NOVEL CHALLENGES: YUCCA MOUNTAIN DOSE LIMIT TO THE PUBLIC

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RADIOLOGICAL PROTECTION STANDARDS

It has Been a Long Standing Policy of the United States Government That High Level Radioactive Wastes be Disposed in a Deep Underground Geologic Repository

Desiring to Ensure That the Public Would be Protected, the U.S Congress in 1992 Requested That the National Research Council (NRC) Advise the Environmental Protection Agency on Standards for the Proposed Yucca Mountain Facility

RESPONSE OF THE NRC

The NRC Recommended That the Standards be Expressed in Terms of Health Risks, Not Dose, the Reason Being That:

- A Risk Limit Would not Need to be Revised, Should the Risk per Unit Dose Change

RESPONSE TO THE RECOMMENDATIONS

While the NRC Recommendations Appeared to be Sound, Questions Arose as How They Could be Implemented

That is, How Difficult Would it be to Develop and Apply a Risk Standard?

FACTORS TO BE CONSIDERED

- The Epidemiological Studies of the Survivors of the WW II Atomic Bombings in Japan Serve as the Basic Source of Information on Health Effects (Risk)
- Prior to Being Applied to the Risks of Radionuclide Releases From a Proposed High-Level Radioactive Repository, the Japanese Observations Must be Made Applicable to the Population Being Exposed

APPLYING THE JAPANESE OBSERVATIONS ELSEWHERE

Step #1: The Health Effects due to High Doses & Dose Rates Must be Modified to Those for Low Doses & Dose Rates

Step #2: The Increase in Cancer Risks Due to Radiation Exposures of the Japanese Population Must be *Spatially* Translated into What Would be Expected in the Population Being Considered

APPLYING THE JAPANESE OBSERVATIONS ELSEWHERE

Step #3: The Cancer Risks Associated with the Proposed Dose Rates Must be *Temporally* Projected on the Basis of the Baseline Cancer Rates Anticipated to Exist in the Exposed Population at the Time the Risk is to be Assessed

Why is the Baseline Rate of Cancers Important?

APPLYING BASELINE RATES

According to the Relative Risk Model, the Risk of Cancer due to Radiation Exposure of a Specific Organ is Proportional to the Baseline Rate for Cancer in That Organ

If, for Example, a “Unit Dose” Increases the Baseline Rate by 10% in the Japanese Population, It Will do the Same for the Baseline Rate in Another Population

FACTORS INFLUENCING BASELINE CANCER RATES

Determining the Baseline Cancer Rates Requires Information on Multiple Factors:

- The Racial Composition of the Exposed Population in Terms of Prostate and Skin Cancer (Melanomas)
- The Personal Habits, Including Diets, Exercise, and Obesity, of the Exposed Population

OTHER INFLUENCING FACTORS

- Specific Body Organs for Which Vaccines for Cancer Have Been Developed (For Example, Cervical Cancer)
- The Fraction of the Children Who are Vaccinated for Chronic Hepatitis C (Liver Cancer)
- The Age at Which Mothers Have Their First Baby (Breast Cancer)
- The Percentage of the Population Who Smoke Cigarettes (Lung Cancer)

CHANGES IN BASELINE CANCER RATES

Historically, the Baseline Risks for Fatal Cancers of the Colon, Lung, and Female Breast Were Higher in the U.S., Than in the Japanese, Population

Following World War II (1950 – 1998), the Baseline Rates for Fatal Cancers in These Organs Among the Japanese Population Increased Significantly

RATE AT WHICH CHANGES OCCURRED

- These Changes Were Attributed to the Fact That the Japanese Population Was Adopting Many of the Characteristics of the U.S. Population – Especially in Terms of Dietary and Smoking Habits
- Undoubtedly, These Types of Changes Will Continue

IMPLICATIONS OF THESE OBSERVATIONS

- It Will be Impossible to Predict the Health Impacts of Ionizing Radiation Exposures, for a Specified Dose Rate, More Than 5 to 10 Decades From Now
- While it Will be Easier to Estimate Future Doses Than Future Risks, the Risk Will be the Primary Factor of Concern

IMPLICATIONS OF THESE OBSERVATIONS

- While the Inability to Predict the Risk is a Major Problem, There is one Consolation
- Methods for the Prevention of Cancer (Vaccines), and Medical Therapies for Curing, Some of the More Common Cancers Existing Today are Expected to Continue to be Developed

IMPLICATIONS OF THESE OBSERVATIONS

- As a Result, the Risk (Cancer Deaths) per Unit of Dose are Expected to Continue to be Reduced
- In Fact, it Could be That, Should a Large Nuclear Facility Experience a Major Failure 100 to 200 Years From Now, the Fatal Cancer Risk of the Associated Radionuclide Releases may be Minimal

IMPLICATIONS OF THESE OBSERVATIONS

- That is to Say, it Could be That, for Nuclear Facilities That Represent Potential Sources of Prolonged Radionuclide Releases, the Projected Time of Maximum Doses May Actually Represent the Time of Minimum Risks
- On This Basis, it Would Appear that Risk is the Proper Basis for Expressing Standards for Protecting the Population