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URI, INC.

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September 17, 1990

Mr. Robert J. King, Director
Office of Natural Resources
Department of Agriculture
P.O. Box 12847
Austin, Texas 78711



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Dear Mr. King:

Although Uranium Resources, Inc. (URI) and other uranium mining firms were invited somewhat earlier to meet with on this date to discuss a report being prepared by you for the Texas Department of Agriculture pertaining to the agricultural and rural impacts of uranium recovery activities in Texas, URI's participation in the review of your study has been seriously limited by the fact that URI did not receive a copy of your study nor did it receive a copy of your executive summary until approximately a week before the meeting. Nevertheless, based upon a rapid review of the ten page, single-spaced executive summary which we have seen, we would like to offer the following preliminary observation:

1. The executive summary begins with a subsection entitled "Background" which seems both hasty and conclusory. At a minimum, a background review comparable to that prepared by the Texas Water Commission in its publication describing underground injection activities in Texas would be appropriate. In addition, the description of the uranium industry and its member firms is so superficial that it is pointless. Likewise, the observation as to the condition of the industry in terms of mines or mine sites and production is a truly useless litany of claims, unless, of course the underlying report demonstrates the significance of the particular statistics which are collected in the summary. Finally, in regard to the background statement, the comment that the "industry has gained ample financial rewards" is remarkable for its superficiality. Once again, perhaps the underlying report will disclose what the writer had in mind, but the information capsuled in the summary is simple a conclusory, non sequitur.

2. In the following subsection, entitled "Concerns Leading to Study," it is clear once again what is needed is the underlying study rather than the document provided. It appears from the text that the writer is not familiar with the definitions of such important terms as radioactive waste and hazardous waste and has no particular appreciation for the manner in which those wastes

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Certified By *Mary C. Hood*

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are handled, either in the uranium mining industry or in other industrial processes. Furthermore, given the volumes and masses of hazardous waste reported to be generated or disposed in Texas, the volumes or masses of by-product material or hazardous wastes resulting from uranium recovery activities in South Texas are rather small and have been managed with considerable success.

It is remarkable that a study of the agricultural and rural impact of uranium recovery activities in south Texas could be commenced or concluded without ever having focused clearly on any single problem or potential problem posed by the lawful operation of uranium recovery activities. Furthermore, it does seem important to note that even if some particular problem or problems were identified at particular sites, there are mines currently in operation which have been designed and operated in an environmentally sound manner. This fact alone indicates that the regulatory program of the state, exercised at various times through the Texas Department of Health, the Texas Water Commission, and the Texas Railroad Commission, can be successful in protecting the public interest.

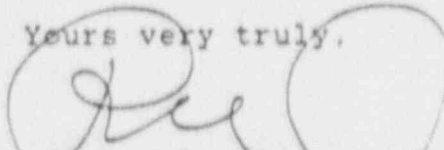
3. The report presents two "overall findings". The fact that the south Texas economy depends on its environment comes as no surprise; Texans have for years managed the land to support such multiple and potentially conflicting uses as farming and ranching, hunting, fishing, tourism, oil and gas production, and related activities. Managing the land for the additional benefits of environmentally sound uranium recovery activities does not present either a novel or an unusually difficult problem.

4. The second "overall finding" of the executive summary seems to confess that the writer cannot reach any conclusions based upon existing data and then suggests that in default of certain policy and technical recommendations may be in order. The fact that the writer of the executive summary was unable to reach a conclusion should, however, be taken more as an autobiographical statement rather than a professional conclusion drawn by a qualified expert upon review of the data. Although the writer may have been unaware of previous studies in the area, a number of studies are well known and indicate that uranium mining may be practiced under certain safeguards and constraints without any long-term adverse environmental consequences. These studies are important, not because they preclude any further research, but because when they are borne in mind, the importance of the following recommendations for further precaution and study lose much of their import.

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5. As a general reflection, it is unfortunate that the writer of the TDA study has not provided the underlying study for review and examination so that the community of persons knowledgeable in the various facets of the matter could provide commentary upon the analysis. However, given the fact that the study was not provided, it is the more remarkable that a so-called executive summary was circulated. This is backwards from the usual course of honest investigation and suggests perhaps even if erroneously, a substantial bias on the part of the investigator.

Yours very truly,



Richard F. Clement, Jr.
Senior V.P./-Exploration

RFC/dlg

cc: Ms. Sara Hana
Department of Agriculture

Mr. Jephtha Hill
Hill, Seals & Bartlett, P.C.

Mr. David Lacker
Texas Department of Health

DRAFT

Agricultural and Rural Impacts of Uranium Recovery Activities in the South Texas Uranium District

EXECUTIVE SUMMARY

BACKGROUND

- Since 1954, a variety of exploration, development, production and restoration activities for uranium minerals, including uranium mining, milling, and waste disposal operations have affected thousands of acres in 18 South Texas counties.
- The uranium industry expanded until 1979 when the price of uranium oxide reached its peak, and in 1984 the market crashed.
- By 1990, ten firms previously involved in Texas mining activities were no longer involved in the uranium business. The current Texas uranium industry consists of nine corporations with two actively producing uranium oxide, one involved in processing activities, one on standby status, and eight of the nine companies actively engaged in various stages of reclamation and restoration of previously mined areas.
- The uranium industry in Texas consists of both solution mining and conventional mining. The legacy of uranium solution mining industry in Texas now consists of: one mine site in production; two mine sites under construction; 16 solution mining sites being restored; seven plugged and abandoned solution mining sites; 32 deep well injection waste disposal sites; five wastewater irrigation sites; two surface water discharge permits for solution mining wastes; and 34 aquifer exemptions. This represents a Texas total of 32 solution mining sites, 80 production areas, and approximately 20,000 solution mining wells. The conventional uranium mining industry in Texas consists of a total of 40 mine sites and 31,000 acres of land permitted since 1975, which includes: one conventional mine site in production; one active uranium mill site; one active mill tailings disposal pond; one inactive mill site; one conventional mine site in temporary cessation; three sites with inactive mill tailings disposal ponds; one conventional site scheduled for joint federal and state remedial action; and one site currently being investigated for federal remedial action. In addition, prior to 1975 various unpermitted and virtually unregulated uranium mining activities were conducted in Texas, which resulted in a presently undetermined number of abandoned uranium mill sites, surface and underground mine sites in South Texas.
- The South Texas uranium industry has gained ample financial rewards from its mining, milling and waste disposal activities. For the years 1980 through 1988, it is estimated that the South Texas uranium industry received more than one billion dollars in revenue from its activities in Texas. Corporate fiscal responsibility calls upon industry to share the research and analysis costs of determining Texas uranium industry impacts and addressing the existing relevant scientific, medical, technical and regulatory uncertainties associated with its activities.

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Agricultural and Rural Impacts of Uranium Recovery Activities in the South Texas Uranium District

EXECUTIVE SUMMARY

BACKGROUND

- o Since 1954, a variety of exploration, development, production and restoration activities for uranium minerals, including uranium mining, milling, and waste disposal operations have affected thousands of acres in 18 South Texas counties.
- o The uranium industry expanded until 1979 when the price of uranium oxide reached its peak, and in 1984 the market crashed.
- o By 1990, ten firms previously involved in Texas mining activities were no longer involved in the uranium business. The current Texas uranium industry consists of nine corporations with two actively producing uranium oxide, one involved in processing activities, one on standby status, and eight of the nine companies actively engaged in various stages of reclamation and restoration of previously mined areas.
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Precautions to Protect Public Health and Safety

o Uranium mining contaminants can be transported to people through air, food and drinking water. People and livestock who eat contaminated food, drink contaminated water or breathe contaminated air receive a radiation and/or chemical "dose." The agricultural pathway with the greatest potential for long-term impacts on humans from mining contaminants is through the food chain. The limited agricultural food product sampling that has been conducted in South Texas around uranium industry activities is insufficient to accurately assess food product quality and safety. In order to begin to evaluate actual impacts on agriculture and rural communities resulting from South Texas uranium industry activities, food product quality and consumer safety uncertainties must be resolved.

Recommendation 1

The Texas Legislature should secure funding for the state regulatory agencies involved in uranium industry oversight - the Health Department, the Railroad Commission, the Water Commission - as well as the Texas Department of Agriculture, to initiate a cooperative agricultural food product sampling program. This recommended cooperative program would consist of routine sampling of forage vegetation and foods, such as, meat, fish, milk, crops and plants grown near uranium extraction facilities. The Texas Department of Agriculture should help design, develop and manage the agricultural food product sampling program.

Recommendation 2

Until South Texas food product quality and safety can be determined, the Texas Legislature should secure funding to direct the Texas Animal Health Commission or appropriate state agency to take actions to restrict the access of livestock to uranium mine waste water effluents and to land that has been irrigated with mine water or is in proximity to mill tailings. This action should significantly reduce the probability of food chain contamination.

Recommendation 3

To remedy the lack of accurate health-risk information on radiation and chemical-induced illness, the Texas Legislature should provide funds for the Texas Health Department, University of Texas Medical Branch at Galveston (UTMB) and the LBJ School of Public Affairs to conduct cooperative research and development in order to implement an industry-funded health care monitoring system. This health care monitoring system would track South Texas citizens at risk from radiation and chemical-induced disease and illness, provide routine and preventative medical care and ensure reasonable compensation to the injured. The cooperative research and development activities should focus on defining implementation costs, health care services, funding mechanisms and compensation structures.

o Current drinking water standards and maximum contaminant levels established under the Safe Drinking Water Act only apply to water delivered by public systems. There are no drinking water standards or maximum contaminant levels for private wells. In addition, no public or private maximum contaminant levels in drinking water have been established for uranium or radon.

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Recommendation 4

The Texas Legislature should provide funding for the Texas Department of Health and the Texas Department of Agriculture to develop a public education and outreach program designed to reduce or eliminate rural health impacts that may result from long-term, low level exposures to uranium industry contaminants in private well water. This program would increase public awareness about groundwater quality issues, the reasons for particular water quality, the sources of drinking water, and practical measures, such as at-source treatments, that people can take to improve drinking water quality. Additionally, this public education program should provide assistance to allow private well users to have their drinking water tested relative to Safe Drinking Water standards. Private well water testing should be provided at no cost to the user. For private wells in proximity to uranium extraction facilities, water testing and analysis costs should be required, as part of the permit process, to be paid by the uranium industry.

Recommendation 5

The Texas Department of Health should actively encourage, pursue and support EPA efforts to establish maximum contaminant levels (MCLs) in drinking water for uranium and radon. In the interim, it is recommended that the Department of Health establish state MCLs for uranium and radon and provide guidance to EPA in the development of federal MCLs for uranium and radon. In addition, the Texas Health Department should carefully monitor, collect, document and catalog the presence of uranium and radon in groundwater wells in the vicinity of active and inactive uranium facilities. When EPA establishes drinking water MCLs for uranium and radon, these "pre-regulatory" monitoring efforts will provide comparative information on water quality and radiation dose estimates.

o *Language in Section 3001(b)(3)(A)(ii) of Resource Conservation and Recovery Act (RCRA), often referred to as the Bevill Amendment, exempts mining wastes resulting from the extraction, beneficiation and processing of ores and minerals from regulation as hazardous waste under RCRA. As a result, conventional and solution uranium mining wastes have been, and are currently, exempt from regulation as hazardous wastes under RCRA. This regulatory exemption is of concern since in addition to their radioactive properties, uranium industry wastes contain a number of heavy metals, organic solvents, and acids which are either listed as RCRA regulated materials, or meet the hazardous characteristics under RCRA.*

Recommendation 6

The Texas Legislature should call for a repeal of the Bevill Amendment, in order to narrow the scope of the exclusion and remove uranium industry wastes and materials from the Bevill exclusion. Furthermore, due to the hazardous nature of the non-radioactive portions of uranium industry wastes, the Texas Water Commission, in coordination with the Texas Health Department and the EPA, should be directed to develop and implement a regulatory program for uranium exploration, mining and milling wastes and materials under RCRA authority. State and EPA resources should be maximized, regulatory gaps should be filled, and effective state and federal programs currently in place should be recognized. This recommended RCRA regulatory program should incorporate an integrated approach to uranium industry activities that

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addresses air, surface water, groundwater, agricultural food product and soil contamination. In order to ensure that this program is protective of human health and the environment, federal oversight and enforcement authorities may be necessary.

o Numerous scientific and medical studies have detected excess lung diseases, cancers and cancer mortalities among uranium miners, in comparison with nonexposed populations. However, inadequacies exist in providing compensation to individuals who have contracted radiation-induced disease and illness as a result of employment in uranium mines. These inadequacies have prevented many uranium miners and their families from receiving compensation for health problems and losses associated with uranium mining activities. Federal compensation legislation for uranium miners has been proposed in the Congress since 1979.

Recommendation 7

The Texas Legislature should support and direct the development of federal and state compensation legislation for uranium miners and others who contract radiation induced illness attributable to industrial processes, releases, or operations.

Proposals for Continued and Increased Research and Analysis

o Current regulatory environmental monitoring programs may not reliably detect noncompliance, violations or determine the presence and extent of contamination. Environmental monitoring inadequacies have been noted at a number of active and inactive uranium facilities. Since an independent and comprehensive assessment of the adequacy of all environmental monitoring programs at Texas uranium facilities has not been conducted, similar monitoring inadequacies may exist at other uranium facilities. Moreover, since the discovery of Texas uranium more than 35 years ago, changes and inconsistencies have occurred in state regulatory jurisdiction, joint regulatory programs and environmental monitoring activities. In addition, significant modifications to uranium industry operations and environmental monitoring technologies have occurred. In light of this evolutionary process, it is important to analyze the impacts that these vital changes may have had on consistency and regulatory structure in the Texas uranium industry.

Recommendation 8

The Texas Legislature should allocate funding sufficient to direct an independent party to conduct a comprehensive assessment of the adequacy of current environmental monitoring programs at Texas uranium recovery facilities. The two main objectives of this independent analysis are: 1) to determine if the current monitoring programs are adequate to protect public health and safety; and, if necessary, 2) to enhance and improve the state monitoring programs to ensure that public health is protected. In order to accomplish this recommendation, state environmental measurements programs, methods and data for all South Texas uranium recovery operations must be reviewed and analyzed. This analysis would also involve a comprehensive review of all industry files, since significant portions of state environmental monitoring programs are based on industry data.

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This review and analysis must determine whether all state environmental monitoring programs for ground- and surface water, air, vegetation, food products and soil are based upon and satisfy performance standards and provide representative information. It is further recommended that a comprehensive review and analysis of hydrogeologic characterization data at all active and inactive uranium mine sites be conducted in conjunction with the groundwater monitoring assessment of the environmental programs review.

Additional activities necessary to fulfill this recommendation include evaluating state uranium mining environmental program goals, structures, schedules and the evolution of Texas regulatory environmental monitoring programs. Cost-effective solutions to update state monitoring programs and technologies to 1990 standards at all uranium facilities should be identified. In addition, uranium facility performance standards established by each state agency should be evaluated and modified, if necessary, to reflect interagency consistency, technological advancements and improvements in knowledge regarding long-term site performance. This independent analysis should include an assessment of the post-restoration monitoring, testing and aquifer studies to be conducted by the Texas Water Commission under Recommendation 13.

o *It appears that insufficient pre-mining environmental information has been collected at a number of Texas uranium mine sites. Furthermore, of the limited data that are available, nearly all are self-reported by industry. Uranium mining impacts can not be accurately determined without adequate environmental data on pre-mining conditions. Additional knowledge of pre-mining environmental conditions is necessary for baseline ground- and surface water, soil, air, vegetation and food products.*

Recommendation 9

The Texas legislature should provide funds for the University of Texas at Austin Bureau of Economic Geology (BEG) to collect and consolidate pre-mining, natural background environmental monitoring data from all industry and regulatory sources. Where data are lacking, it is recommended that BEG acquire natural background environmental data through direct basic research and field work. A comprehensive and integrated evaluation of the background data should be performed to establish baseline parameters for all conventional and solution uranium facilities. The collection and consolidation of natural background environmental data should include the development and maintenance of an environmental data base. The environmental data base should be made available for public input, review and comment.

o *A complete absence of state environmental monitoring data trend analyses was noted during this investigation. Trend analyses are important to evaluate how environmental conditions and contaminant concentrations have changed over time. Environmental monitoring data trend analyses are essential to accurately determine the impacts associated with Texas uranium industry operations. In order to perform environmental data trend analyses, environmental monitoring data are collected, consolidated, graphed chronologically and evaluated for significant changes in natural or pre-mining conditions. Background environmental data, collected under*

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Recommendation 9, are necessary in order to perform accurate trend and impact analyses of Texas uranium activities.

Recommendation 10

The Texas Legislature should allocate funds sufficient to enable the BEG to graphically compile all Texas uranium mining environmental monitoring data and provide written statistical trend analysis evaluations on a site-by-site basis. Statistical trend analyses should include the natural background data acquired in Recommendation 9, historical and current environmental monitoring data collected during operations, and other applicable post-operational data. The compilation of uranium mining environmental monitoring data should be coordinated with and incorporated into the previously recommended environmental data base. A final evaluation report should be submitted by BEG which summarizes overall environmental data observations and evaluations.

o *The number and extent of health effects caused by ionizing radiation and chemicals at low doses and dose rates are presently unknown and unlikely to be precisely quantified in the immediate future. However, it is widely accepted in the scientific and medical communities that ANY dose of radiation may produce harmful human health effects. The combination of low doses of chemicals and ionizing radiation may increase harmful health effects. Recently, the National Academy of Sciences' Committee on the Biological Effects of Ionizing Radiations (BEIR) noted in its 1990 report that harmful radiation-induced health effects may even increase with decreasing dose and dose rate. The 1990 BEIR report recommends that radiation-induced human health effects studies of internally deposited radionuclides should continue.*

Recommendation 11

The Health Department and UTMB should continue to conduct scientifically valid health effects studies on radiation and chemical-induced illness in Texas. These health effects studies should be designed to determine health risks of the general public from uranium mining and radioactive waste disposal and monitor the short and long term health of South Texas citizens living in the vicinity of uranium facilities.

o *Comprehensive dose estimates have not been conducted for South Texas citizens in the Uranium District. Developing dose estimates is an important step to finding the facts about people at risk. Without comprehensive dose estimates it is difficult, if not impossible, to determine health risks. South Texas dose estimates would determine what radiation and chemical doses from uranium mining activities have been received by people in the area. Dose estimates alone would not link any particular person's health problems to radiation or chemical doses from uranium mining, but would indicate those who may be adversely affected by uranium industry materials in the environment. Dose estimates help provide the basis for conclusive health effects studies. Dose estimates research would benefit the ongoing UTMB-Health Department health effects study, "Potential for Health Risks in Residents Exposed to Uranium Mining Waste" because it would estimate how much radioactivity and chemicals from uranium industry activities have reached people in South Texas. Dose estimates provide an important connection between harmful*

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health effects and exposure and can be used to determine which people are at greatest risk for adverse health effects. Calculating comprehensive dose estimates for people in the South Texas Uranium District would be an enormous undertaking with the potential for both national and international health implications. However, dose estimates are an important link to health risks, and yet they are not currently proposed to be conducted in conjunction with the uranium mining health risk study.

Recommendation 12

The Texas Legislature should provide funding to undertake research on dose estimates for South Texas citizens. The Health Department and UTMB in cooperation with the Texas Department of Agriculture should determine the feasibility of performing historical and cumulative dose estimates for people in the South Texas Uranium District. The dose estimate research should be conducted in coordination with the ongoing Health Department-UTMB health risk studies. It is recommended that these dose estimates consider environmental data and the following factors which influence the actual doses received by people:

1. Food consumption - the actual diet, which includes the amount and types of food and water consumed;
2. Food distribution - the processing of foods before sale and the final destination of contaminated foods;
3. Radioactive decay - the quantity of contaminated material in the environment, food and the human body may be reduced, depending upon the half-life of the material;
4. Dose factors - different contaminants react in different ways in the human body depending on biological functions and internal deposition sites;
5. Age and gender - differences in food consumption, metabolic processes, organ size and body weight.

o *Currently there are no long-term environmental monitoring or extended care provisions for restored solution mining sites or deep-well injection sites, as there are for mill tailings ponds.* The purpose of long-term monitoring for solution mining sites would be to detect any unforeseen degradation of water quality and to determine the migration rate of dissolved contaminants. Without extended monitoring, potentially harmful aquifer contamination from solution mining activities may remain undetected.

Recommendation 13

The Texas Legislature should designate earmarked funds for the Texas Water Commission and an independent party to conduct limited, long-term post-restoration testing and monitoring at solution mining sites. The Texas Legislature should also direct the Water Commission to conduct complete and extensively documented studies of uranium mining restoration efforts, aquifer sensitivity to mining degradation and the long-term impacts on mined and restored aquifers.

o *Final, complete and interagency approved closure, reclamation and long-term care plans are not required prior to the issuance or renewal of solution and conventional uranium facility operating permits and licenses.* A primary purpose of closure and restoration efforts is to achieve site stability. However site stability is a time-dependent concept. Closure, reclamation and

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long-term care cannot be viewed independently because, as the quality of closure and reclamation efforts increases, long-term care costs and levels of extended effort decrease. In addition, closure, reclamation and long-term care plans are submitted for final approval following a licensee's notice of intent to close, and closure activities may proceed without a completed closure plan. There is reasonable cause for concern because this fragmented approach fails to link front-end activities to long-term management strategies.

Recommendation 14

The Texas Water Commission, Health Department and Railroad Commission should enact and enforce a requirement for new and existing licensees and permittees that, prior to the issuance or renewal of uranium facility operating licenses or permits, each uranium facility must have final, complete, interagency approved and integrated closure, restoration and long-term care plans in place, unless immediate threats to public health and safety prevent it. In the absence of license or permit renewals for existing facilities, final, complete, interagency approved and integrated closure, reclamation and long-term care plans should be in place prior to the commencement of closure activities. Restoration, closure, and perpetual care plans should be regarded as integrated and dynamic documents subject to change with changes in technologies, license conditions and/or regulations. The Water Commission, Health Department and Railroad Commission should establish a schedule for the periodic review of closure, restoration and long-term care plans.

o *The disposal of chemically hazardous and radioactive materials other than uranium mining wastes in Texas mill tailings ponds has altered the radioactive inventory and chemistry of the tailings ponds, which complicates waste containment, site closure and long-term care. Adequate tailings pond characterization and waste inventory are essential to long-term environmental care and public health.*

Recommendation 15

Routinely after the issuance of a uranium recovery facility license or permit, each regulatory agency with jurisdiction should require characterization of wastes generated and materials placed in tailings or on-site industrial waste ponds to be conducted by the site operator. This characterization should be the basis for establishing all site specific performance standards. Waste and materials characterization should include: toxic metals; a measure of acid generation potential; and radionuclides generated, handled and/or disposed. In addition, the applicable agency should require periodic written waste characterization reports to be submitted by the site operator.

o *Although the uranium industry has provided short-term economic benefits to a few corporations and landowners in South Texas, the potential remains for long-term adverse environmental impacts in the region. Additionally, the industry has received substantial revenues from uranium mining in Texas - estimated to be over one billion dollars, for the years 1980 through 1988. Yet, the average income of residents in the uranium district is among the lowest in the state - estimated at \$10,000 annually.*

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Recommendation 16

The Texas legislature should provide funds to initiate a cooperative program between the Texas Department of Agriculture, South Texas citizens and local governments to design and conduct economic diversification research and development projects for counties in the South Texas Uranium District. This economic research and development should investigate methods to encourage local economic diversification and enhance sustainable uses of the land. Research and development should concentrate on reducing regional dependence on short-term economic activities that deplete and contaminate renewable and non-renewable natural resources, and focus on long-term economic activities that conserve natural resources, and enhance the productive capacity of this region.

SARAH L. HANA
1730 E. Oltorf #215
Austin, TX 78741
Home: (512) 443-8474

-CAREER OBJECTIVE-

Executive level responsibilities involving development of technical and policy directives within the environmental protection, preservation and resource management fields.

-PROFESSIONAL EXPERIENCE-

Demonstrating 10 years of progressive responsibility and achievement in the following capacities:

RADIATION HEALTH PHYSICIST: Washington State Department of Ecology, Nuclear and Mixed Waste Program, Low-Level Radioactive Waste Group.

- > Represented Washington State in national Host State Technical Coordinating Committee for Low-Level Waste Disposal;
- > Developed Washington State low-level radioactive and mixed waste legislation, policies & strategies;
- > Analyzed & implemented state & federal hazardous & low-level waste laws and regulations;
- > Reviewed & prepared program priority documents;
- > Established & managed projects for site operations, closure & post-closure requirements for the Hanford commercial low-level radioactive waste disposal facility;
- > Provided management and direction to technical contractors;
- > Supervised program and group staff.

1986-1989

RESEARCH ASSISTANT: Nuclear Engineering & Engineering Physics Department, University of Virginia (UVA). Analyzed radiation-enhanced corrosion of steel to assess radioactive waste package performance. Developed radiation safety procedures for cobalt-60 facility in the nuclear research reactor. Initiated radiation research for bacterial disinfection of waste water effluent.

1984-1986

SUPERVISOR: Mathematics Laboratory, Virginia Commonwealth University (VCU). Supervised teaching assistant staff. Served as liaison between faculty and students. Managed staff & student disputes. Performed administrative duties. Secured laboratory at closing.

1983-1984

TEACHING ASSISTANT/TUTOR: As staff to UVA & VCU in Nuclear Engineering, Calculus, Algebra, & Mathematics.

1980-1985

SALES REPRESENTATIVE: STAR TV - Satellite dish television sales.

1980-1981

J.C. Penney, Co. - Various departments.

1979-1983

RADIO ANNOUNCER: WVCW, 825 AM in Richmond, VA. FCC License: Restricted Radiotelephone operator permit.

1979-1980

SARAH L. HANA

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- EDUCATION/TRAINING -

M.S., ENGINEERING PHYSICS, University of Virginia, 1986. Major areas: radiation physics, nuclear & chemical engineering.

THESIS: Radiation-Enhanced Corrosion of Mild Steel in Aqueous Brine Solutions

B.S., PHYSICS, Virginia Commonwealth University, 1984. Major areas: experimental physics, advanced political science, & honors writing courses. Graduated with honors.

Earned 100% of college expenses.

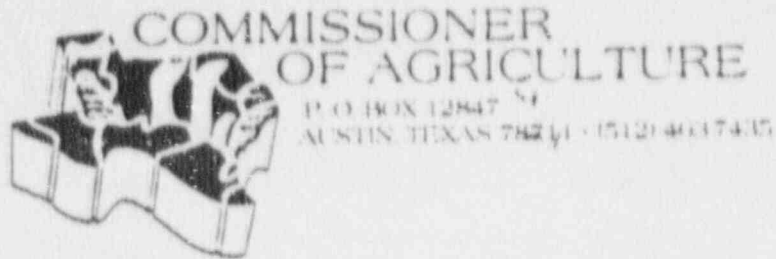
- PUBLICATIONS -

- Hana, S.L., Greer, P., Ridgway, J. "Washington's Experience in Determining Site Inventory & Subsidence Potential at the Hanford Commercial Low-Level Radioactive Waste Disposal Facility," *Waste Management Proceedings*, 1989.
- Anderson, D.C. and Hana, S.L. "Results of Washington's Phase Two Study on Closure for the Hanford Commercial Low-Level Waste Facility: Design Objectives & Cover Alternatives," *Waste Management Proceedings*, 1989.
- Singh, P. and Hana, S.L. "Site Closure & Perpetual Care of a Low-Level Radioactive Waste Disposal Facility in Semi-Arid Climate," *Hazardous Waste & Hazardous Material Conference Proceedings*, 1988.
- Carlin, E. and Hana, S.L. "Impact of Liability & Site Closure & Long-Term Care Issues on Future Siting Efforts," *Waste Management Proceedings*, 1988.
- Singh, P. and Hana, S.L. "Wind Erosion Control of Low-Level Radioactive Waste Sites," *IECA Proceedings*, 1988.
- Reda, R., Hana, S.L. and Kelly, J. "Intergranular Attack Observed in Radiation-Enhanced Corrosion of Mild Steel," *Corrosion*, 1987.
- Reda, R. and Akers, S. L. "Radiation-Enhanced Corrosion of Mild Steel," *ANS Transactions*, 1986 winter meeting.

- AWARDS & ACTIVITIES -

- > American Nuclear Society - Award of Recognition: A SIGNIFICANT CONTRIBUTION TO MATERIALS SCIENCE AND TECHNOLOGY FOR NUCLEAR ENERGY, 1986.
- > College Bowl Intramural Competitions, 1980-1984.
- > Member, The Society of Physics Students, 1981-1983.
- > Scholarship recognition: VCU Honors & Awards Convocation, 1980.

- References Available Upon Request -



September 4, 1990

Robert Bernstein, M.D., F.A.C.P., Commissioner
Texas Department of Health
1100 W. 49th Street
Austin, TX 78756-3199

Dear Commissioner Bernstein:

Thank you for sending me a copy of your June 22, 1990 correspondence with the University of Texas Medical Branch at Galveston (UTMB) regarding the Uranium Mining Health Risk Study. In that correspondence you expressed a number of concerns related to scientific inconsistencies and uncertainties associated with the UTMB proposal entitled, "Potential for Health Risks in Residents Exposed to Uranium Mining Wastes." It is my understanding that you have since begun, nevertheless, to undertake the study with UTMB as proposed. If The UTMB study is carefully peer reviewed and monitored it is our belief that some beneficial and meaningful results will emerge from the study.

I appreciate the difficult nature of the task before you. In fact, due to the numerous uncertainties associated with assessing adverse public health effects from chronic exposure to low-levels of harmful substances present in uranium mining wastes, we have ourselves concluded that definitive study results may not be achievable. However, we also understand that differences of opinion exist regarding how definitive any results will be.

As you know, the Texas legislature also directed the Texas Department of Agriculture to conduct a study of South Texas uranium industry impacts on agricultural practices and rural communities. My staff in the Office of Natural Resources has been working closely with your staff in the Bureau of Radiation Control to determine what can be done for this study. We have enclosed a copy of the DRAFT Executive Summary of our findings and recommendations for your review. In our DRAFT Executive Summary we have described options that the state may wish to exercise in order to address relevant uncertainties and enhance our knowledge regarding this complex subject. My staff would appreciate the opportunity to discuss our DRAFT Summary with your staff, and would like to arrange a meeting for the week of September 10, 1990. We will be contacting your staff in the Bureau of Radiation Control to coordinate meeting logistics.

If you wish to discuss this or any other matter, please let me know. I look forward to continuing our work together on this and other important issues.

Best regards,

Jim Hightower

Enclosure