

DON KELLEY, M.D.

NRC HEARING NARRATIVE

SLIDE 1: GOOD EVENING AND THANK YOU TO THE COMMISSION FOR THIS OPPORTUNITY TO SPEAK ABOUT CONTENTION NO. 3.

I'M GOING TO LIMIT MY REMARKS TO THE EFFECTS OF INCREASING RADIOACTIVITY IN THE ENVIRONMENT.

SLIDE 2: SO, ARE THERE ACCEPTABLE HEALTH RISKS ASSOCIATED WITH ISL MINING OF URANIUM?

SLIDE 3: <sup>IN 1986</sup> THERE WAS AN ATTEMPT TO LOOK AT THE EFFECTS OF PAST URANIUM MINING IN THE STATE. THE S.D. DEPT OF HEALTH SIMPLY TALLIED THE RATES OF CANCER CASES BY COUNTIES, AND FOUND THIS SITUATION, WHERE THE RATE OF CANCER DIAGNOSES IN FALL RIVER CO. WAS HIGHER THAN IN THE STATE AS A WHOLE, OR IN THE NATION.

— — ALTHOUGH THIS COULD MAKE YOU SUSPICIOUS THAT THERE WAS A RELATION BETWEEN RADIATION EXPOSURE AND CANCER, WE REALLY DON'T HAVE THE KIND OF INFORMATION WE NEED TO DRAW SUCH A CONCLUSION — — THERE COULD BE TOO MANY OTHER POSSIBLE FACTORS.

SLIDE 4; IN ORDER TO DRAW ANY FIRM CONCLUSIONS, WE'D NEED A MUCH MORE DETAILED STUDY, WHERE EVERY CANCER CASE IN THE REGION WAS CHECKED FOR SUCH THINGS AS THE INTENSITY OF THE RADIATION SOURCE AND ITS DISTANCE FROM THE SUBJECT, HOW THE RADIATION MADE IT INTO THE BODY, THE LENGTH OF EXPOSURE, ETC. WE DEFINITELY NEED THIS TYPE OF STUDY TO BE DONE, BUT SINCE IT HASN'T BEEN, WE HAVE NO WAY OF SAYING THAT RADIATION LEVELS IN THIS AREA IN THE PAST HAVE BEEN SAFE OR UNSAFE FOR THE PEOPLE LIVING AND WORKING HERE.

SLIDE 5: RELATED TO THIS IS THE ISSUE OF WHETHER WE CAN DETERMINE A "SAFE" LEVEL OF RADIATION EXPOSURE.

SLIDE 6: SOME PEOPLE (PARTICULARLY THOSE IN THE NUCLEAR INDUSTRY) WOULD SAY "YES", AND THEY'D BASE THIS ON STATISTICAL PROBABILITY, SUCH AS WE SEE ILLUSTRATED IN THIS GRAPH, SHOWING THE INCREASE IN CANCER AND OTHER RADIATION DAMAGE RELATED TO RADIATION DOSE. IN FACT, THEY WOULD SAY THERE ARE A COUPLE OF THRESHOLDS BELOW WHICH YOU SHOULD FEEL PRETTY SECURE. THE LOWER THRESHOLD IS FOR PREGNANT WOMEN AND CHILDREN, AND ANOTHER ONE (TEN TIMES HIGHER) IS FOR PEOPLE WITH OCCUPATIONAL EXPOSURE. THE LOWER ONE CONSIDERS THE FACT THAT RAPIDLY DIVIDING CELLS, LIKE IN A FETUS OR CHILD, ARE MORE SUSCEPTIBLE TO RADIATION DAMAGE, BUT ALSO CONSIDERING THAT RADIATION DAMAGE IS CUMULATIVE DURING A PERSON'S LIFETIME, AND THE FETUS OR CHILD HAS A LONGER LIFETIME IN WHICH TO ACCUMULATE DAMAGE.

SLIDE 7: NOTICE THAT, AT THIS LOW-DOSE END OF THE GRAPH, THE NUMBER





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Steve Pimer, Secretary  
Department of Environment and Natural Resources  
523 East Capitol  
Pierre, SD 57501

RE: Uranium mining: concerns on cancer mortality and incidence

Dear Steve:

**Overview.** Cancer is a major public health problem in South Dakota and the United States. Cancer is a neoplastic disease marked by uncontrolled growth of cells, often with invasion of normal tissue. Cancer is the second leading cause of death in South Dakota. In 2004 there were 6,811 deaths reported in South Dakota, with 1,559 (23%) of these deaths due to cancer. Cancer deaths have been reported in residents of every county in South Dakota. Cancer evolves from a complicated combination of multiple exposures or risks. The most commonly attributable risk factors for cancer are tobacco use 30%, diet/obesity 30%, sedentary lifestyle 5%, occupational factors 5%, family history of cancer 5%, viruses-biological agents 5%, perinatal factors/growth 5%, reproductive factors 5%, alcohol 3%, socioeconomic status 3%, environmental pollution 2%, ionizing/ultraviolet radiation 2%, prescription drugs/medical procedures 1% and salt/food additives/contaminants 1%. Prevention, early detection and prompt and appropriate treatment are the keys to addressing the cancer burden.

**Question:** Concerns about uranium mines and radioactive pollution in western South Dakota prompted the Department of Health to review cancer death rates and cancer incidence<sup>2</sup> for counties with uranium mines and counties in the Standing Rock and Cheyenne River Reservations.

**Cancer death rates.** A one-year snapshot of cancer deaths would give a limited picture of the over-all cancer burden, especially in low population counties such as are common in western South Dakota. A 33-year, 1969-2002, cancer death review of the nine counties and comparisons to the state and national cancer death rates offers a larger-scope evaluation of the cancer burden in the counties under question (Butte, Corson, Custer, Dewey, Fall River, Harding, Lawrence, Pennington, and Ziebach).

The population of the nine counties at the 2000 census was 148,214, representing 20% of the states population. During the 33-year period, 1969-2002, there were 46,060 deaths due to cancer reported among South Dakota residents.

Cancer deaths and rates, 1969-2002, South Dakota  
select counties, (age-adjusted)

County (2000 population)	Number of cancer deaths	Cancer death rate* (±95%CI)
United States	15,500,598	208.4 (208.3-208.5)
South Dakota	46,060	187 (185.3-188.8)
Butte (9094)	623	201 (185.1-217.4)
Corson (4181)	242	209 (182.1-239.2)
Custer (7275)	389	175 (158.1-194.1)
Dewey (5872)	280	229 (202.2 - 259.1)
Fall River (7453)	744	197 (183.0-212.6)
Harding (1353)	89	186 (132.6-205.3)
Lawrence (21302)	1,258	186 (177.3-198.4)
Pennington (88505)	3,938	198 (191.3-203.8)
Ziebach (2515)	89	206 (162.7-258.8)

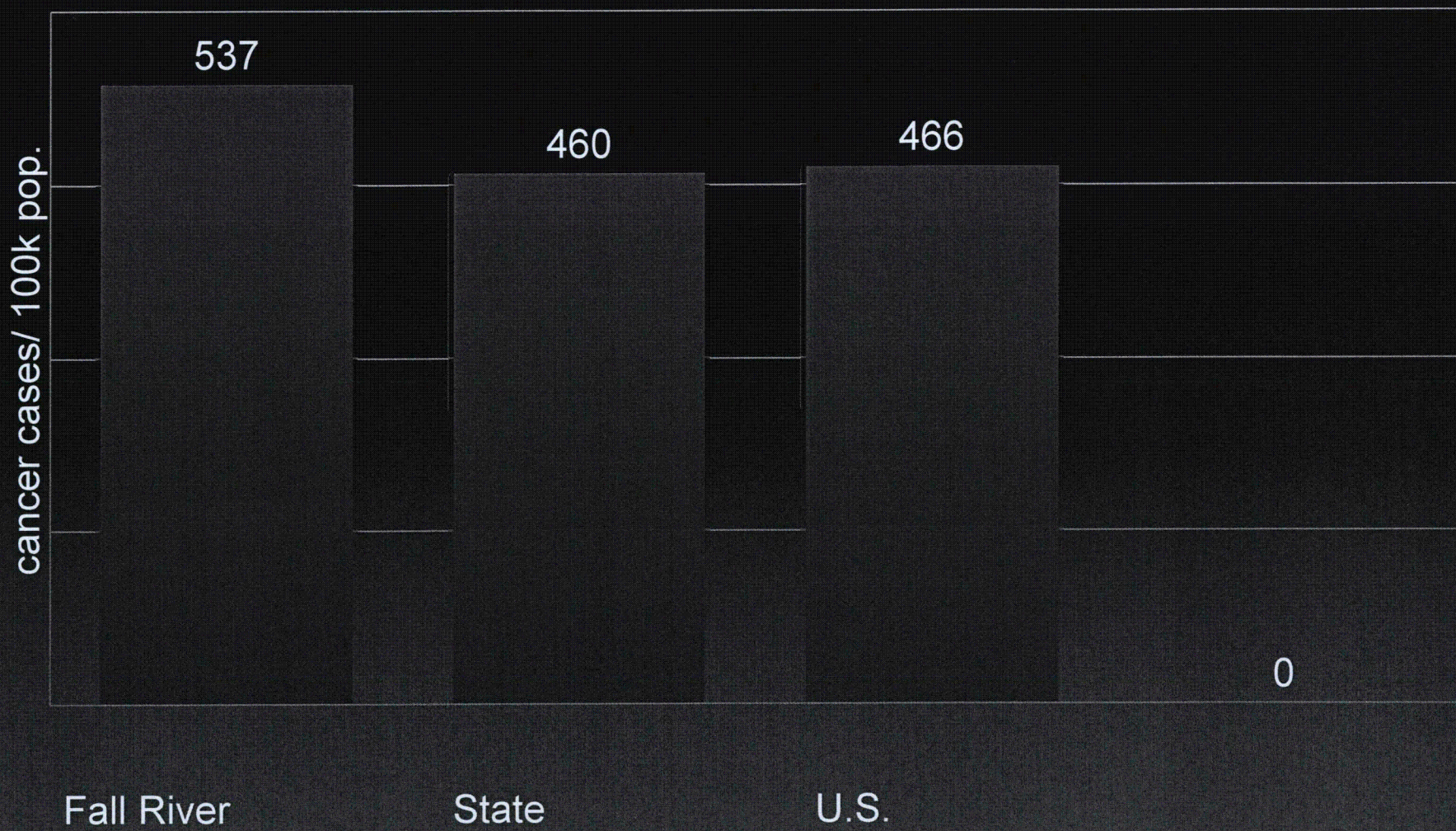
\*Rates are per 100,000 persons age adjusted to the 2000 US  
standard population.

Source: SEER (Surveillance, Epidemiology and End Results  
Program) Statistical Review, 1969-2002.

<sup>1</sup> Harvard Reports on Cancer Prevention, 1996,  
([www.hsph.harvard.edu/cancer/resources\\_materials/reports/HCCPreprint\\_1fulltext.htm](http://www.hsph.harvard.edu/cancer/resources_materials/reports/HCCPreprint_1fulltext.htm))

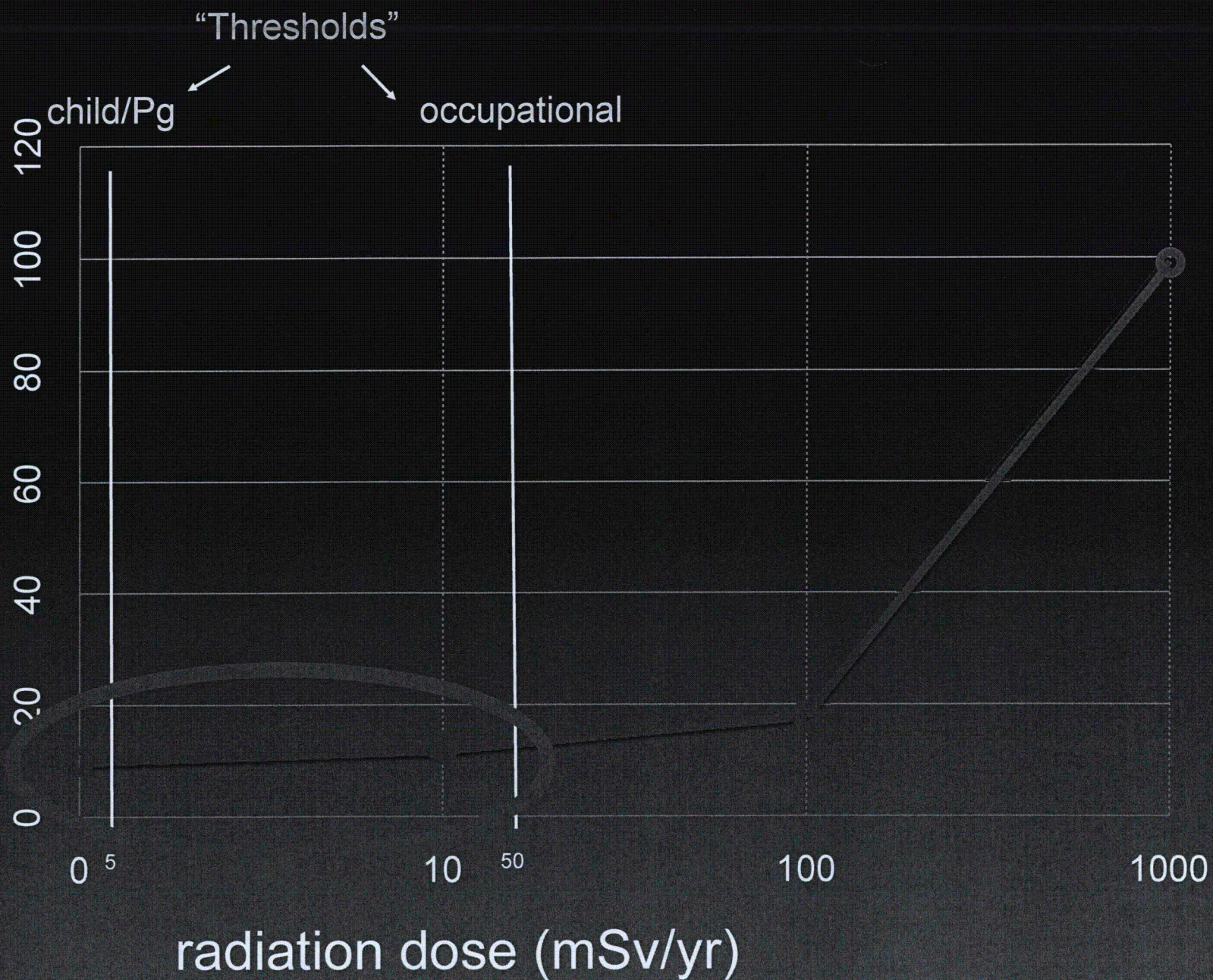
<sup>2</sup> Incidence rate is the number of new cancer cases occurring in a population over a given period of time, expressed as cases per 100,000 population.







disease/death cases per 1000 pop.





OF CASES IS NOT ZERO, EVEN THOUGH THIS IS THE REGION WHERE WE FIND SUCH THINGS AS DIAGNOSTIC X-RAYS, OR THE KIND OF EXPOSURE YOU MIGHT GET FROM DRINKING WATER FROM A SOURCE CONTAINING MILDLY INCREASED AMOUNTS OF RADIOACTIVITY.

SLIDE 8: SO, WHAT CAN WE SAY ABOUT THIS LOW-DOSE REGION OF THE GRAPH? <sup>"TAIL"</sup>  
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— — CONSIDERING THOSE PEOPLE WHO DO DEVELOP CANCER OR OTHER PROBLEMS, HAVE WE SHOWN THAT LOW-DOSE RADIATION CAN'T BE THE CAUSE? NO! IT HAS BEEN CALCULATED, IN FACT, THAT IN THE UNITED STATES, THERE ARE APROX. 5700 EXCESS CASES OF CANCER DEVELOPING EVERY YEAR WHICH ARE CAUSED BY DIAGNOSTIC X-RAYS.

— — AND OF THOSE PEOPLE EXPOSED TO LOW DOSES WITHOUT SHOWING EFFECTS IN THEIR LIFETIMES, DO WE KNOW THAT THEY AND THEIR FAMILIES HAVE ESCAPED RADIATION DAMAGE? NO! THERE CAN BE A FORM OF DAMAGE THAT AFFECTS ONLY THE DIVIDING CELLS THAT PRODUCE SPERM AND EGGS! ALTHOUGH THE PERSON RECEIVING THE RADIATION SHOWS NO EFFECTS, LATER GENERATIONS CAN THEN INHERIT MUTATIONS AS A RESULT.

SLIDE 9: JUST TO PROVIDE A PICTURE OF HOW RADIATION CAN AFFECT CELLS, HERE WE SEE A PHOTON OF RADIATION HITTING THE GENETIC MATERIAL OR DNA OF A CELL. THIS CAN THEN RESULT IN A VARIETY OF MUTATIONS OR "FAULTS" IN GENES THAT CAN THEN RESULT IN CANCER AND OTHER DISEASES IN THAT INDIVIDUAL, OR, IF THE DNA IS THAT OF A SPERM OR EGG, IT CAN PASS THE MUTATION ALONG TO LATER GENERATIONS.

SLIDE 10: AS AN EXAMPLE, HERE'S A FAMILY TREE WITH WHICH I'M VERY FAMILIAR, IN WHICH ONE OF THESE "GERM-LINE" MUTATIONS OCCURRED IN ONE OF THE GRANDPARENTS, IN EITHER THE SPERM OR THE EGG CELL LINE. THE GRANDPARENTS DIED WITHOUT SHOWING ANY INHERITED-TYPE DISEASE. OF THEIR 3 KIDS, ONE SON AND ONE DAUGHTER DIED OF "FAMILIAL CANCER OF THE PANCREAS". GENETIC TESTING SHOWED THAT THERE WAS A WELL-KNOWN FORM OF MUTATION PRESENT, ONE THAT CAUSES NOT ONLY FAMILIAL PANCREATIC CANCER, BUT ALSO MALIGNANT MELANOMA OF THE SKIN. SO FAR, 2 GRAND-DAUGHTERS HAVE TURNED UP WITH MALIGNANT MELANOMAS, AND WILL HAVE TO BE MONITORED FOR PANCREATIC CANCER FOR THE REST OF THEIR LIVES. IF THESE DAUGHTERS WERE TO HAVE CHILDREN, THEY COULD PASS THE MUTATION ON TO ANOTHER GENERATION. — — OF COURSE WE DON'T KNOW THAT STRAY RADIATION CAUSED THE ORIGINAL MUTATION, BUT WE DO KNOW THAT RADIATION IS QUITE CAPABLE OF DOING THIS.

SLIDE 11: SOME PEOPLE IN THE NUCLEAR INDUSTRY WOULD NOT ONLY SAY THAT LOW-DOSE RADIATION IS OF NEGLIGIBLE RISK, BUT THAT IT'S ACTUALLY BENEFICIAL, PROVIDING A PROTECTIVE EFFECT. THEY BASE THIS ON SOME LABORATORY STUDIES IN CERTAIN ANIMALS, WHERE UNEXPECTEDLY LOW CANCER RATES WERE FOUND WITH RADIATION