A quick look at research on non-occupational or community exposure to uranium…

Uranium Contamination Stakeholders' Workshop
4/16/13 Gallup, New Mexico

Lisa Allee, CNM
Program Director

It can be confusing…

- One article says these problems happen due to uranium, another says those problems not seen…
- Animal studies—how do the results translate to humans?
- Hard to study community level exposure:
  - Very difficult to measure exposure.
  - What level is safe, what is not?
  - How long does it take for health problems to appear with low-level, chronic exposure?
  - Lots of other exposures, lots of other possible causes for health problems.

Animal Studies

Reproductive and developmental toxicity of natural and depleted uranium: a review

Reproductive Toxicology 15 (2001) 603–609

Jose L. Domingo Laboratory of Toxicology and Environmental Health, School of Medicine, "Rovira i Virgili" University, Reus 43201, Spain

- **Decreased fertility, embryo/fetal toxicity, including teratogenicity, and reduced growth of the offspring have been observed following uranium exposure at different gestational periods in mice.**
- **Moderate preventative effect of chelation agent Tiron given to pregnant mice.**

Drinking Water with Uranium below the U.S. EPA Water Standard Causes Estrogen Receptor–Dependent Responses in Female Mice

Environmental Health Perspectives • VOLUME 115 | NUMBER 12 | December 2007

Stefanie Raymond-Whish, Loretta P. Mayer, Tamara O'Neal, Alisyn Martinez, Marilee A. Sellers, Patricia J. Christian, Samuel L. Marion, Carlyle Begay, Catherine R. Propper, Patricia B. Hoyer, and Cheryl A. Dyer

Department of Biological Sciences, Northern Arizona University, Flagstaff, Arizona, USA; Department of Physiology, College of Medicine, University of Arizona, Tucson, Arizona, USA

- **Mice had decreased fertility and reproductive tract abnormalities after exposure to uranium and their female offspring had suggestions of decreased fertility, also.**
- **They concluded: "Our data support the conclusion that uranium is an endocrine-disrupting chemical and populations exposed to environmental uranium should be followed for increased risk of fertility problems and reproductive cancers."**

More animals

Preconceptional paternal exposure to depleted uranium: transmission of genetic damage to offspring.

Health Phys. 2010 Sep;99(3):371-9

Miller AC, Stewart M, Rivas R.

Scientific Research Department, Armed Forces Radiobiology Research Institute (AFRRI), Uniformed Services University, Bethesda, MD 20889-5603, USA. millera@afrri.usuhs.mil

- **Medium and high dose DU exposed mice fathers had a significant increase in gene mutation frequency in their offspring in comparison to controls. The mutation frequencies in offspring of low dose DU fathers were not significantly different than control levels.**

Studies on the protective effect of dietary fish oil on uranyl-nitrate-induced nephrotoxicity and oxidative damage in rat kidney.

Prostaglandins, Leukotrienes and Essential Fatty Acids 82(2010) 35–44

Shubha Priyamvada, Sara A. Khan, Md. Wasim Khan, Sheeba Khan, Neelam Farooq, Farah Khan, A.N.K. Yusufi

Department of Biochemistry, Faculty of Life Sciences, Aligarh Muslim University, Aligarh 202002, U.P., India

- **They found that feeding rats fish oil prevented and reversed uranium-caused kidney damage.**
  - **THIS MAY BE APPLICABLE TO HUMANS!! Omega rich oils such as fish oil, flax seed oil, hemp seed oil, evening primrose oil are very good for us!**





Humans

Fernald, Ohio—uranium processing plant 1951-1989, citizens won a class action suit against the contractor and DOE and the settlement included a medical monitoring program—numerous articles from the data of this program:

Medical Monitoring: A Beneficial Remedy for Residents Living Near an Environmental Hazard Site

J Occup Environ Med. 2009;51:1374–1383

Robert Wones, MD, Susan M. Pinney, PhD, Jeanette M. Buckholz, MSN, Colleen Deck-Tebbe, PharmD, Ronald Freyberg, MS, Amadeo Pesce, PhD

- **They found decreases in common risk factors (cholesterol and blood pressure) and deaths from cancer when people received regular health care.**
- **Their conclusions: "These data support the appropriateness of comprehensive medical monitoring as a remedy for people affected by defined sources of environmental contaminants."**
- **(Of note—this model of care is what Indian Health Service provides overall and the information from this article helped guide the development of the Community Uranium Exposure—Journey To Healing program.)**


(The Fernald Site before environmental restoration)

Fernald, con't

Health effects in community residents near a uranium plant at Fernald, Ohio, USA.

Int J Occup Med Environ Health. 2003;16(2):139-53.

Pinney SM, Freyberg RW, Levine GE, Brannen DE, Mark LS, Nasuta JM, Tebbe CD, Buckholz JM, Wones R.

Department of Environmental Health, University of Cincinnati College of Medicine, Cincinnati, Ohio 45267-0056, USA. susan.pinney@uc.edu

- **Findings suggest increased prevalence of urinary system disease-- bladder and kidney disease including sub-categories, kidney stones, chronic nephritis and increased rates for hematuria and urethral stricture. In regression analyses with adjustment for age and sex, serum creatinine levels were increased in those who had lived close to the plant. Increased white blood cell count and hemoglobin levels, and decreased mean corpuscular volume were also found in those living less than 2 miles from the plant. Those who used a well or cistern for drinking water were found to have increased urinary microalbumin, red blood cell count and hematocrit.**

Uranium Exposures in a Community near a Uranium Processing Facility: Relationship with Hypertension and Hematologic Markers

Environ Res. 2010 November ; 110(8): 786–797

Sara E. Wagner, MSPH, PhD, et al.

- **Participants with elevated uranium exposure had decreased white blood cell and lymphocyte counts and increased eosinophil counts. Female participants with higher uranium exposures had elevated systolic blood pressure compared to women with lower exposures. However, no exposure-related changes were observed in diastolic blood pressure or hypertension diagnoses among female or male participants.**

One more from Fernald..

Uranium Exposure Linked to High Lupus Rates in Community Living Near a Former Refinery

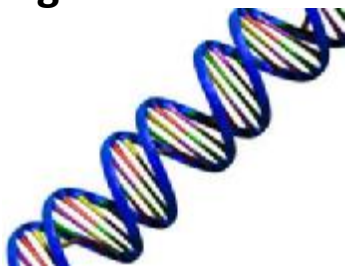
http://www.sciencedaily.com/releases/2012/11/121110155813.htm

Nov. 10, 2012 — High rates of systemic lupus erythematosus have been linked to living in proximity to a former uranium ore processing facility in Ohio, according to new research findings presented this week at the American College of Rheumatology Annual Meeting in Washington, D.C.

- **Systemic lupus erythematosus, also called SLE or lupus, is a chronic inflammatory disease that can affect the skin, joints, kidneys, lungs, nervous system, and/or other organs of the body. The most common symptoms include skin rashes and arthritis, often accompanied by fatigue and fever.**
- **Researchers at the University of Cincinnati and Cincinnati Children's Medical Center sought to explain an excessive number of lupus cases reported in a community five miles from a former uranium plant in Fernald, Ohio, from 1990 to 2008. They used available medical data from the Fernald Community Cohort, an 18-year study of 8,788 adult volunteers living near the plant, not including any plant workers.**
- **Estimated levels of uranium exposure from the plant were associated with higher rates of lupus. Among the lupus cases, 12 were in the high exposure group, seven with moderate exposure, and five in the low exposure group. Prevalence of lupus in this group, however, is five times higher than expected in the group exposed to higher amounts of radiation.**

Off to Texas…

Au, et al, at University of Texas Medical Branch Galveston, have published a number of articles about their investigations of residents in Karnes County Texas who had non-occupational exposure to uranium. They found that people who had been exposed to uranium had DNA-repair abnormalities which may mean a higher risk for cancer.



Biomarker Monitoring of a Population Residing near Uranium Mining Activities

Environmental Health Perspectives Volume 103, Number 5, May 1995

Monitoring populations for DNA repair deficiency and for cancer susceptibility.

Environ Health Perspect. 1996 May;104 Suppl 3:579-84.

Population monitoring: experience with residents exposed to uranium mining/milling waste.

Mutat Res. 1998 Sep 20;405(2):237-45.

Life style factors and acquired susceptibility to environmental disease.

Int J Hyg Environ Health. 2001 Oct;204(1):17-22.

But then Boice, et al, looked at cancer deaths in Karnes County and found: "No unusual patterns of cancer mortality could be seen in Karnes County over a period of 50 years, suggesting that the uranium mining and milling operations had not increased cancer rates among residents."

Cancer mortality in a Texas county with prior uranium mining and milling activities, 1950-2001.

J Radiol Prot. 2003 Sep;23(3):247-62

Boice JD Jr, Mumma M, Schweitzer S, Blot WJ.

International Epidemiology Institute, 1455 Research Boulevard, Suite 550, Rockville, MD 20850, USA

Water

Uranium in drinking water: renal effects of long-term ingestion by an aboriginal community.

Arch Environ Occup Health. 2009 Winter;64(4):228-41.

Zamora ML, Zielinski JM, Moodie GB, Falcomer RA, Hunt WC, Capello K.

Radiation Protection Bureau, Health Canada, Ottawa, Canada.

- **This was a very small study (n=54), but they did find a correlation between uranium excreted in urine and bio-indicators that indicated interference with the kidney's re-absorptive function.**
- **Because of the community's concerns about cancer, the authors calculated total radiation exposure and even at the highest dose the risk of cancer was so small (13 in 100,000) it would be difficult to detect any increase in cancer in such a small population size (1,480). They concluded that at the observed levels of uranium intake, chemical toxicity would be a greater health concern than would radiation dose.**

Grand rounds: nephrotoxicity in a young child exposed to uranium from contaminated well water.

Environ Health Perspect. 2007 Aug;115(8):1237-41

Magdo HS, Forman J, Graber N, Newman B, Klein K, Satlin L, Amler RW, Winston JA, Landrigan PJ.

Western University of Health Sciences, College of Osteopathic Medicine of the Pacific, Pomona, California, USA.

- **A family in Connecticut drank uranium contaminated water from their well, kidney damage was found especially in the youngest child, but resolved once they stopped drinking the contaminated water.**
- **The authors concluded: "This case underscores the hazards of consuming groundwater from private wells. It documents the potential for significant residential exposure to naturally occurring uranium in well water. It highlights the special sensitivity of young children to residential environmental exposures, a reflection of the large amount of time they spend in their homes, the developmental immaturity of their kidneys and other organ systems, and the large volume of water they consume relative to body mass."**

Food

Are uranium-contaminated soil and irrigation water a risk for human vegetables consumers? A study case with Solanum tuberosum L., Phaseolus vulgaris L. and Lactuca sativa L.

Ecotoxicology. 2009 Nov;18(8):1130-6. doi: 10.1007/s10646-009-0376-4. Epub 2009 Jul 10.

Neves O, Abreu MM.

Centro de Petrologia e Geoquímica, Instituto Superior Técnico, Universidade Técnica de Lisboa, Av. Rovisco Pais, 1049-001, Lisbon, Portugal

- **Potatoes, beans and lettuce were grown in contaminated soil and with non-contaminated and contaminated water.**
- **Uranium ranged in the following order: lettuce (234 microg/kg) > green bean (30 microg/kg) > potatoes without peel (4 microg/kg).**
- **They concluded: "Although uranium in soil, irrigation water and vegetables was high, the assessment of the health risk based on hazard quotient indicates that consumption of these vegetables does not represent potential adverse (no carcinogenic) effects for a local inhabitant during lifetime."**

Actinides in deer tissues at the rocky flats environmental technology site.

Integr Environ Assess Manag. 2005 Nov;1(4):391-6.

Todd AS, Sattelberg RM.

U.S. Fish and Wildlife Service, Building 111, Rocky Mountain Arsenal NWR, Commerce City, Colorado 80022, USA.

- **In this study, measurements were done on select liver, muscle, lung, bone, and kidney tissue samples harvested from resident Rocky Flats deer (N = 26) and control deer (N = 1). Conservative risk calculations suggest minimal human risk associated with ingestion of these edible deer tissues. The maximum calculated risk level in this study (4.73 x 10(-6)) is at the low end of the U.S. Environmental Protection Agency's acceptable risk range.**

Bottom Line

- Link to possible kidney damage seems likely, so if exposed to uranium protect your kidneys:

  - Prevent diabetes and hypertension with healthy diet, daily moderate to vigorous exercise, normal weight for height, get blood sugar and blood pressure checked at least yearly.
  - If have diabetes and/or hypertension—keep them under control with diet, exercise, normal weight and medications.
- Connection to cancer unclear so be sure to get recommended cancer screenings
  - Pap tests, mammograms, colonoscopy
- Benefits of regular health care demonstrated to decrease health risks, so be sure to see your health care provider regularly.
- Drink water from regulated water sources only.