ENVIRONMENTAL SURVEILLANCE REPORT

ANALYSIS OF WELL-WATER FOR RADIOACTIVITY

ORACLE AGRICULTURAL CENTER

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Waste Facility Background:

In 1962, the University of Arizona first used its Radioactive Waste Burial Facility on the Page-Trowbridge Ranch, now known as the Oracle Agricultural Center (OAC), under a license issued by the U.S. Atomic Energy Commission. (Licensing authority was later transferred to the Arizona Atomic Energy Commission, which eventually became known as the Arizona Radiation Regulatory Agency (ARRA)). Routine use of the Facility for radioactive waste disposal began in 1966. About the same time, the University initiated disposal of hazardous waste at the same facility through neutralization and open-pit burning.

Monitoring History:

In early 1979, the Radiation Control Office decided that it would be prudent to sample wells in the Oracle Junction area. Initially, a list of eight wells in that area was assembled based upon hydrological records. This list included three City of Tucson wells, three Falcon Valley Ranch wells, and one well each on the Goodman Ranch and Martin Ranch. (The latter property may have been known as the Nelson Ranch during the well selection process.) The first samples were collected from the three Falcon Valley Ranch wells, Martin Ranch and Goodman Ranch. Although the date of sample collection was apparently not recorded, the date of analysis was April 5, 1979.

Criteria for final selection of sampling wells included:

- those closest to the OAC
- those for which we had owner permission
- those with locations in the direction of Tucson
- those that had reasonably convenient access.

The wells selected for continued monitoring were:

Falcon Valley Ranch Well (at the Falcon Valley Ranch headquarters)
Catalina Well (owned by Falcon Valley Ranch, off Hwy 77 on east side, north of milepost 92.)
Oracle Junction Well (well owned by Arizona Water Company at Oracle Junction serving Oracle)
Tucson Water Well I-2 (well owned by the City of Tucson located in Catalina behind the 'Lariat Inn')
Goodman Ranch Well (on Goodman Ranch, later known as Eagle Crest Ranch, north of Catalina)

Oral authorization was obtained from all well owners. Later, a written agreement was established with the City of Tucson. In the mid-1980's, the Goodman Ranch became known as Eagle Crest Ranch. Access eventually became a problem, and sampling at that location was discontinued at the end of 1986. The Tucson I-2A well was also replaced by the Tucson I-2B well at the same site.

In the mid-1980's, the University's Department of Risk Management and Safety, having responsibility for hazardous waste disposal, drilled four monitoring wells adjacent to the facility under a requirement of the US Environmental Protection Agency and the Arizona Department of Environmental Quality (ADEQ). Routine monitoring of these wells for radioactivity began in May 1985. Local opposition to the site resulted in a decision by University of Arizona President Koffler to discontinue use in 1986 and close the facility. In 1990, on-site monitor well #1 was replaced with well #5. In 1999, the sampling frequency for radioactivity analysis changed from monthly to quarterly for the off-site wells, as authorized by ARRA. About the same time, the sampling frequency for hazardous materials analysis briefly changed from semi-annual to annual for the on-site wells, as initially authorized by ADEQ. However, the University subsequently reinstated a semi-annual sampling frequency. These samples are also analyzed for radioactivity.

Sample Analysis Discussion:

The attached report includes data obtained by liquid scintillation counting (LSC) of the well water samples. Due to the small quantities of naturally-occurring radioactive materials being present throughout the environment and the nature of radioactivity analysis, one can never prove the total absence of man-made radionuclides. Such analyses will provide either an estimate of the quantity present or indicate that the level is below a calculated lower limit of detection (LLD) for the counting system. When a sample activity greater than the LLD is detected, either the sample is recounted or another replicate sample is prepared and counted if adequate sample is still available. The LSC analysis was used to specifically assess the levels of ^{3}H and ^{14}C primarily, although all other materials will be detected if they exceed the LLD. Currently, ~99.9% of the remaining radioactivity in the material buried at the site is ^{3}H and ^{14}C.

In the earlier data, samples were counted on a two-channel LSC system, in which Channel A data represents ^{3}H with all other radionuclides appearing in a second channel, identified herein as Channel C. More recent samples have been counted on a three-channel LSC system, in which Channel A represents ^{3}H, Channel B data represents ^{14}C, and all other radionuclides appear in Channel C. While other radionuclides may appear in Channels A and B, the predominance of ^{3}H and ^{14}C in the remaining radioactivity buried at the site make this analytical approach a very reliable one. All "Value" and "Sigma" data are expressed in picocuries/liter (pCi/l) of water. The "Sigma" (σ) values are one standard deviation, providing an indication of the statistical accuracy of its corresponding specific activity "Value".

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The drinking water limits established by the U.S. Environmental Protection Agency are 20,000 pCi/l for ^{3}H and 2,000 pCi/l for ^{14}C. These limits are those specific activities (concentrations) that can result in a 4 mrem dose to a person consuming 2 liters of water/day for a year. When two or more radionuclides are present, the stated limits are adjusted by the relative percentages of the radionuclides present.

Conclusions:

The geological, hydrological, and climatological characteristics of the Oracle Agricultural Center are such that there is no significant downward migration of disposed materials. However, even if there were such migration, virtually all of the radioactivity would have decayed to levels indistinguishable from background in the several hundred to thousands of years required for such migration to reach the water table.

The attached data indicate that no radioactivity appreciably above background has been detected. This is consistent with the characteristics of the site and research regarding migration of chemical substances in arid environments.

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