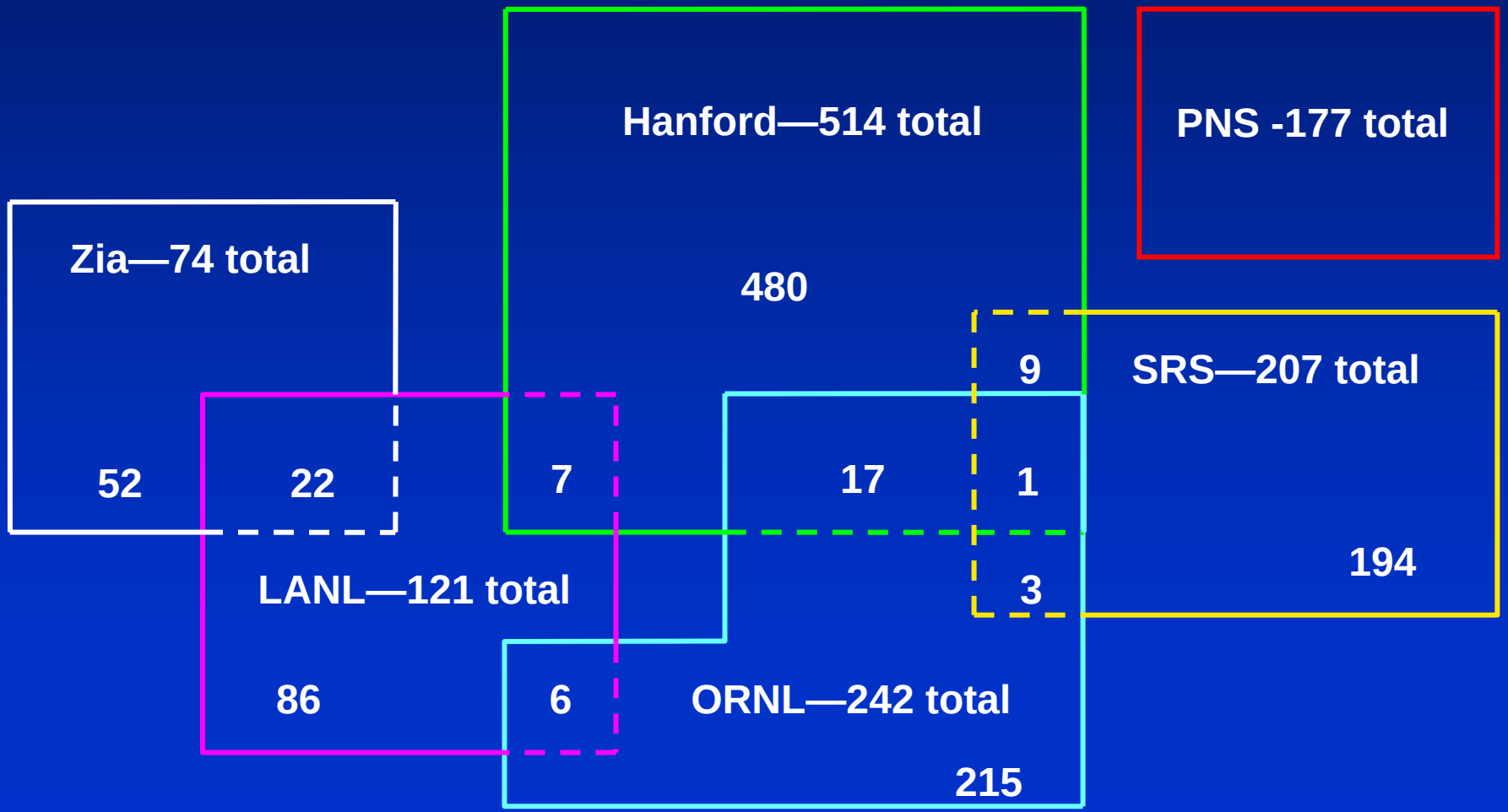
LCCS – Overlapping Employment



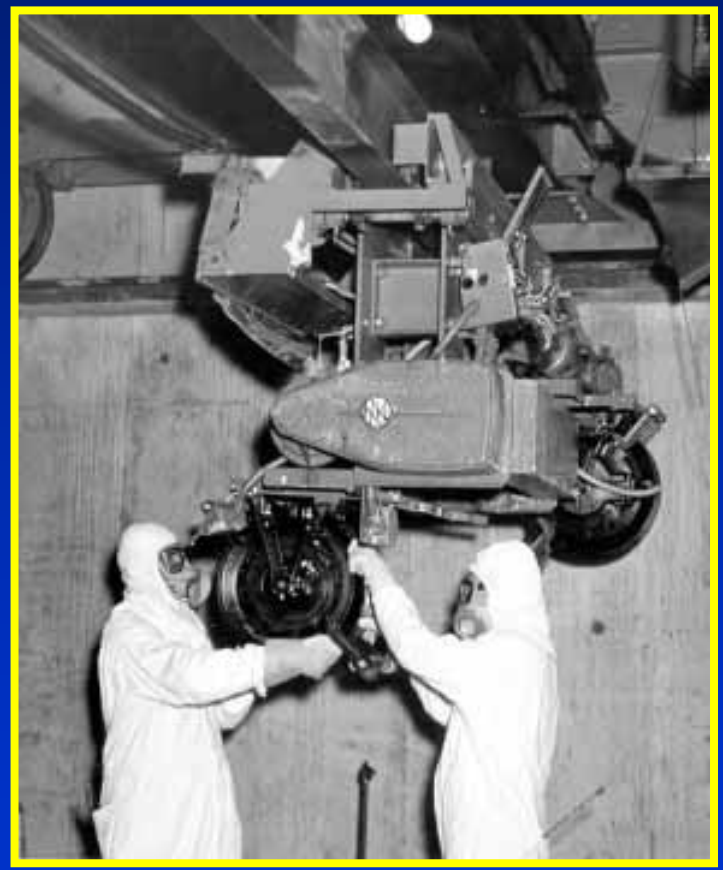
Leukemia & Ionizing Radiation Multi-site Case-Control Study (LCCS)

- Exposures
  - Ionizing radiation (gamma, x-ray, neutron, tritium, and plutonium)
  - Chemicals (benzene, carbon tetrachloride)
  - Smoking
- Outcome – Leukemia all subtypes including CLL

Leukemia & Ionizing Radiation Multi-site Case-Control Study (LCCS)

Research Questions:

- Does chronic, low-level radiation exposure cause leukemia among workers?
- What is the dose-response relationship between exposures and leukemia mortality?
- Is chronic lymphocytic leukemia (CLL) associated with radiation?
- Is there a smaller effect at low dose rates (for the same total dose)?
- How does radiation interact with other workplace exposures (High-LET radiations, chemicals, smoking)



LCCS Unique Aspects

- Cohort includes workers from five DoE facilities and one DoD facility for increased statistical power
- More leukemia cases (*n*=257) than in previous studies. (IARC 15 country study has 196 cases)
- Most informative for CLL dose-response. Contributes a relatively large number of CLL cases (*n*=43)
- Examines potential confounding and interactions from competing exposures such as high-LET irradiation and chemical exposures

LCCS - Recent Accomplishments

- Finalized exposure assessments
  - Assessed benzene and carbon tetrachloride exposures
  - Estimated equivalent dose to bone marrow from all occupational ionizing radiation sources.
  - Three methods manuscripts in peer-reviewed scientific journals
- Completed smoking status
- Completed analysis plan
- Conducted Epi analyses

LCCS- Remaining Tasks

- Peer review of Epi analyses
- Communicate study results to workers
- Publish the results in the peer-reviewed literature
- Submit study data to the Comprehensive Epidemiologic Data Resource (CEDR) http://cedr.lbl.gov

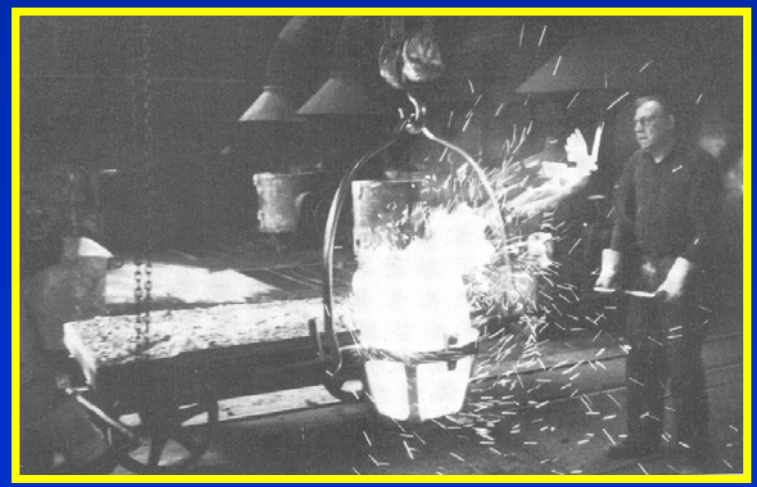
Portsmouth Naval Shipyard Lung Cancer Case-Control Study

- Scheduled completion: Early 2006
- Case-control study:
  - Workers (*n*=4,392) from a cohort (*n*=37,853) ever employed at the Portsmouth Naval Shipyard (PNS)1952-1992
- Exposures
  - Ionizing radiation (gamma, x-ray)
  - Chemicals (asbestos, welding fume)
  - Smoking
- Outcome – Lung Cancer

Portsmouth Naval Shipyard Lung Cancer Case-Control Study

Research Questions:

- Does chronic, low-level radiation exposure cause lung cancer among workers?
- How does radiation interact with cigarette smoking in producing lung cancer risk?
- How does radiation interact with other workplace exposures?
- What is the dose-response relationship between exposures and lung cancer mortality?



Mortality of Chemical Laboratory Workers

- Estimate to completion: Early 2006
- Cohort Mortality Study
  - Workers (*n*=6,157) from the Oak Ridge facilities X-10, Y-12, and K-25 between 1943 and 1999, and the Savannah River Site between 1951 and 1990.
- Exposures
  - Chemicals (Organic and inorganic)
  - Ionizing radiation (gamma, x-ray, neutron, internal emitters)
  - Outcome – cause-specific mortality

Mortality of Chemical Laboratory Workers

Research Questions:

- Do mortality patterns among Chemical Laboratory Workers (CLWs) differ from the U.S. population?
- What is the dose-response relationship between chemical exposures and cause-specific mortality?
- How do chemical exposures interact with other workplace exposures (ionizing radiation)?

Multiple Myeloma at K-25 Plant

- Estimate of completion : 2007
- Case-control study:
  - Workers (*n*=588) employed at the K-25 Gaseous Diffusion Plant between 1945 and 1985
- Exposures
  - Ionizing radiation - uranium (internal and external)
  - Chemicals – carbon tetrachloride, fluorides, mercury, nickel, and trichloroethylene
- Outcome – multiple myeloma

Multiple Myeloma at K-25 Plant

Research Questions:

- Does chronic, low-level exposures to internally deposited uranium cause multiple myeloma?
- How do these radiation exposures interact with other workplace exposures to co-carcinogens (external ionizing radiation and chemicals)?
- What is the dose-response relationship between exposures and multiple myeloma?

Fernald Cohort Mortality Study

- Estimate of completion: 2007
- Retrospective cohort mortality study:
  - Workers (approx. 7,300) hired at the former Feed Materials Production Center (FMPC) between 1951 and 1989
- Exposures to:
  - Ionizing radiation (internal and external) from uranium, thorium, radium, and radon
  - Chemicals
- Outcome – All cause-specific mortality

Fernald Cohort Mortality Study

Research Questions:

- Do mortality patterns among Fernald Workers differ from that of the U.S. population?
- What is the dose-response relationship between ionizing radiation exposures and cause-specific mortality?
- How do these exposures interact with other workplace exposures (chemicals)?

NIOSH OERP Epidemiologic Data Management System (HEDS)

- Relational database of all DoE and DoD workers studied under the OERP
  - Demographic and work history data
  - Exposure data
- Workers employed at multiple sites are linked by Master Roster (~300,000 workers currently)
- Powerful tool for future research involving exposure-based cohorts from multiple DoE and DoD sites

Advisory Committee for Energy-Related Epidemiologic Research (ACERER) Research Principles

Research Principle	Ongoing Study
Combine Cohorts for Greater Power	LCCS, CLWS
Improve Exposure Assessment	All ongoing studies
Include Non-Whites and Females	All ongoing studies
Consider Previously Unstudied Sites	Paducah (UK & UL)
Develop Studies of Current Workers	Future research needs
Increase Morbidity Studies	Future research needs

NIOSH CLL Research Initiative

- In 2004, Congress directs NIOSH to investigate a possible link between radiation exposure and the occurrence of CLL
  - CLL non-compensable under EEOICPA
- NIOSH conducts Expert Panel Meeting (July 2004) to discuss research strategies for evaluating any relationship between exposure to ionizing radiation and CLL

Expert Panel Meeting, July 2004

- Six experts in epidemiologic and molecular CLL research were invited to provide opinions
- Twenty-five people attended the meeting, including the six panel members, NIOSH and other federal staff, and the public
- Meeting Documentation
  - Proceedings (2005)
  - Annotated bibliography (2004)

NIOSH Research Focus

- Based on the panel's suggestions, NIOSH has:
  - Prioritized existing epidemiologic studies with focus on CLL
  - Pursued pooled analyses, with examination of alternate lag assumptions, in both the IARC-commissioned CLL analyses and the multi-site leukemia case-control study
  - Initiated a systematic review of the previously published literature on the radiogenicity of CLL

NIOSH CLL Research Projects

- Completed Studies
  - Cohort Mortality Study of Idaho National Laboratory (INL) Workers (2005)
  - Portsmouth Naval Shipyard (PNS) Leukemia Case-Control Study (2005)
- Continuing Studies
  - CLL analysis of the International Agency for Research on Cancer (IARC) 15 country study of ~400,000 workers (2006)
  - Multi-site Leukemia Case-Control Study (2006)
  - CLL Systematic Review (2006)

Impact of Ongoing OERP Research

- In principle, occupational studies are well suited (and preferred) for the direct estimation of the health effects of worker exposures
- Current risk models and protection standards are derived from the Life Span Study (a-bomb survivors) and medically exposed cohorts
- Ongoing OERP research demonstrates improved study design and increased followup, which is expected to provide a foundation for future policies on worker protection
- Future OERP research will build from ongoing activities for addressing relevant worker protection and public health questions