The Legacy of the Manhattan Project and Cold War in Iowa

Former Worker Medical Screening Program (FWP)

Burlington Atomic Energy Commission Plant (BAECP)
at the Iowa Army Ammunition Plant (IAAP)
and
Ames Laboratory

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Overview

- Department of Energy- Former Worker Program
- Two sites in Iowa involved with the atomic weapons industry during WW II & the Cold War
  - BAECP and Ames Laboratory
- Toxic Exposures
- Health Effects
- Medical Screening Program
- Occupational Illness Compensation Program

Department of Energy-Former Worker Program (DOE-FWP)

- In 1993, Congress passed Public Law 102-484
- Section 3162 required the DOE to evaluate long-range health condition of former employees who may be at risk for health problems as a result of their employment at DOE sites.

DOE- FWP in Iowa

- In 2000, DOE contracted with The University of Iowa to coordinate and implement a medical surveillance program for sites in Iowa
  - Iowa Army Ammunition Plant (IAAP)- near Burlington
  - Ames Laboratory at Iowa State University, Ames (2005)
- These Former Workers labored under a great weight of secrecy and significant uncertainty from the health risks associated with working in the nuclear weapons industry.
- We owe these workers a tremendous debt of gratitude for their patriotism, placing themselves in harms way in defense of our country during both WW II and the Cold War.

Iowa Army Ammunition Plant (IAAP)

- Located in Middletown, IA (Des Moines Co.)
- Over 19,000 acres of Government Owned – Contractor Operated (GOCO)
  - Over 1,000 buildings, 142 miles of roads, 103 miles of railroad tracks
- 19,000 acre facility which houses a large DoD conventional explosives manufacturing facility and a previously secret atomic bomb assembly plant.
- Designed and built between 1941-1943 as conventional munitions Loading, Assembly and Packing (LAP) facility.
  - Produced conventional missile warheads, caliber tank ammunitions, mines, mortars, artillery, demolition charges and weapons' component parts.
- Midwest Area Demilitarization Facility for disposing of old and/or obsolete ammunition.
- Still in operation - current workforce approx. 1,000 employees

DOD and DOE Funded Work at IAAP

- Conventional, high explosive weapons
  - Department of Defense
  - Division A
  - ~31,000 workers
- Nuclear Weapons assembled, disassembled, modified & tested
  - Department of Energy
  - Line 1/Division B
  - Burlington Atomic Energy Commission Plant (BAECP)
  - 1947 – 1975
  - 1947-1951- the only manufacturer of such a kind in the US
    - 1st Plant in the nation to assemble atomic weapons for the Atomic Energy Commission (AEC)
  - Production transferred to Pantex Plant, Amarillo, TX in 1975
  - ~5,000 workers

BAECP Legacy of Secrecy

- Prior to 1999, retirees from Line 1 were not included in the DOE epidemiological studies and medical surveillance programs that evaluated the long-range health effects of employment in AEC sites

- For years, IAAP workers were sworn to secrecy regarding what they did and what they handled at the Plant.
  - This federal restriction has been lifted and workers have been encouraged to discuss health issues with their doctors.

- This work was secret and literally forgotten in the transfer from AEC to DOE, until a retired Security Guard developed non-Hodgkin's lymphoma and found out that the Burlington workers were the only such workers in the nation not undergoing medical surveillance.
  - Contacted IA Senator Tom Harkin

Environmental Toxicity from IAAP

- Brush Creek ran red during the 1950's from photochemical products of TNT production
- "You could identify workers in town who worked with TNT because their skin was yellow and they turned blond!!!"
- Plant is now a Superfund site

Line 1 Work

- Assembly & disassembly of nuclear weapons
  - Intimate contact with:
    - Strong sources of radiation
    - Handling fissile central components of the weapons inches from their bodies without lead aprons
- Melting, pouring, molding, pressing, machining, storing, reclaiming, and burning high explosives or their waste products
- Encased containers of fissionable material with high explosives
- Assembled uranium or plutonium “packages”

Line 1 Work, cont.

- Casts made of metals were tooled and machined, sandblasted, ground, polished, and painted
- Solvents used to clean parts and equipment
  - Methyl ethyl ketone, Toluene, Acetone
- Heavy metals in the primers, paints, and plating operations
    - Lead azide, styphante, Hg fulminate
- X-ray & gamma sources were used for QA to detect cracks and homogeneity of products

Health & Safety on AEC Line 1

- Safe working conditions were severely lacking
  - Used the best knowledge of the time
- Worker protection was inadequate and inappropriate by today's standards
  - Radiation shielding, monitoring
- Production was the primary focus

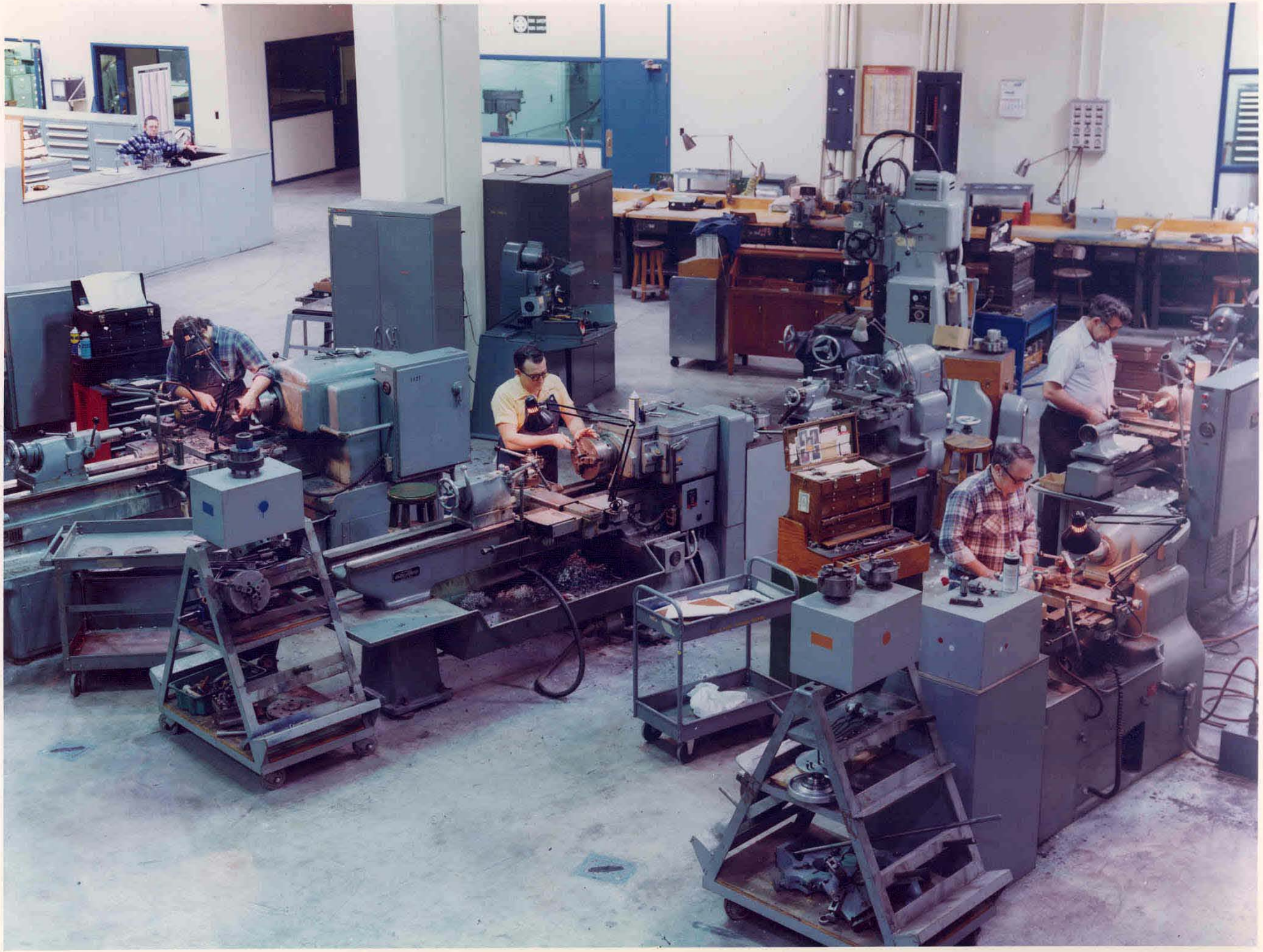
Underground Assembly Sites

"Gravel gerties" are concrete structures whose roofs consist of cable mesh supporting large amounts of gravel. Beneath them are bays, where workers assemble and disassemble nuclear warheads. Should a warhead's conventional explosives accidentally detonate, the roofs of these structures are engineered to give way, releasing the gravel and trapping the plutonium particles. Up to 2,000 warheads per year are now being dismantled at this site. *Pantex Plant, Amarillo, Texas. November 18, 1993.*

Line 1 Type Underground Facility

This underground waste-disposal room, excavated in 1986, was the first of 56 chambers to be excavated at the WIPP. It is 300 feet long, 33 feet wide, and 13 feet tall and could hold six thousand 55-gallon drums of transuranic waste. It lies 2,150 feet below the surface of the earth. *Room 1 of Panel 1, Waste Isolation Pilot Plant, near Carlsbad, New Mexico. February 25, 1994.*

Plutonium Pucks



BAECP Toxicants

- Occupational exposures to fissionable or radioactive materials and a variety of hazardous substances
  - High explosives, solvents, epoxies, toxic metals, fibrogenic dusts
- Uranium and Plutonium, (U-235, Pu-239)
- Beryllium, Asbestos
- Isocyanates
- MOCA, B-Naphthylamine
- Benzene, Nitrobenzene, Dinitrobenzene
- TNT, DNT, Tetryl
- RDX, PBX, HMX, Octol, PETN
- Lead, Mercury, Arsenic, Cadmium, Manganese
- Depleted Uranium, (U-238)
- Physical Hazards- Noise

Exposure to Line 1 Bystanders

Worked in the vicinity of Line 1:

- Guards
- Laundry personnel: handled contaminated clothing
- Cafeteria staff
- Various tradespersons
- Delivery and storage personnel
- Contractors (ongoing construction & maintenance)
- Worked in rail and storage yards, burning fields and demolition areas

Exposures

- High noise levels
- Paint vapors
- Asbestos
- Silica

Ames Laboratory

- In 1939, the U.S. government asked leading scientists to join in a consolidated national effort to develop atomic energy

- Tons of uranium metal needs to be produced for a uranium fission chain reaction to be successful
  - Not available commercially

Ames Lab Research/Ames Project

- In 1942, chemical research to accompany the Manhattan Project's physics program was established at ISU by Frank H. Spedding and Harley A. Wilhelm

- Developed new methods for melting and casting uranium metal and a process for producing nearly pure uranium
  - Cast large ingots of uranium for nuclear reactor purposes and reducing production costs by as much as twenty-fold
  - Process still used today

Ames Project

- Furnished 1/3 of the uranium metal used in the first successful demonstration of a chain-reaction pile at the University of Chicago
- Proved that a chain reaction could be self-sustained and controlled
  - Need for pure uranium greatly increased
- Produced as much metal as possible until private industry took over the process in 1945

Ames Project, cont.

- In 1947, Ames Lab was established as an AEC/DOE research facility as a result of the their successful development of the most efficient process to produce high-purity uranium metal in large quantities for atomic energy

Ames Laboratory

- Over 12,000 employees have worked for the DOE-Ames Lab
- Those who worked prior to 1955, were highly exposed to hazardous substances

Toxic Exposures at the Ames Lab

- Ionizing radiation
  - From processing over one million pounds of uranium and thorium, generating radioactive dusts at extremely high levels without personal protection, engineering controls or radiation monitoring to protect them from exposures and risks
- Machining Beryllium vessels
  - Filling Be vessels with pure uranium and monitoring the heat generation (exothermic reaction)
  - Reports of regular “blow-outs” of uranium and thorium from uncontrolled exothermic reactions
- Applied research with lanthanide series metal, rare earth elements, alkaline metals and rare gas solids
  - Radioisotope exposures, beryllium machining, and other toxic metals

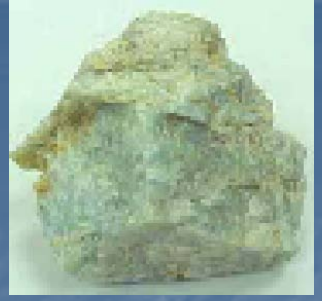
Beryllium Residue of At-Risk Buildings, 2001

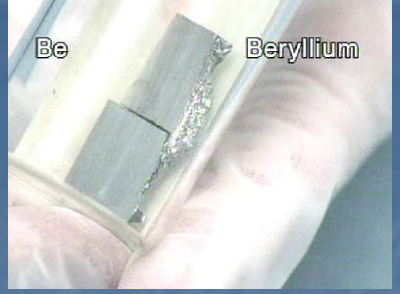
- Wipe sampling from horizontal surfaces and spaces in the walls
- Beryllium concentrations were below the detection limit in all accessible public areas
- Nine samples from the ‘restricted access’ mechanical spaces had beryllium concentrations greater than the analytical methods’ detection limit

Ames Lab Bystanders

- Scientific and technical staff
- Paid undergraduate and graduate students
- Administrative and support staff shared workspaces
- Construction & maintenance workers, subcontractors
- Custodians

Beryllium (Be)





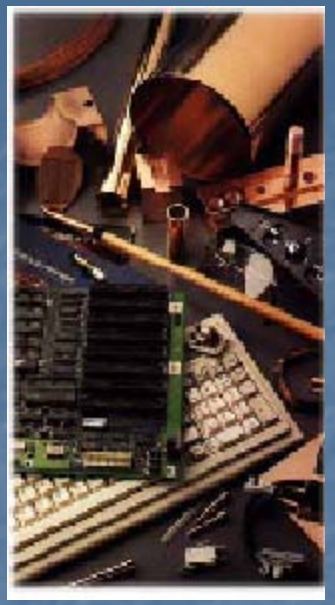
- Naturally occurring earth metal found in coal, wood, foodstuffs, soil, & gemstones
- Properties:
  - Light weight (lighter than aluminum)
  - High stiffness (higher than steel)
  - Resistance to deformity over a wide range of temperatures
  - Resistance to corrosion
  - Transparency to x-rays
  - Non-sparking properties
- In industrial use since 1940's

Periodic table Group IIA
Atomic Number 4
Atomic Mass 9.012182
Density 1847.7 kg m $^{-3}$
Thermal conductivity 200 W m $^{-1}$ K $^{-1}$
Melting point 1551 K (2348.6°F = 1278.0 °C)
Boiling point in 3243 K (4479.8°F = 2970.0 °C)

- Irreplaceable in aerospace, automotive, energy, defense, medical and electronics industries
- United States is the largest producer and consumer of beryllium products in the world

-- The US Geological Survey – Mineral Resources Information Program, 2000

Explosive Weaponry Uses of Beryllium



- Widely used in housings of explosive weaponry
- Virtually all the tools used, as it is a spark-free metal
- “Pit Liner” in nuclear warheads – reflector and additional source of neutrons increasing the force of explosion

Beryllium Toxicity

- Classified as a Probable Human Carcinogen
  - International Agency for Research on Cancer (IARC).

- Target Organs, Exposure Routes
  - Lung, “the primary target organ” – through inhalation
    - Particles in mists, dusts, fumes
  - Skin – through a direct contact
  - Other organs– liver, kidneys, heart, spleen, bones

Health Effects of Beryllium Toxicity

- Skin- dermal lesions
- Lungs-
  - Acute Beryllium Disease (ABD)
    - Chemical pneumonitis (not observed now)
    - Metal Fume Fever, Pneumonitis
  - Chronic Beryllium Disease (CBD)
    - Chronic irreversible disease
    - Pneumoconiosis, Emphysema, Fibrosis of lungs
      - Destroyed lungs, respiratory failure and eventually death
    - Sensitization, Granulomatous Lung Disease
    - Latency period – on average 10-15 years (up to 40 years) after initial exposure & sensitization
    - Symptoms:
      - shortness of breath, weight loss
      - chest pains, weakness and exhaustion
      - persistent coughing, night sweats
  - Lung cancer

Risks of Beryllium Disease

- Beryllium workers at highest risk for adverse health outcomes (higher than environmental exposures)
- Others: smokers, worker's family members, community residents
- Berylliosis has been documented in very high prevalence in workforces who machined such casings, Oak Ridge and elsewhere.

Beryllium tools were the norm in munitions industry. These were typically 2% copper Beryllium alloys, used for avoiding spark.

Occupational Health Conditions of Former Workers

- Chronic Beryllium Disease (Beryllium-related diseases)
- Asbestos-related diseases
- Emphysema
- Obstructive Airway Disease
- Cancers

Medical Screening Program Goals

- To detect conditions that are amenable to early intervention
  - Bladder cancer, colorectal cancer
- To ameliorate certain conditions
  - Chronic respiratory diseases
- To provide primary prevention
  - Lung cancer via smoking cessation
- Fortunately, Former Workers lives have been saved as a result of early detection of cancers and other conditions

Medical Screening Tests

- **Chest X-Ray (CXR)**
- **Pulmonary Function Test (PFT)/Spirometry**
  - Lung function test that determines whether breathing patterns are within normal limits.
- **Laboratory Tests** (blood and urine samples)
  - Blood counts; liver, kidney and thyroid functions; blood sugar; urinalysis.
  - Hemoccult fecal blood test ("stool card" kit) screens for gastrointestinal bleeding, which may be a symptom of colon cancer.
- **Beryllium Lymphocyte Proliferation Test (BeLPT)**
  - Blood test that measures sensitization to beryllium
  - BeLPT examines how a type of disease-fighting blood cell, lymphocyte, reacts to beryllium.

EEOICPA Claims

Energy Employees Occupational Illness Compensation Program Act 2001 Congressional Law

- Provides compensation and medical benefits to employees who have developed health conditions from working in the atomic weapons industry
- Provides benefits to living survivors
- Compensates for 22 radiation-induced cancers, silicosis, CBD
  - Resulting from exposure to radiation, silica or beryllium
- Payment of $150,000 plus medical expenses

Radiation-Induced Cancers

- Leukemia, other than CLL
- Lymphomas (except Hodgkin's)
- Multiple Myeloma
- Thyroid cancer
- Breast cancer
- Ovarian cancer
- Stomach cancer
- Lung cancer
- Bone cancer
- Skin cancer
- Colon cancer
- Rectal cancer
- Bile duct/gall bladder cancer
- Laryngeal cancer
- Primary liver cancer
- Cancer of the salivary gland
- Cancer of the urinary tract
- Cancer of the pharynx
- Cancer of the esophagus
- Cancer of the small intestine
- Cancer of the pancreas
- Tumors of the brain and central nervous system

Claims Requirements

- Worked 250 days
- Dose Reconstruction for cancer claims

- BAECP Special Exposure Cohort (SEC)
  1) For all who worked on Line 1 from 1949 to 1974
  2) For radiographers from 1948-1949 involved with building Line 1

- Ames Lab Special Exposure Cohort (SEC)
  1) For all who worked prior to 1955, for risks from processing over 1 million pounds of uranium & thorium without protection or radiation monitoring

  2) Sheet metal workers and others associated in the tear-out of the ventilation system from 1940 to 1969.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For more information.....

Former Worker Medical Screening Program

toll-free 1-866-282-5818

www.iowafwp.org

U.S. DOL-EEOICP Resource Center

toll-free 1-866-540-4977

www.dol.gov/owcp/energy