January 3, 1975

Mr. Leonard G. Wilkerson
Minerals Leasing Specialist
Division of State Lands
1445 State St.
Salem, OR 97310

Dear Mr. Wilkerson:

The attached report is in answer to your letter of October 3, 1974. The report is not based on any field inspection. It is based on a literature search and what can be seen from a topographic map. A large portion of the report's value would lay with the report's bibliography. We have a copy of each report listed in the bibliography if you would have need to consult any of them.

If we can be of further service, please advise.

Yours truly,

Jerry J. Gray
Staff Geologist
Mined Land Reclamation

JJG/lb
encl.

January 3, 1975

POSSIBLE ENVIRONMENTAL IMPACTS FROM LEASING STATE LAND IN LAKE COUNTY FOR URANIUM EXPLORATION AND EXPLOITATION

by

Jerry J. Gray, Staff Geologist
Mined Land Reclamation

Environmental Impact From Uranium Exploration

The exploration program as outlined by Exxon letter would fall into two classes of environmental impact. The first would include such things as ground or airborne radiometric, magnetometer, gravity, geochemical and induced polarization surveys. These surveys, by their very nature, can be conducted with very little environmental impact. The impact could be compared to that caused by big game hunters in their search for deer. The second class would include such things as trenching and drilling. The impact of this could be little or great, depending upon the firm.

The mining industry's black eye has been caused, in a large part, by the visual impact of unreclaimed bulldozer trenches. From the Cox Flat quadrangle topographic map, Figure 1, it would appear that any bulldozer trenching would be visible from the Thomas Creek road. To minimize visual impact, the trenching should be done in such a way that the material removed can be replaced and the area reclaimed. Another adverse impact from the trenching could be increased erosion if the trenching is cut up and down the slope.

The major impact from drilling is in the building of access roads to the drill sites. If the drill site access is well planned and either reclaimed or incorporated into the local road net, visual and erosional impacts can be kept to a minimum. A minor impact could arise from the drilling medium; however, the amounts of the non-toxic drilling water and muds used at each site tend to be small, and it is simple to install a recycling system.

These types of activities ranging from the various types of surveys to exploration drilling, because of their small size and scatter nature, would not need a permit under the Mined Land Reclamation Law.

Fox Flat Quadrangle, Oregon,
Lake County
7.5 Minute Series (Topographic)
U. S. Geological Survey

Environmental Impact from Development of a Uranium Mine

In the mine development stage, the environmental tempo increases. A Mined Land Reclamation operating permit probably will be needed, because close spaced development drilling will be needed to outline the ore body. Permanent roads will be needed. Overburden will be stripped and disposed; office and equipment repair buildings will be built; and water control and treatment will be needed.

The formal reclamation plan presented to the Department should tend to minimize the long term environmental impacts. However, druing the short term, the major environmental impact will be the visual one. This impact is not all negative. People will drive miles to see a mine in action. The development of a formal viewing site might be something to consider.

Environmental Impact from Producing Uranium Ore

The mineral production stage includes mining and, if any, milling. During the course of the actual mining of an ore body by an open pit method, dust and noise will be produced by blasting and the movement of heavy equipment. Safety hazards of vertical walls will be created. Parenthetically, in open pit mining, the danger faced by the underground uranium miner from radon-daughters radiation, is not a problem. 4/ In an open pit, the radon-daughters do not have a chance to concentrate as they could in a poorly ventilated underground mine. 3/ If the water table is tapped, water will have to be discharged. Traffic along Thomas Creek road will increase several-fold due to the employee vehicles and to the ore trucks.

The mineral production stage can include a great amount of processing or very little. At the minimum, the ore would be crushed to a size convenient for transporting and sent out of State for further processing. The only processing would be from a primary crusher which could be located at the mine. In this case, the total environmental impact would be confined to the small area of the mine. However, if the ore is to be concentrated to yellow cake, the environmental impacts multiply a thousand-fold. It is the mill site that causes, or has the potential to cause, great and long lasting environmental damages to life. The reason for this damage is "roughly 85 percent of original radioactivity remains in the milling wastes". 2/

If a mill is built, it could draw on ore from deposits other than that which might be located on State lands. Therefore, the mill site could have a concentration of radioactivity from several sources.

The topograph map shows that the State land contains a level area along Thomas Creek that could be used for a mill site. A major environ-

mental decision for the State to make is whether or not to allow, or on the other hand, to require that if a mill is to be built, that it is to be built on State land. If the mill were to be built on State land, the State would have better long term control of the radioactive tailings and the radioactive liquid effluents.

Environmental consideration to be taken into account for the siting of a uranium concentration mill should include the following:

1. Long term control of the tailings are needed. Covering and vegetating seem to provide a good measure of control. 6/
2. Direction of the prevailing wind. Wind blowing across an abandoned tailing pile will increase the background radiation for a distance of 1/2 mile down wind. 7/
3. The tailings should not be used for construction purposes such as fill for building or sand for mortar.
4. Liquid effluents must be controlled. The report by Beverly states that the radioactivity released can be substantially reduced by recirculation of the tailing pond liquid and the liquids can be decontaminated by a barium chloride or barium carbonate circuit. Figure 2, taken from Sceva 5/ report shows that a mill located in Lake County could theoretically not need to have a discharge into a stream or into an underground water supply. This is so because, in Lake County, annual evaporation exceeds annual percipitation.

FIGURE 2 AREAS IN PACIFIC NORTHWEST WHERE ANNUAL EVAPORATION GENERALLY EXCEEDS ANNUAL PRECIPITATION

Bibliography

1. Beverly, R. G., Unique Disposal Methods are Required for Uranium Mill Waste, Mining Engineering, June, 1968, pp 52 - 56.

2. DeCarlo, Joseph A., and Charles E. Shortt, Uranium Chapter, Mineral Facts and Problems, U. S. Bureau of Mines, Bulletin 050, 1970, p.233

3. Federal Radiation Research Council Staff Guidance for the Control of Radiation Hazards in Uranium Mining Report No. 8 (rev.), 1967, 60 pp.

4. Rock, R. L., Radiation-Ventilation Relationships in Six Underground Uranium Mines, U. S. Bureau of Mines Information Circular 8413, 1969, 17 pp.

5. Sceva, Jack E., Water Quality Considerations for the Metal Mining Industry in the Pacific Northwest, Environmental Protection Agency Report No. Region X-3, 1973, 69 pp.

6. U. S. Department of Health, Education, and Welfare, Federal Water Pollution Control Administration "Disposition and Control of Uranium Mill Tailings" Piles in the Colorado River Basin, Denver, Colo., U. S. Department of Health, Education and Welfare, March, 1966, 35 pp.

7. U. S. Department of Health, Education and Welfare, Public Health Services, and U. S. Atomic Energy Commission, Joint Project and Report - "Evaluation of Radon - 222 Near Uranium Tailings Piles", March, 1969, 29 pp.

U.S. Bur. Mines State Liaison Officers News Bull. Feb. 1975

- Post:
- Return to my files

OREGON

Oregon Environmental Quality Commission Changes Rules on Amax - For several years the Oregon Environmental Quality Commission had avoided reaching a decision on approval of construction of the Amax aluminum plant at Warrenton. At one time the Commission adopted a standard of an emission of 1 pound of fluorine for each ton of aluminum produced. At a recent meeting, it suddenly proposed a zero emission standard for the plant site and the nearby Young's Bay estuary. If the standard of zero is adopted, Amax will have to abandon the project.

Gold Miners Angered by State Rules Governing Placer Mining - Recreational gold placer miners joined industrial gold miners in protests against Environmental Quality Commission plans for enforcing rules passed in January 1972 governing mining in wildernesses. These standards appear to be an administrative action without basis of law. They are far more restrictive in their provisions in regard to air, water, and noise controls than the standards being enforced statewide. Most miners, both industrial and recreational, said that if the wilderness rules are adopted, it will put them out of business, primarily because of the permit requirements and restrictive provisions.

Exxon Co. Explores for Uranium in South-Central Oregon - Exxon Co. has obtained permission from the Federal Government to explore for uranium in the Fremont National Forest in an area that surrounds a privately owned parcel of 240 acres on which the State holds mineral rights. The State Land Board has agreed to allow the company to explore the privately owned parcel for uranium. Environmental impact statements will be required on both the Federal land and the privately owned parcel should Exxon find uranium and decide to mine it.

Board Chairman Expresses Concern about Mined-Land Reclamation Law - At a recent Governing Board Meeting of the Department of Geology and Mineral Industries, the board chairman, R. W. deWeese, said "proper enforcement of Oregon's Mined-Land Reclamation Law is impossible with the income from the current fee structure." He also stated that "until the State Legislature indicates that it intends to do something, I will vote against changing the fee structure." The Board Chairman has real and sufficient reasons to be perturbed with the law. Enforcement is expected to be self-supporting through the fees collected for filing and renewal of applications; however, because of grandfather and other exemptive clauses in the Act, enforcement of the law cannot be self-supporting. To date, the owners of 1,300 sites have been contacted. Under the present statute, not more than 100 of the total will fall under the law, 300 have limited exemption, 600 have total exemption, and 300 are inactive. The State Geologist will attempt to have the law amended during the upcoming Legislative Session.

October 24, 1974

Division of State Lands
Office of the Director
1445 State Street
Salem, ORegon 97310

Attn: Mr. Leonard G. Wilkerson
Minerals Leasing Specialist

Dear Mr. Wilkerson:

Your memorandum dealing with Exxon Company applications to lease approximately 240 acres in Lake County for uranium exploration is being considered by this office and a full impact statement will be submitted. It is pertinent to point out at this time that the Exxon Company is required by Oregon State Statute ORS 517.750 et seq. to apply for and obtain a surface mining permit from the Department of Geology and Mineral Industries prior to beginning its mining development program. From the description contained in Mr. Leon Scibal's letter to the Division of State Lands dated June 7, 1974, the development program described as Phase II is considered to be a permit requiring activity. The exploration program described as Phase I would probably be exempt as provided by ORS 517.750 (11).

The permit requirements include the submission and approval of the development and reclamation procedures and extend, not only to the lands leased from the State of Oregon but would also include National Forest Service lands. This latter requirement is detailed in the memorandum agreement between the National Forest Service and the State of Oregon, Department of Geology and Mineral Industries, dated July 1, 1973, and also the National Forest Service regulations 36 CFR Part 252.

Should the Division of State Lands lease the parcels described to the Exxon Company, these requirements should be referenced.

Sincerely,

Standley L. Ausmus
Administrator
Mined Land Reclamation

SLA/lb

October 24, 1974

Mr. Leon L. Sciba
The Exxon Company
Minerals - Exploration
P. O. Box 120
Denver, Colorado 80291

Re: Applications for State leases, Lakeview
Project 3614, Lake County, Oregon

Dear Mr. Sciba:

The applications to lease all minerals except coal, oil, gas and sulphur on behalf of the Exxon Corporation on lands in Lakeview County, Oregon, described as:

Township 38 South, Range 18 East

Section 1: $SW\frac{1}{4}SE\frac{1}{4}$, $S\frac{1}{2}SW\frac{1}{4}$
Section 12: $N\frac{1}{2}NW\frac{1}{4}$, $NW\frac{1}{4}NE\frac{1}{4}$

has been referred to this office from the Oregon Division of State Lands for impact evaluation and comment. We are preparing a full response to the Division of State Lands but I would like to take this opportunity to advise you of the requirements of the Oregon State Surface Mining Reclamation Statute ORS 517.750 et seq., a copy of which is enclosed for your purposes.

In reviewing your letter to Mr. Wilkerson, dated June 7, 1974, it would appear that Phase I of your proposed mining exploration program would be exempt from the requirements of the Oregon Surface Mining Law. (ORS 517.750 (11)) Phase II and Phase III, however, would require an approved application for a surface mining permit and the submission of a development and reclamation plan approved by this Department. I am certain that Exxon's established policy and practice and the restoration procedures and landscape architect's plans would fully meet Statutory requirements for the reclamation of surface ~~mined~~ lands in Oregon. It would be necessary to include a reclamation plan for Phase II if this expanded pre-development program exceeds the area limitations imposed by ORS 517.750 (11) as it would appear to do. You should be further advised

that such applications, permits and reclamation plans extend to National Forest lands as well as the State Leased lands, inasmuch as the mineral exploration and development are for locatable minerals. This provision is detailed in the memorandum of agreement between the National Forest Service and the State of Oregon dated July 1, 1973, and in the National Forest Service regulations 36 CFR Part 252.

Please feel free to contact me should you have any questions or comments regarding permit applications and reclamation plan development as required by the enclosed Statute.

Sincerely,

Standley L. Ausmus
Administrator
Mined Land Reclamation

SLA/lb
encl.

Stan - Can you pls comment on this? If this would involved much of your or the staff's time, we would need to charge D.S.L.

DIVISION OF STATE LANDS

RECEIVED
OCT 10 1974
DEPT OF GEOLOGY & MINERAL INDUS.

OFFICE OF THE DIRECTOR

1445 STATE STREET • SALEM, OREGON • 97310 • Phone 378-3805

October 3, 1974

Agency Addressed

Gentlemen:

The Division has received an application to lease approximately 240 acres in Lake County for uranium exploration. The Exxon Company has obtained mineral rights on adjacent Federal lands and proposes to exercise the same level of environmental protection as is required by Federal authorities. The attached letter details some of the planned control points.

The proposal to prepare a full scale Environmental Impact Statement if mining is contemplated is somewhat contradictory because if impacts are too high, the mining, which justified the exploration expense, cannot be allowed. Prior to the State Land Board's consideration of a state lease, we wish to obtain whatever examination of this proposal you feel is warranted for the state-owned mineral rights and your comments concerning the advisability of leasing the parcels described in the attached letter. Please consider all impacts through and including full development as an open pit uranium mine.

We appreciate your cooperation. Please call us if you have any questions concerning this matter.

Sincerely yours,

Leonard G. Wilkerson

Leonard G. Wilkerson
Minerals Leasing Specialist

LGW/dr
Enclosure

RECEIVED
OCT 4 1974

EXXON COMPANY, U.S.A.
POST OFFICE BOX 120 . DENVER, COLORADO 80201

MINERALS DEPARTMENT
EXPLORATION

June 7, 1974

Re: Application for State Leases
Lakeview Project No. 3614
Lake County, Oregon

Mr. Leonard G. Wilkerson
Mineral Leasing Specialist
DIVISION OF STATE LANDS
Office of the Director
1445 State Street
Salem, Oregon 97310

Dear Mr. Wilkerson:

Mr. W. M. Bateman recently made application to lease all minerals except coal, oil, gas and sulphur on behalf of Exxon Corporation, on the following lands:

Township 38 South, Range 18 East
Section 1: SW¼SE¼, S½SW¼
Section 12: N½NW¼, NW¼NE¼

A reply to your letter to Mr. Bateman dated May 1, 1974, may be best served by explaining some of Exxon's operating procedures for its exploration programs. These procedures have been in effect for many years and are adhered to whether the program is being conducted on Federal, State or Private ownerships.

It should be pointed out that the Lakeview area, in which the application for lease is being made is within the Fremont National Forest and Exxon will enter into a signed, cooperative agreement with the United States Forest Service, detailing its operating procedures, prior to beginning its exploration program. All land in which Exxon has an interest will be accorded the same environmental protection. including Leased Lan

The Proposed uranium Exploration Program will consist of portable drilling rigs, attending 4-wheel drive vehicles such as water trucks, pick-up trucks, Broncos and Blazers, each equipped with muffler spark arrestors, fire extinguishers, pick-axe and shovels, and inspected by a U.S.F.S. Ranger before operations begin. Portable slush pits will be used and the drilling mud will be recycled. Care will be taken to avoid contaminating the water shed and polluting the streams. Exxon's drilling contracts require the drillsites to be kept free of all trash, with a proviso that failure to comply with the signed agreement could result in a witholding of 10% of the total cost.

Drillsites are deliberately selected along existing roads and trails to avoid new road construction. Bulldozers are used for removing slash, landslides, fill-in of eroded areas in the road bed and the removal of boulders. The bulldozer operator is instructed not to disturb native grasses or the top soil unless absolutely necessary. Should this become necessary, the disturbed area is reseeded with a native grass mixture recommended and supervised by the U.S.F.S. at Exxon expense.

Exxon is proud of the reputation that it has acquired by the conduct of its mining exploration program. This fact may be further emphasized that, statistically, every third hole drilled can be attributed to environmental protection. Drill hole locations are deliberately selected along existing roads and trails, which requires additional drilling to obtain sufficient geological information that fewer holes, ideally located, could provide. This operating procedure also requires greater hole depths, in most instances, since drilling will occur at higher elevations than would normally be required because most roads and trails are constructed along ridge lines.

An Exxon Geologist supervises each project. These gentlemen insure the protection of Exxon's written or verbal agreements with the surface ownerships. Every surface owner is contacted by an Exxon employee prior to entry to explain Exxon's operations, with instructions to contact the proper representative immediately if any of the commitments are violated.

A distinction should be made between Exxon's mining exploration program and its mining development program.

The exploration program is designed to test, with drilling, geological concepts that have been developed from exhaustive field studies which include lithological and mineralization studies, geochemical analysis of rock-chip samples, ground and/or air borne radiometric, magnetometer, gravity, and induced polarization surveys.

Should an ore deposit be discovered, the exploration program is expanded to determine the size and extent of the deposit and to evaluate the economic feasibility of mining the ores. This process considers three factors:

1) Per Cent of ore grade of the deposit.
2) Depth of the deposit.
3) Areal size of the deposit.

This expanded program requires the random spacing of drill holes approximately ¼ to ½ mile apart. Phase 2 involves a pre-development program that is designed to determine the actual tonnage or pounds of the deposit. Drillsites are spaced from 100 feet to 600 feet apart.

Phase 3 is the actual mining operation which involves the construction of millsites, smelters, road construction, etc. Prior to the mining operation, Exxon makes an Environmental Impact Study which it submits to the Environmental

Protection Agency for its approval. This study observes all environmental regulations established by Federal State and local agencies as well as its own regulations that, in some instances, exceed those of the regulatory bodies. The study includes the restoration procedures and the landscape architect's plans that are to be implemented when mining operations cease. Industry odds of discovering a viable ore deposit approximate 100 to 1 and the average time from establishing a land position, to exploring, to making a discovery, to mining an area is approximately seven years.

Exxon's interest in the Lakeview area is of an exploratory nature only and in no circumstance is an ore discovery implied nor is any mining operation intended. The Lakeview area is in a geological environment that is conducive to a potential ore deposit.

Exxon is a major Company excelling in the exploration, production, and marketing of fossil and mineral resources with a Company policy that simultaneously protects the environment and diligently pursues a sound geological and responsible economical exploration program that could lead to the development of commercially acceptable natural resource deposits.

I hope that this letter has answered your questions satisfactorily. We, at Exxon, genuinely feel a strong obligation to be an excellent corporation as well as private citizens and we welcome the opportunity to display our intentions wherever we conduct our business.

Very truly yours,

Leon L. Sciba

LLS/ld

cc: L. J. Burkett

MEMO DATE: June 24, 1986

TO: Don H.

FROM: John B.

SUBJECT: Conversations with Jerry Gray

1) The material on Oregon uranium mines and EPA radon rules which Jerry forwarded to you, requires some explanation. Basically, his comments to inquiries from DEQ were relating to mining potential, to him it was a routine question of a mining nature. The manner is which his statements are presented and their context in the material which he provided to you is misleading. He forwarded the material to you so that the agency would be aware and could handle it in its regulatory scheme as it saw fit. Jerry's understanding of how he must separate regulatory issues from assessment issues, the pile of paper that was ultimately forwarded to him took his assessment comments out of context and presented them in an inaccurate fashion. I suspect the Hoffman statements are also inaccurately reconstructed.

2) There may be a need for the agency to have a coordinated release of the COMA study in early August. Mining companies will pickup the reports here in response to the press release. Farmers who work land and own surface rights but do not own mineral rights in the Bend area may not be able to get the report in a timely fashion. Accordingly, they could be victimized by mining company people who begin staking claims on their surface land for the mineral rights. To avoid this, Jerry recommends a release in the Portland office like we normally have but a concurrent release in the Bend area which will get information to the farmers in timely and equitable fashion. I indicated to him that the split estate aspect of this particular study poses unique problems and that you and I would work out the best way to handle them. Nobody is anxious to manage a report release in the Bend area, but on the other hand this particular situation warrants some sort of unique treatment.

JDB:ab

cc: Jerry G.

7/3

John,
FYI

STATE DEPARTMENT OF GEOLOGY
AND MINERAL INDUSTRIES
BAKER FIELD OFFICE
2033 FIRST STREET
BAKER, OREGON 97814

June 30, 1978

Mr. Don Hull
State Dept. of Geology & Mineral Industries
1069 State Office Bldg.
Portland, Oregon

Dear Don:

There is a uranium claim staking boom going on in the McDermitt area. I was there June 14-15.

It talked with Brian Broskey of Cordex, Tak Matsumoto, an associate of Locke Jacobs and Martin Alexander of Alexander Enterprises, Inc. Companies and individuals who have located claims in Oregon include Cordex Exploration Company, 573 East Second Street, Reno, Nevada; Alexander Enterprises, 452 Center Street, Sublimity, Oregon 97385; and Locke Jacobs, Box 10386, Reno, Nevada, 89510. Martin Alexander told me that Western Nuclear recently leased about 6,000 acres of the land they hold. He also said that St. Joe Minerals has a crew staking claims in the area and were using a helicopter. The McDermitt motel owner told me that a Continental Oil Company crew was "doing somthing" in the area. A helicopter and backup truck belonging to Hosking Exploration Helicopters, Salt Lake City were parked at the airport. Another helicopter was parked at the motel across the street.

The area of interest extends west and southwest from McDermitt including the Bretz and Opalite mines, Disaster Peak and the eastern flank of Kings River Valley. Most of this area lies within the McDermitt caldera.

On my way home I stopped at the Malheur County Court House in Vale and looked up the pertinent claim entries. Locke Jacobs and his associates had filed at least 468 claims in Oregon. The associates names include George Allen, Barry Bradshaw, Tak Matsumoto and Richard W. Forman. Their latest entry was 4-28-48. Alexanders had filed 154 claims. Their latest entry was on 5-8-78. John Livermore located claims for Cordex.

Cordex did some drilling in and near the old Bretz workings within the last month or two. Locke Jacobs was drilling east of the Bretz with a new Gardner-Denver rotary rig.

On the 15th on my way to the Steens Mountain area I drove by the Kings River area which is about 35 miles west of Orovada. Chevron had several cats,

drill rigs and related equipment working in that area. They were working near the base of a thick rhyolitic flow. Their prospect area is several miles long.

Sincerely,

Howard

HOWARD C. BROOKS

HCB/a

cc - John M. West, U.S.B.M. - Salem
cc - Dick Appling, Jr., U.S.B.M. - Spokane
cc - Jerry Gray, DOGAMI - Albany

TO: E. E. Thurlow, Manager
Denver Area Office

February 28, 1957

FROM: M. E. Denson, Chief, Geophysical Research and Development Branch, DRM, Denver

SUBJECT: TRANSMITTAL OF REPORT - RME-1091

SYMBOL : DRM:BMB

Transmitted herewith are two copies of a report by F. H. Geier and W. Y. Holland entitled, "Equipment and Analytical Procedures in Geochemical-Radiometric Reconnaissance for Uranium", dated February 28, 1957.

Other copies of the report are being distributed as shown on the Distribution Sheet, Page 2 of this report.

Enclosures:
As Indicated

CC: A. E. Jones
E. A. Youngberg
E. R. Gordon
R. D. Nininger
A. E. Granger
M. E. Denson
M. R. Reyner
J. W. King
E. W. Grutt
H. D. Wolfe
S. R. Steinhauser
L. P. Barrett
F. W. Stead
T. B. Nolan

U. S. ATOMIC ENERGY COMMISSION
DIVISION OF RAW MATERIALS
GEOPHYSICAL RESEARCH AND DEVELOPMENT BRANCH

RME-1091

EQUIPMENT AND ANALYTICAL PROCEDURES IN GEOCHEMICAL-RADIOMETRIC RECONNAISSANCE FOR URANIUM

By
F. H. Geier
and
W. Y. Holland

Denver, Colorado
February 15, 1957

EQUIPMENT AND ANALYTICAL PROCEDURES
IN GEOCHEMICAL-RADIOMETRIC
RECONNAISSANCE FOR URANIUM

RME-1091

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U.S.G.S., Denver (F. W. Stead)	1
U.S.G.S., Washington (T. B. Nolan)	1

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ILLUSTRATIONS

EQUIPMENT AND ANALYTICAL PROCEDURES IN GEOCHEMICAL-RADIOMETRIC RECONNAISSANCE FOR URANIUM

RME-1091

By
F. H. Geier
and
W. Y. Holland

ACKNOWLEDGEMENTS

The writers wish to acknowledge the assistance of the following members of the Geophysical Research and Development Branch: James H. Scott for overseeing the construction of the geochemical unit and equipping the original tow and power truck; Charles T. Illsley for his assistance in designing the sample preparation truck and aid in analytical procedures; Joan Davlin and Laura Bruckheimer for their soil sampling and sample preparation during the initial testing. We wish to express our appreciation to Dr. M. E. Denson for consultation and advice.

INTRODUCTION

Much of the United States has been surveyed by airborne and surface radiometric methods and the most promising areas of anomalous radioactivity have already been explored for uranium. Because of the inherent depth limitations of this type of exploration, the Geophysical Research and Development Branch of the U. S. Atomic Energy Commission is developing supplementary geophysical and geochemical techniques. This report describes the mobile geochemical laboratory we have placed in operation and the geochemical procedures used in field studies.

Prior to the design and development of our mobile geochemical field laboratory, consideration was given to other methods of handling and testing field samples. Our choice of method was guided by the following considerations:

1. There are some analyses which necessitate rapid determination because of natural instability such as pH and bicarbonate analyses. Many variables are introduced during transit by temperature changes and container effects. These could be minimized with a mobile field laboratory.

2. An effective reconnaissance may depend on easily and quickly obtained analytical data to guide the day to day progress and to maintain close coordination with rapid radiometric surveys. Again, only a mobile field unit could provide this information rapidly and economically.

3. Better economics are obtained by less sample handling, and better coordinated field applications can be made from analytical data obtained directly on the job.

4. The design had to be sufficiently versatile to permit flexibility for the research aspects of our program as well as for the routine tests.

THE MOBILE GEOCHEMICAL FIELD LABORATORY

A three-room, thirty foot house trailer was converted into a highly versatile geochemical field laboratory. This was accomplished by the relocation of one partition, installation of service benches, the utilization and expansion of storage compartments and the addition of special services and equipment.

As shown in Figure 1, four separate work areas are provided in this design. Room 1 serves as the chemical preparations area where digestions, fusions, filtrations or other treatments can be made prior to final analysis. Room 2 houses analytical equipment such as the automatic titrimeter, spectrophotometer, torsion balance, etc. This room also provides the bulk of our storage for replacement glass ware, hardware and instrument supplies.

Room 3 is reserved for office space with provision for drafting and map display.

Room 4, which was the original shower stall, was converted to a fluorimeter room and serves as a dark room for black light studies.

The trailer has been in service for more than a year and has proven very satisfactory. Only minor additions such as the installation of a fume hood are planned in the near future.

Several work areas are worthy of a more detailed description since they contribute vastly to the successful operation of this laboratory unit. Figures 1, 2, 3, 4 and 5 can be used to follow this discussion.

The design had to provide safe storage during rough transit for laboratory glassware and liquid chemicals. This was accomplished largely by compartments for individual pieces. The storage wells beneath the counter top and along the forward wall are typical examples of these compartments. Five pound acid and solvent bottles are stored in this area (Figure 2). Each bottle fits into a circular guide hole through a spacer approximately 7 inches above the bottom of the well. As shown in Figure 2, the well covers are hinged and fit flush to provide a major part of the 46 square feet of counter top in the preparation room.

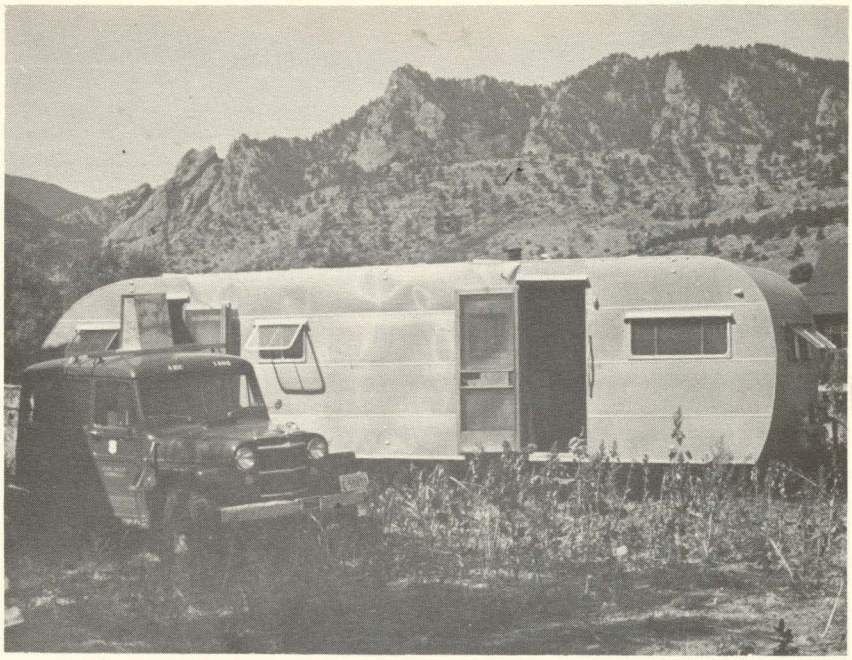


Figure 1A
Geochemical Trailer

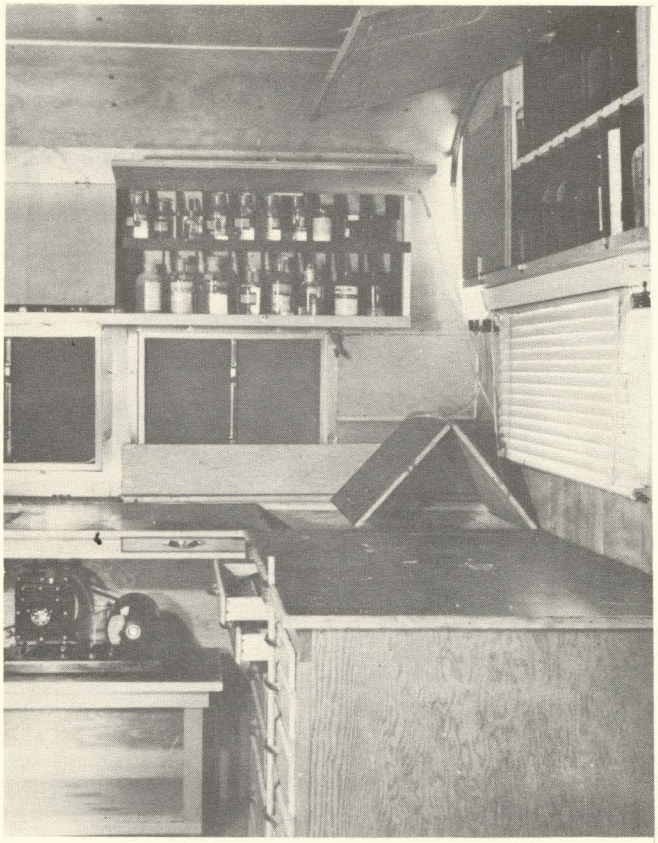


Figure 2
Preparation Room (Right Side)

Another useful feature used throughout the design are the writing boards which pull from beneath the counter top at convenient locations.

The drawer handles have been fabricated to serve as dowel holders. Dowels are inserted through the handles and into inserts in the floor and serve to lock the drawers during transit.

Of utmost importance to field geochemistry is an adequate source of demineralized water. For this purpose the trailer is equipped with a Barnstead Bantam Demineralizer. (Figure 3). Raw water is pumped into the trailer with an electric pressure pump. This unit can be by-passed if municipal water is available. The demineralizer intake is a direct connection from the main line so as not to tie up the water supply to the sink. Because of comparatively slow delivery from the demineralizer, a five gallon storage bottle (J. Figure 1) was installed to provide a more rapid delivery upon demand. The transport lines for the demineralized water are tygon tubing encased in metal electrical conduit fastened to the ceiling. An overflow line from the storage bottle back to the sink was also installed. The demineralizer (Figure 3) employs a mixed bed system of anion and cation exchange in a replaceable cartridge. On top of the unit is a direct reading conductivity meter, calibrated in ohms per milliliter and parts per million, to show when the cartridge is exhausted.

To provide a gas supply for the flame photometer a compartment (R, Figure 1) was designed to hold 4 standard tanks of acetylene and oxygen. This compartment was constructed with a reinforced, hinged top and cabinet door end to facilitate replacement of these tanks with a minimum of lifting. Retainer cleats on the floor to match the guide holes in the cabinet cover secure the tanks during transit. An exhaust hood (Figure 4) was provided for the flame photometer to prevent heat damage to the ceiling.

The spectrophotometer and automatic titrator were secured by straps attached to the cabinet tops.

Some of the original trailer equipment was retained and used without alteration. This included the cooking stove, which is used as a hot plate and drying oven, the refrigerator and an oil burning heater.

DESCRIPTION OF EQUIPMENT

Geochemical Field Laboratory

The field laboratory is equipped with the usual items pertinent to the digestion of rocks, soils and vegetation prior to analysis. The removal of colloidal clays and silica from natural water and soil leaches is accomplished by using Mandler Bacteriological Filter Candles, size number 3, with porosities of 4, 7, 9 and 12 depending on the

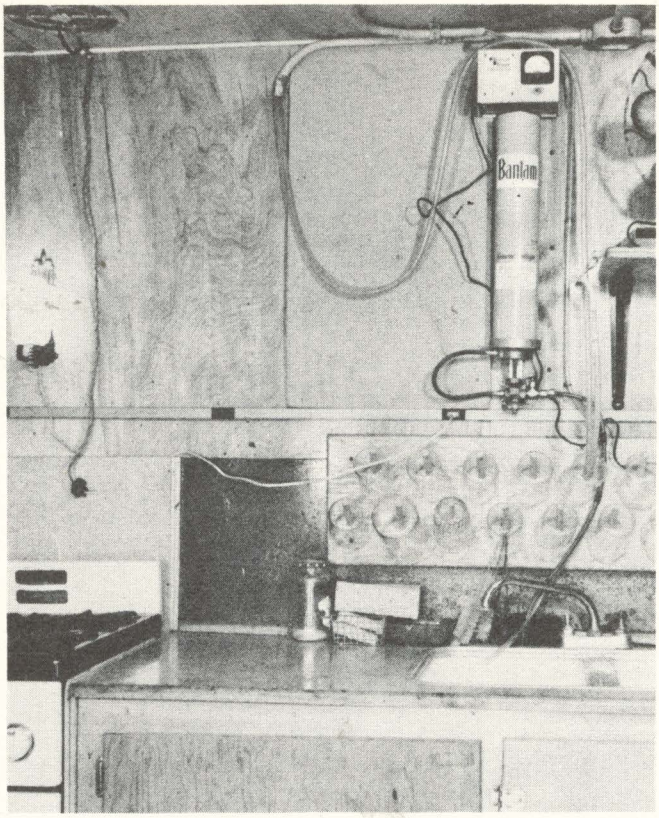


Figure 3
Preparation Room (Left Side)

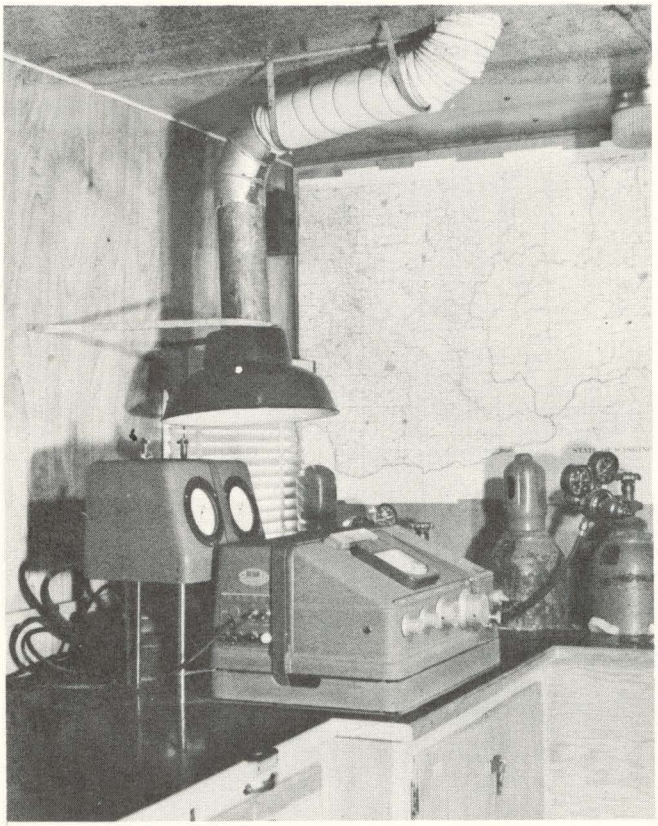


Figure 4
Instrument Room (Left Front)

particle size of the material. Figure 6 shows the filtering rack with the solution to be filtered on the top shelf. An automatic decantation syphon which is started with a pressure bulb transfers the solution into the Mandler filter tubes. The filtrate is caught in the 500 ml side arm suction flasks, the vacuum being provided by a Wegner Vacuum Pump (Figure 2). An Eberback variable speed laboratory shaker provides the agitation necessary for soil leaching.

The Phosphor fusion burner, (Figure 7), consists of a ring burner above which is a motor driven dish-mounting plate. The dishes are supported by fused quartz rods, 4mm in diameter. A detailed description of this equipment can be found in Trace Elements Investigation Report 578. (Machine for Preparing Phosphors for the Fluorimetric Determination of Uranium, by R. E. Stevenson, W. H. Wood, K. G. Goetz, and C. A. Horr of the United States Geological Survey).

In addition, several standard analytical instruments such as a Beckman Model B Spectrophotometer, a Beckman Model K automatic titrimeter and a Jarrell Ash Model JA-2600 Fluorimeter are included as permanent features of the mobile geochemical laboratory.

All electrical power is supplied by an external 5 KW generator which is transported in the tow truck.

Grinding Unit

The necessity of a mechanized sample preparation unit became evident during early field operations in order to keep pace with the output of chemical analyses. To house preparation equipment the original stake-bed tow truck was replaced by a 1½ ton truck with a van body. The front section of the van body was designed for storage and includes a 350 gallon water tank with cupboards built in above the tank. A vertical pulverizer and chipmunk jaw crusher are mounted on a work bench with their respective motors mounted underneath as shown in Figure 8. An exhaust fan mounted in the wall back of the pulverizer removes most of the dust during operation. The grinding units are cleaned with compressed air furnished from a compressor mounted under the opposite work bench.

The rear floor area of the van is kept clear to transport the 5 KW power generator. The generator is hoisted into the truck by means of a swing-out hoist located in the right rear corner of the van.

Carborne Scintillator

The scintillator is mounted in a standard 4 wheel drive Willys Jeep station wagon. (Figure 9). The instrument was manufactured by Sherwin Instrument Company and reads 120 c.p.s. from a microroentgen source per minute. The seven inch plastic crystal is shock mounted on

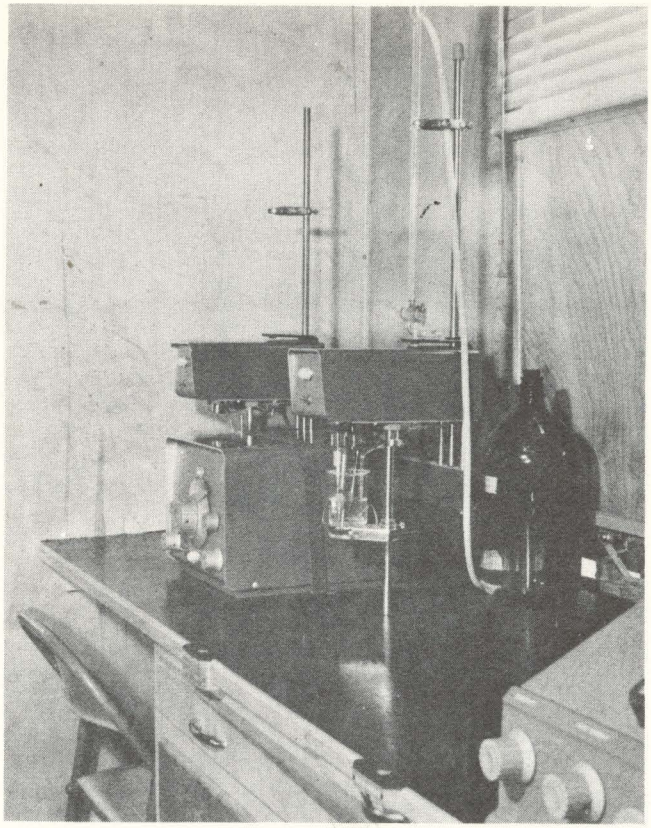


Figure 5
Instrument Room (Left Rear)

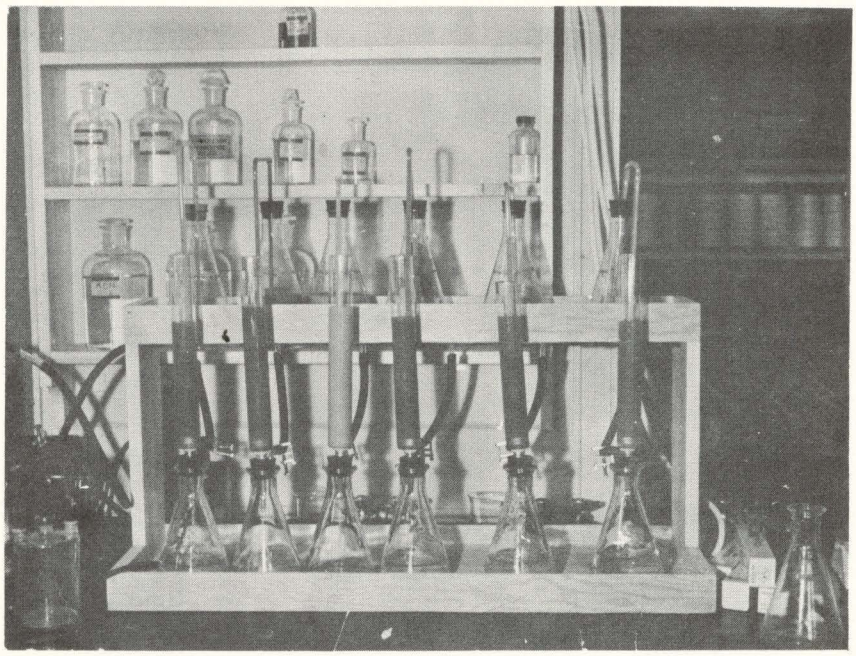


Figure 6
Soil Leach Apparatus

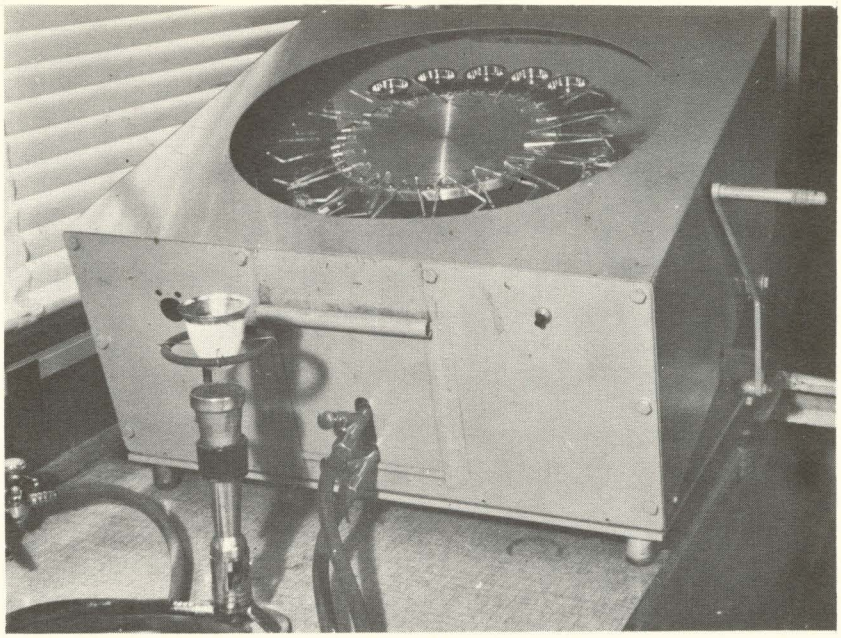


Figure 7
Phosphor Fusion Burner

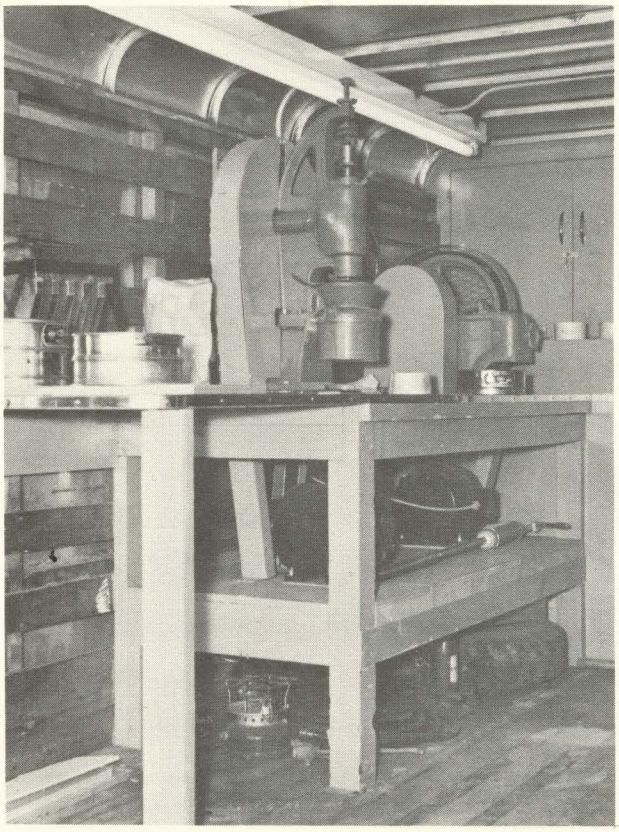


Figure 8
Grinding Unit

the roof and is protected by an aluminum housing. The counter is shock mounted inside the Jeep in view of the driver. An Esterline Angus recorder is shock mounted in front of the counter and is also visible from the driver's seat (Figure 10). A second rate meter similar to the one in the counter is mounted on the dash in direct view of the driver. The Esterline Angus recorder is synchronized with the Jeep to operate at a rate of 3 inches per mile. This equipment can be operated conveniently by one man.

Soil Sampler

The soil sampling drill is mounted on a Willys Jeep pickup truck. (Figure 11). The truck was loaded with 1000 pounds of concrete to offset the thrust of the hydraulic piston which drives the sampling drill into the ground. The soil sampler was constructed and installed by a local machinist (who is also the patentee). The drill bit designed by AEC recovers a 30 inch soil samples 3/4 inch in diameter, provided this maximum depth is available. The soil sampler has been found to be very efficient. Drills and drill stems with standard fittings have been provided which will recover soil samples at any depth up to 12 feet if desired from a deep soil region. The portion of the core sample collected or analyses is selected by inspection through a long open slot in the drill.

SOIL SAMPLE PREPARATION PROCEDURES

Drying Procedure

Soil samples with average moisture content are air dried overnight at room temperature. Samples with high moisture content are placed under a bank of infra-red lamps to hasten removal of excess moisture. When the sample no longer has a muddy consistency, the heat is removed to avoid baking the soil. The dried samples are passed through a 2mm soil sieve to remove rocks, twigs and other debris. The sieved portion is then rolled on a rubber rolling mat until thoroughly mixed, (usually fifty rolls are sufficient).

Water Leach Procedure

Twenty grams of soil and 400 ml of demineralized water are added to a 500 ml Erlenmeyer flask, stoppered tightly and placed in the carrier of a mechanical shaker.

After one hour of agitation the flask is removed and placed on the top shelf of the filter rack (Figure 6) where the dense portion is allowed to settle. This usually requires 15 minutes. A glass siphon, extending from about 1/4 inch above the settled solids to 1/4 inch above the filter candle, is used to transfer the leach solution to the

Figure 9
Scintillator Equipped Vehicle

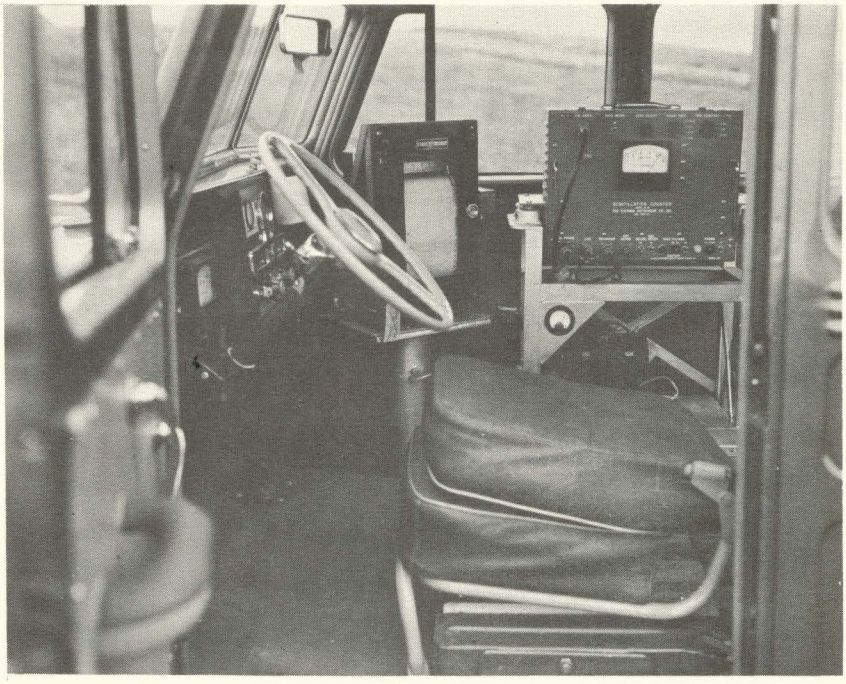


Figure 10
Scintillator Vehicle, Interior View

GPO 845489

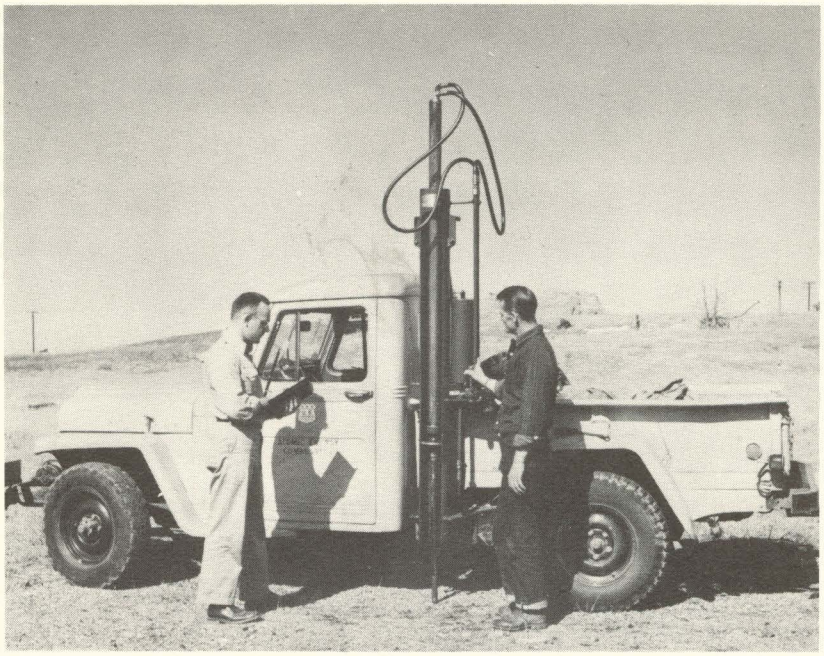


Figure 11
Soil Sampling Vehicle

bacteriological filters. With proper adjustment the level of the solution in the filter will reach equilibrium before it overflows and will maintain an automatic feed during operation. Intermittent suction is applied to the filter flasks to maintain a continuous flow without plugging the filter and degassing of the filtrate.

The filtrate is transferred to a pint polyethylene bottle and set aside for future analyses.

Acid Leach or Fusion Procedure

Between 5 and 10 g of the sieved sample are pulverized to pass a 100 mesh sieve. After thoroughly mixing on a rolling cloth, the sample is ready for acid leaching or fusion analysis. These analyses utilize standard techniques.

Rock samples are handled similarly to soil samples except for crushing and pulverizing prior to sieving.

WATER SAMPLE PROCEDURE

Collection Procedure

Duplicate water samples are collected in pint polyethyene bottles having bakelite caps with polyseal liners. This type of cap provides an air tight seal which helps preserve the original gaseous content of the water. The samples are allowed to settle and any foreign material is separated by filtration through a bacteriological filter.

General Tests Procedures

The conductivity of the filtrate is first determined in order to get an approximate value of the dissolved solids in the sample. A 50 ml sample of the water is pipetted out for pH, $CO_3^{=}$ and HCO_3^{-} determinations. Another sample (100 ml) is treated with NaHSO and passed through a small anion exchange column to separate the uranium as the bisulfate complex (see analytical procedures).

Just what constitutes proper treatment from the time of collection of the sample until the uranium analysis can be run is still under investigation. If sediment is present in the original sample, acidification can contaminate the sample by leaching elements from the foreign material and also would destroy the carbonate content of the sample which is largely responsible for the solubility of uranium in normal waters. Thus, we prefer a means of filtration when collecting the sample to preserve its true identity. Our mobile geochemical field laboratory definitely helps to minimize any changes which normally occur during transit to a central laboratory for analysis. This is especially important in helping to control the variables being considered in our research program.

DESCRIPTION OF ANALYTICAL PROCEDURES

The following analytical procedures have been used in the geochemical field laboratory during past field operations. Standard procedures are used where applicable with minor changes to fit existing field laboratory equipment.

Uranium in Waters

1. Cover end of $2\frac{1}{2}$", 8mm glass tube with $\frac{1}{2}$" x $\frac{1}{2}$" piece of 80 mesh nylon and slip into a 1 inch length of 3/8 inch ID tygon tubing. (Figure 12).

2. Fill tube with approximately 1 g.-treated Amberlite IRA-400. Prepare resin by washing in filter paper funnel with 100 ml, N/1, NaOH about 8-10 times, rinsing with distilled water until neutral and dry overnight at room temperature.

3. Plug top of tube with ball of 80 mesh nylon.

4. Attach tube with resin to apparatus (Figure 12) pour a few ml of distilled water in funnel, enough to wet resin. Put clamp on bottom rubber connection after resin is wet. Keep enough water in funnel to replace the trapped air. Get all air out of upper part of system by tapping with stirring rod. Open stopcock on separatory funnel long enough to get level of distilled water to top of constriction of funnel.

5. Filter sample to be tested if turbid.

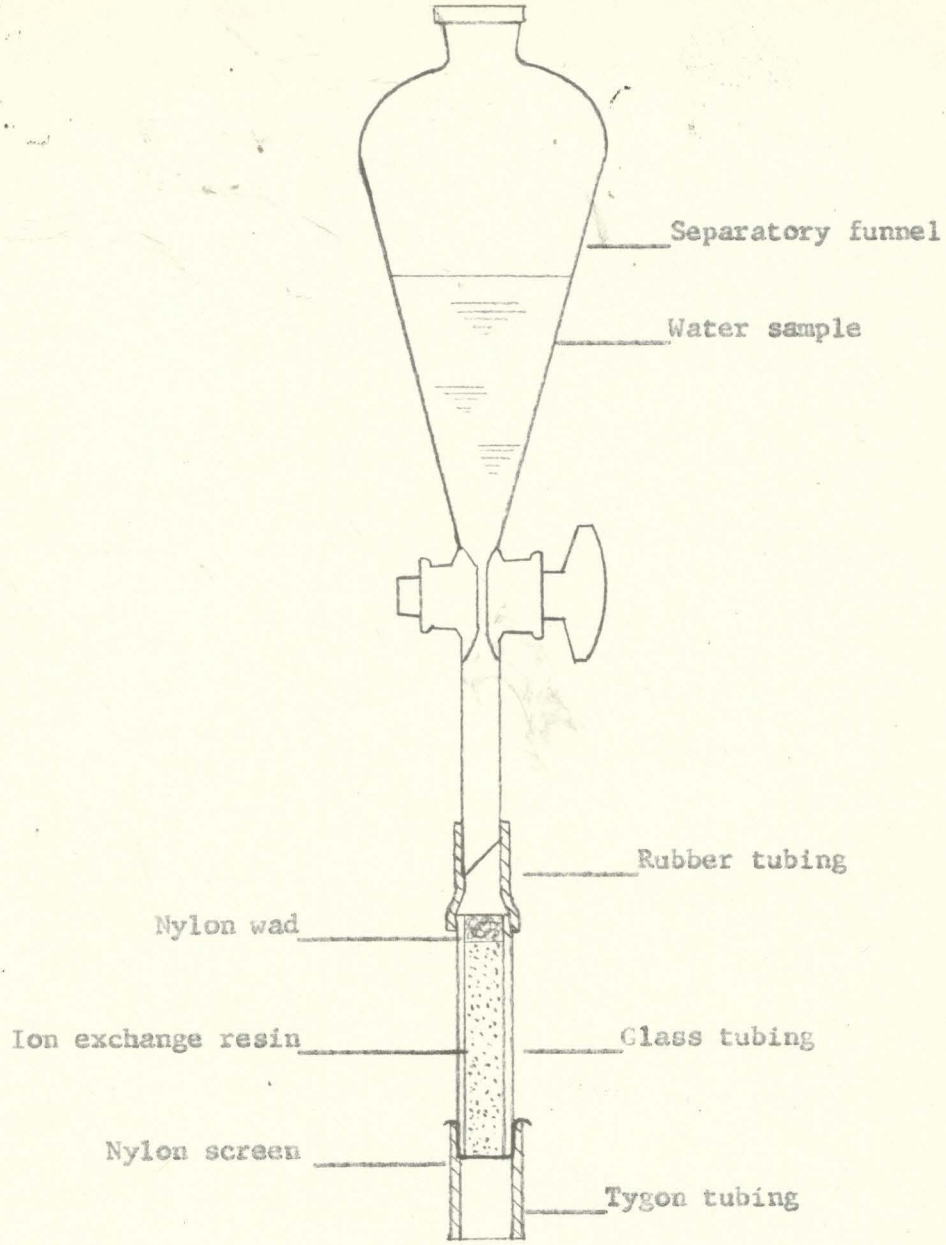
6. Put 100 ml sample in 100 ml volumetric flash and add aproximately 1 g. (small scoop) of Sodium Bisulfate. Shake until dissolved.

7. Pour into funnel and open stopcock--adjust flow to approximately 1 drop per second. Time the percolation from start to finish. Percolation time for 100 ml should not be less than 10 minutes.

8. Take tube containing resin out of system and dry under infra-red lamp until all water is evaporated--resin turns dark brown (approximately 30 minutes).

Note: If suction is available, dry with suction under infra-red lamp for 15 minutes.

9. Take end plugs out of tube and pour into clean platinum or gold dish carefully, avoiding spillage.



Scale: 1:$\frac{1}{2}$

FIGURE 12

APPARATUS FOR EXTRACTION OF URANIUM FROM WATER
(DETAIL)

10. Heat resin in platinum dish slowly. Place wire screen and thin asbestos pad over burner and heat with low flame until resin turns black. Raise heat gradually until resin ignites. Allow to burn slowly.

Note: This step may be done on rotary type burner. (Figure 7).

11. Take wire screen and asbestos off burner and turn back to low flame. Put dish and resin on triangle over burner and heat until carbon film is burned off.

12. Put dish and resin in muffle at dull red heat and allow to ash until only a few particles of ash remain in dish, or increase burner flame until resin is ashed. Remove from heat and allow to cool.

13. Add 1.0 to 2.5 grams flux (amount depends upon size dishes used and amount of uranium in sample) to dish and heat slowly to fusion over Bunsen flame. Do not allow platinum dish to get hotter than a dull red glow. Shake after fusion and hold at dull red glow. Agitate for 1 minute, then cool and tap dish until phosphor falls out. Determine fluorescence with reflection type fluorimeter.

Note: See "Test for Uranium in Soils" for alternate procedure using rotary type burner.

Flux:

Sodium Fluoride--9 parts by weight.
Sodium Carbonate--45.5 parts by weight.
Potassium Carbonate--45.5 parts by weight.
Grind and mix intimately.

Uranium in Soils

1. Pulverize sample to pass 100 mesh sieve.

2. Place 1 gram of soil sample into a 15 x 150mm. culture tube, graduated at 5 ml and 10 ml.

3. Heat tube and contents to destroy organic matter, cool and place a glass stirring rod in each tube.

4. Add 1-3 HNO_3 to the 5 ml mark, mix acid and soil thoroughly by means of the stirring rod. Place tube in a water bath for 25 minutes, stir frequently.

5. Add hot distilled water to the 10 ml mark, mix well, place tube in water bath for 5 minutes, stirring at least twice during the 5 minutes. Remove from bath and place in a tube rack, with a fine

jet of cool distilled water rinse the stirring rod, while removing it from the tube (care must be exercised at this point so that the level of the solution does not exceed the 10 ml mark). When the temperature of the tube has reached room temperature, adjust the volume to 10 ml with demineralized water.

6. Stopper the tube with a rubber stopper and shake tube and contents until they are thoroughly mixed, replace tube in rack and allow the contents to settle for 5 minutes.

7. Filter contents of tube through a dry Whatman #41 Filter paper, catching the filtrate in a dry 15 x 150mm culture tube.

8. Weight 9.5 grams aluminum nitrate and transfer it into a clean dry 60 ml separatory funnel. (Be sure stopcock on the funnel is closed).

9. Pipette exactly 5 ml of filtrate into the funnel, warm contents by placing funnel in a beaker of boiling distilled water and effect solution by repeated shaking. When solution is complete, cool the sample to room temperature.

10. Pipette exactly 10 ml of ethyl acetate into the cool separatory funnel, stopper tightly and shake vigorously for 2 minutes. Place funnel in a funnel rack for 5 minutes, carefully draw off the bottom laver until the top layer is just about to start flowing into the stopcock of the funnel. (Do not lose any of the top layer, but be sure that the bottom layer is completely removed.) The top layer contains the uranium, so great care should be taken at this point.

11. Fold a Whatman #40 - 5.5 cm paper and hold it in the top of a clean, dry 25 ml mixing cylinder. Carefully pour the ethyl acetate into the paper by inverting the separatory funnel and pouring the ethyl acetate out of the top of the separatory funnel. As soon as the ethyl acetate has passed through the paper, stopper the cylinder with a ground glass stopper.

12. Place a clean gold or platinum dish in a shallow pan and add water to the pan so that the bottom is covered and half the dish is immersed in water. (This is to keep the dish from getting too hot when the acetate is ignited.) Clean and thoroughly dry a 2 ml pipette. Pipette 2 ml of the filtered ethyl acetate into the gold or platinum dish and ignite.

Note: Procedure if no phosphor burner is available. (Steps 13, 14 and 15.) Steps 16, 17 and 18 are to be used in place of 13, 14 and 15 if a phosphor burner is used.

13. After the acetate has been ignited, place the dish on a steam bath and evaporate any residue to dryness. Then carefully heat the dish over a Meeker or Fisher burner, until the fumes of nitric acid residue stop being evolved. Then heat to a dull redness to burn off any organic matter. Cool and add 2 g of the NaF, K_2CO_3, Na_2CO_3 flux.

14. Fuse the flux in the oxidizing flame of the burner with swirling to pick up the uranium. Remove the flame and pick up the solidifying flux on the sides of the dish. Immediately continue heating. Keep flux molten at a very light pink stage for one minute. Cool on an aluminum plate.

15. Knock the wafer from the dish and read the fluorescence on a suitable instrument or any visual comparison with standards under ultraviolet light.

Procedure if phosphor burner is used:

16. After the acetate has been ignited, place the dish on a steam bath and evaporate any residue to dryness, cool, then place the dish in the phosphor burner, add 2 gram flux. Be certain the dishes are level in the holders.

17. Light the burner, start the dish holder in motion, adjust the flame so that the flux is about three-fourths molten, (2 to 3 minutes), tilt the burner, by raising the handle (Figure 7) until it comes to rest against the stop. Continue heating until flux is completely molten and two minutes longer. Return burner to original position, stop motion, level dishes. Place in motion for another minute, extinguish the flame and allow motion to continue until flux solidifies, cool.

18. Remove the wafer from the dish by inverting the dish and tapping it gently on the bottom. Anneal the wafer on a hot plate at approximately 75° C for 45 minutes. Place in a dessicator to cool. Read the fluorescence on a suitable instrument.

Reagents

Nitric Acid 1-3
Aluminum Nitrate C.P. grade
Ethyl Acetate

Flux

Same as for uranium in water test.

Determination of Calcium and Magnesium in Water and Soil Leach Solutions

Combined Calcium and Magnesium

Test Procedure

Pipet 50 ml of the water sample into a 250 ml flask. Add 1 ml of the buffer solution and mix by swirling. Add four drops of the indicator. Titrate with the standard sodium versenate solution. At the endpoint, the solution should be clear and should change from wine-red to pure blue with no reddish tinge remaining. In daylight the color beyond the endpoint is sky blue, but under a tungsten filament lamp it is almost colorless.

If titration takes over 20 ml of Na_2 Vers. use 25 ml sample and make up to 50 ml.

Reagents

1. Buffer solution. Mix 67.5 g of ammonium chloride with 750 ml of concentrated ammonium hydroxide and dilute to about 1 liter.

2. Indicator. Mix 0.5 g of analytical reagent grade Eriochrome black T (F24J) with 4.5 g of hydroxylamine hydrochloride; dissolve 5 g of this mixture in 100 ml of alcohol, methyl. Dissolve in diethanolamine or triethanolamine. No other salts or solvents.

3. Standard calcium chloride solution. Dissolve 1.000 g of pure calcium carbonate in a little dilute hydrochloric acid. Dilute to exactly 1 liter and store in a glass stoppered bottle; 1 ml of this solution is equivalent to 1.000 mg of calcium carbonate.

4. Standard sodium versenate solution. Dissolve 4.00 g of analytical reagent grade disodium dihydrogen versenate and 0.5 g of magnesium chloride, $MgCl_2.6\ H_2O$ in 750 ml of water. Pipette out 25.0 ml of standard solution of calcium chloride, add about 1.0 ml of buffer solution and four drops of the indicator. Titrate with the standard sodium versenate solution according to the procedure described in the following section. The sodium versenate solution prepared as indicated should be equivalent to more than 1.0 mg of calcium carbonate per milliliter. Using the volume required for the titration and the total volume of the standard solution, calculate the volume to which the solution must be diluted to make equivalent to 1.0 mg of calcium carbonate per milliliter. Make required silution, mix and restandardize.

Determination of Calcium

Test Procedure

Measure 50 ml of the sample and transfer to a casserole. Add 2 ml of 1.0 N sodium hydroxide to the sample and stir. Add 0.20 g of calcium indicator and stir (a calibrated dipper is sufficiently accurate for this purpose). If calcium is present, the sample will turn salmon-pink.

Add titrating solution slowly from the burette with continued stirring. When approaching the endpoint, the sample begins to show a purple tinge. The endpoint is a final change to orchid-purple. Once the endpoint is reached, additional titrating solution will not produce any further color change. The endpoint should always be checked by adding an additional drop of titrating solution and observing whether any further color change occurs.

If the color fades due to interfering substances, pipette new sample and add 2-4 drops of hardness sulfide solution before adding the indicator.

Reagents

1. Sodium hydroxide--1.0 N solution.

2. Versene titrating solution. The same as for the total calcium and magnesium test.

3. Calcium indicator. Mix well 0.20 g ammonium purpurate with 100 g of C.P. sodium chloride. Grind the mixture to 40-50 mesh.

4. Sulfide Solution. Dissolve 10 gram NaOH in 100 ml of water. Dissolve 5 gram Na_2S in 100 ml of water. Cool the two solutions, mix together and dilute to 1 liter.

Calculations

Ca^{++} Titrate against 25 ml of standard $CaCl_2$ solution containing equivalent to 1.000 mg of $CaCO_3$ per ml.

$$\frac{25.0 \text{ ml of } CaCl_2}{\text{ml } Na_2 \text{ versenate}} = \text{mg of } CaCO_3 \text{ equivalent to 1 ml } Na_2 \text{ Versenate}$$

$$\frac{\text{Mg of } CaCO_3 \text{ equivalent to 1 ml Na ver. x 1000}}{\text{Eq. Wt. of } CaCO_3 \text{ (50) x 50}} = \text{Factor for } Na_2 \text{ Ver.}$$

Ml of versenate x factor = Me/l Total Calcium and Magnesium when 50 ml sample is used.
Me/l Calcium + Magnesium - Me/l Calcium = Me/l Magnesium.
Me/l Calcium x 20 = Ppm Calcium.
Me/l Magnesium x 12.2 = Ppm Magnesium.

Sodium and Potassium

Sodium and Potassium are determined using a Beckman B. Flame-photometer. Two series of standards are prepared, a strong series containing 5, 4, 3, 2, 1 me/l and a weak series containing 1, 0.8,

0.6, 0.4, 0.2 me/l of sodium and potassium chloride. These standards are used to prepare a curve from which the percent transmittance of the unknown is converted to me/l sodium or potassium.

pH-Carbonate-Bicarbonate

Carbonate, bicarbonate, pH are determined using the Beckman Model K Titrimeter. An aliquot of sample containing not more than 1.0 milliquivalent of carbonate plus bicarbonate is taken. In the majority of cases, a 50 ml sample will suffice. The procedure is similar to the APHA method (1) except indicators are not used. If chloride is to be determined the aliquot from this series can be used.

Chlorides

Chlorides are determined by the standard Mohr method(2).

Carbonates

Alakli carbonates are determined by Gravimetric loss of Carbon (3) Dioxide. Rapid evaluation of alkali carbonates in soils by this method requires a minimum of equipment and time but will produce an accuracy of ± 5%.

Lead-Copper-Zinc

The procedures given in the Geological Survey Circular 161 (4) are used.

Total Iron in Water and Leach Solution

The Bipyridine spectrophotometric method (5) for iron is used. With this method the only interfering substance of much importance in ordinary water seems to be $CO_3^{=}$ which is easily removed.

Phosphate in Water and Leach Solutions (6)

The amino-naphthol sulfonic acid method for determination of phosphate in water and leach solutions was chosen because of its accuracy, speed and reproducibility. This and the iron determination mentioned above indicate the advantage of a spectrophotometer.

CONCLUSIONS

The geochemical field laboratory and its auxiliary units have operated successfully during field operations in the Southern Black Hills and Mt. Spokane areas. The mobile laboratory is adaptable to making analytical determinations using colorimetric, gravimetric and titrimetric methods. The analytical procedures used are determined by the problems encountered in a geochemical-geophysical reconnaissance for uranium. It is foreseen that geochemistry may be of considerable value in extending the exploration techniques in areas where low radiometric anomalies are inconclusive evidence of mineralization.

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Uranium

Uranium minerals vary in color from black or dark gray and brown and yellow to greenish yellow or orange yellow. Field investigations throughout the world have shown uranium in nearly every type of rock, and discovery of uranium in places where its presence was unsuspected has greatly increased the likely areas to prospect.

Various uranium minerals have been found in the volcanic rocks of Oregon. Much of the mineralization is thinly disseminated and to date has not proven to be economic. Two deposits in the Lakeview area of Lake County in south-central Oregon have a record of production extending over a period of years. A large treatment plant was constructed and both underground and open pit mining was conducted at the White King Mine. An open pit mine has also been operated at the nearby Lucky Lass property. Occasionally uranium coatings are found in geodes, their presence being detected by the fluorescense of the secondary uranium minerals. The first such occurrence was discovered in the Mutton Mountains of Wasco County about 1947. Since that time other localities have been found and a considerable amount of semiprecious gem material has been sold containing this element.

Uranium mine

3818

Preliminary core drill

By CHRIS MOORE, editor
Daily Argus Observer

McDERMITT—A public meeting this week informed people of this area of impending plans for the proposed uranium mine west of this small town and just inside the Oregon line. About 80 people from both sides of the Nevada-Oregon state line attended to hear Placer Amex, Inc. explain what is involved in the project.

The company officials told the group it has completed a drilling program of approximately 470 holes on the mineralized zone of the Aurora uranium property in Malheur County. This is some 10 miles west of McDermitt. The analysis of the drill results indicate 15 million tons of an average grade of a half of one percent ore, equivalent to one pound of uranium oxide per ton.

Sandy Laird, manager of mines for Placer Amex, said there are still a lot of studies to be completed prior to learning whether the operation could be economically viable. Before the go-ahead is given, the company will have to complete a study of the following factors:

1. Engineering and development of a processing method to recover the uranium from the ore in salable form.
2. Marketing forecasts and a sales commitment for the long term delivery of the yellowcake product.
3. Environmental conditions and the acquisition of all operating permits.
4. Preparation of a detailed feasibility study which includes all the factors necessary to develop the property, including economics.

Following the community meeting, mine officials were to meet with a number of agency representatives regarding the necessary permits which will have to be acquired before the company invests in a plant to recover the uranium. Those meetings were Wednesday and today.

The community meeting was Tuesday night. The importance of siting was addressed by Jim Smolic, metalurgist for Placer Amex.

"Siting for a mill and the tailings ponds are critical," he said. "Many places such as next to a town, on a flood plain or a river bank could make for problems," Smolic noted, but said the uranium ore and the area proposed for the mill and ponds are some distance from any of these.

The Tuesday night meeting was attended by members of the Malheur County, Ore., county court and some members of the Humbolt, County, Nev. court and county officials as well as interested area residents. Few questions were asked of the company and later during a coffee hour few concerns of those people were revealed.

Concerns which did surface involved possible influx of residents and an increase in students in the school. As the city straddles the state line and the school is in Nevada, Oregon students are tuitioned into the school. Some residents objected to a development which would see all the mine's taxable development in Oregon while city and school services costs would be born by Nevada.

"Actually, we are the forgotten corner," commented George Wilkerson, a rancher who has holdings in the sourthern part of Malheur County and in Nevada. "All Oregon and Malheur County wants from us is our tax dollars; then they ignore us."

MALHEUR COUNTY Judge Ernie Seuell talks to a McDermitt resident about county services.

ling completed

SITE of the proposed uranium mine.

The mine development could mean a large increase to the valuation of that part of Malheur County. However, it is likely that the families providing the 100 to 150 person labor force, will live in the Nevada side of the state line.

Already the company has prepared and submitted to the Oregon State Department of Energy a preoperational environmental program to monitor the proposed site of the mill and the tailings disposal area over the next 12 months. The Tuesday night session was to provide community residents with a review of the project status and discuss the environmental data acquisition program.

Yesterday and today a number of Nevada and Oregon agency representatives will visit McDermitt to familiarize themselves with the project area and to discuss the proposed environmental data collection program. Because of the project location and siting conditions, it is important to get agency input and approval of this data acquisition program.

Smolic explains that the data collection program will establish baseline conditions prior to project operation, estimate impacts of the proposed operation, and determine appropriate corrective actions after operations commence.

He said "We are very serious about selecting a site for the uranium mine and tailings. We are very concerned about the environmental effects. We don't want to contribute to disruption of the environment."

Laird did express concern that the biggest effect would be on the area's population. "This mine would be bigger than the McDermitt (mercury) Mine which runs 4-5 days a week. We would have more employees, run long hours and more days." He

(Continued on page 6)

● Uranium

(Continued from page 1)

continued, "We want to attract as many from the local labor force as we can, but if it is necessary, some will be brought in in addition to the engineering and managerial staff."

A brief questioning of local citizens following the evening and the next day revealed little concern over the uranium mine except for possible straining of local services in the tiny border town. A service station attendant said, "I'll have to wait and see. It isn't built yet and they sure have an awful lot of regulations to meet."

Wilkerson who with his brother, Fred grazes cattle on a BLM allotment adjacent to the proposed site, commented, "We'll work with them. But the restrictions of the agencies on developing companies are really tough."

Uranium strike in South End

Uranium has been discovered in the Trout Creek Mountains in the extreme southeast corner of Harney County. The deposit is part of an extensive pocket of the radioactive mineral discovered by exploratory drilling along the rim of a volcanic caldera in Malheur and Humboldt (Nevada) counties.

Anaconda Corporation has staked 320 claims in the Harney County portion of the deposit, and Bureau of Land Management officials expect the company to file mining plans soon with the Burns district office.

"The ore, although low-grade, is very close to the surface," explained Ed Fivas, BLM Vale district geologist. "So it's financially attractive. About one pound of uranium could be extracted from a ton of the ore."

Anaconda, Chevron Resources, Inc., and eight other companies have staked over 5000 claims in Malheur County and almost 400 claims in Harney County. They expect the crater and surrounding area (over 100,000 acres) to yield about 15 million pounds of the element. At $43-$50 a pound, that's about $750,000,000 worth. It has been estimated that up to half of the income will ultimately remain in the county economies.

"The companies are planning to hire as many local people as possible," Fivas said.

The uranium will be brought out through an open pit mining operation similar to the cinnabar mine in McDermitt. Fivas says the area has already been heavily impacted by cinnabar (mercury ore) mines, but the mining companies still plan to stockpile as much overburden (topsoil) as possible. Then they will fill and reseed the pit with crested wheat. The proposed excavation will temporarily remove part of an existing BLM seeding, so the companies will reimburse ranchers who have AUM allotments in the seeding.

"The uranium is found in black sedimentary rock," Fivas said. "It was apparently deposited by sedimentation from seven large lakes that covered the area five million years ago."

A majority of one

754

Intelligent meeting marred only by nuclear groupies

By Gary Whitehouse

Generally, everybody who attended the meeting of the Energy Facility Siting Council Friday, April 11 was pleased with the way in which it was conducted and with the attitudes of the council members. I among them. I take to task Mr. Scoville's assertion that the timing of the meeting was bad, which provided lop-sided representation of points of view. At least as many persons spoke who were not bothered by uranium mining and milling as who were; at least as many expressed confidence in the collective wisdom of the council and its actions as did not.

Those who did express opposition to future uranium mining and processing in the Goose Lake Valley seemed to outnumber those who did not, perhaps because, in the case of one of them at least, their voices were louder and their claims more outrageous. I refer to Dennis Igou, who represented the Uranium Resistance Coalition. Igou not only gave the council the mistaken impression that he was representing local opinions and persons, he made some statements that were, if not bald-face lies, at least gross misrepresentations of fact. This Bonanza man presumed to speak for the 4,000 or so residents of the Goose Lake Valley, saying "We demand" this, and "We demand" that. Loudly. Not only that, but he stated flat out that past uranium activity was killing vast numbers of people in the area through cancer, causing a high infant mortality rate and on and on...all statements easy enough to make, but very difficult to prove.

A local man who attended the meeting referred to Igou and Lloyd Marbet, another out-of-towner who spoke, as "nuclear groupies." For those not familiar with the term, a "groupie" is one, usually a nubile, impressionable teenage girl, who follows a particular rock & roll performer or group from place to place, and often attempts to give her body and other favors to her idols. Everybody I have spoken to about the meeting, those on both sides of the issue, resented the presence of these groupies at the meeting, especially that of Igou when he presumed to speak for us. That relieves me. For nothing will escalate this discussion into a full-blown confrontation among neighbors faster than local folks bringing in and following inane rabble-rousers.

My point about all this, and I keep coming back to it, is there are no easy answers. There are two sides to every argument, and in this case, both have some merit. Fortunately, the EFSC is, I think open-minded. The unfortunate thing is, the vast majority of the media coverage on the general question of nuclear power, radiation and its hazards, is not so open-minded. About the only place one finds coverage of both sides of the issue is on the editorial pages. The front page news columns seem biased, indeed.

That goes for television news, as well. The Atomic Industrial Forum, an international pro-nuclear group based in Washington, D.C., has published excerpts from a report by a clinical psychiatrist who says that TV news coverage of nuclear energy is fostering a nuclear phobia.

Dr. Robert L. DuPont, associate clinical professor of psychiatry and behavioral sciences at the George Washington University School of Medicine, a leading authority on phobias, studied 13 hours of broadcasts aired by three network evening news shows.

"According to Dupont, a phobic person often is intelligent and thinks clearly and realistically outside of the situation promoting his phobia. There may also be some risk in that situation, but for the phobic person this fear 'is out of proportion to the real, external danger.' One characteristic of the phobic person's think process, DuPont says, 'is a spiraling chain reaction...of what ifs and each what if leads to another.' He says, 'Phobic thinking always travels down the worst possible branchings of each of the what ifs until the person is absolutely overwhelmed with the potentials of disaster.'

DuPont said the TV news coverage he reviewed was a striking example of just such a line of reasoning. The news stories were based on "what if" thinking rather than "what is" thinking.

" 'That is not common in journalism,' DuPont says. 'You just do not see a lot of stories of planes that might have crashed.'

"DuPont emphatically rejects the notion that everyone who opposes nuclear energy has a phobia, or that opposition to nuclear energy is wrong. 'Nevertheless, after viewing the 13 hours of network TV news tapes, I am convinced that fear is the dominant theme of this particular TV coverage and that much of the fear of nuclear power has elements of phobic thinking,' he says."

What the media do, and I can verify this, is, when a nuclear expert testifies that nuclear power plants are safe, they push a microphone in his face and ask "But can you be SURE?" Of course he can't. Death and taxes...But then the headline reads that the head of this agency or that committee admits a nuclear accident could happen.

What I can't understand is how the Walter Cronkites and John Chancellors of the media, trained in their trades, could allow such tactics to be used on their programs by reporters. And how so much of the public could fail to see through it. Let's assess the risks intelligently!

The same publication quotes Rep. Morris Udall of Arizona, (the once-darling of liberals during the preliminary 1976 presidential campaign) as saying nuclear power is needed for the interim, and that construction and licensing of

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The same publication quotes Rep. Morris Udall of Arizona, (the once-darling of liberals during the preliminary 1976 presidential campaign) as saying nuclear power is needed for the interim, and that construction and licensing of plants should go ahead if the lessons of Three Mile Island have been learned.

"'I'm prepared to say, if North Anna (one of the plants scheduled to begin operation this year) is ready to go and NRC says the lessons of TMI have been learned, load fuel and turn it on,' he said. 'Nuclear's got to be there to provide a transitional source (of electricity,)' Udall said. 'We've got 14 plants scheduled for this year. Let's apply the lessons of TMI and put them on line.' Udall also criticized legilsators who are anti-nuclear without substituting a real energy alternative. 'We ought to be required to put up or shut up.'

Uranium tailings site designation criticized by property owners

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The designation of the entire 258 acres owned by Precision Pine in Lakeview as a uranium mill tailings site by the federal government may have a negative impact on industrial growth, and local officials are hurriedly attempting to change that designation.

Representatives of the state and federal energy departments, state Health Division and federal consultants were in Lakeview for a hearing last Wednesday night, August 29, laying out a program by which the government will purchase and maintain the radioactive portion of the tailings site to minimize future health hazards. But property owners and others with an eye to industrial development in Lakevie disagree with the definition of the site.

Under the so-called Uranium Tailings Act of 1978, the United States Department of Energy is cooperating with several states in stabilizing and cleaning up several hazardous sites in western states. The uranium tailings pond site of the Lakeview Mining Company, now owned by Precision Pine, is one of those sites.

The program calls for the state to purchase and maintain the site.

The hearing in Lakeview was one of a series in which the definition of the site and location of other sites will be determined. Local property owners and governmental representatives have until September 14 to make comments to the state on what should be included.

The main point of the local hearing, it turned out, was that the definition of the site at Precision Pine is claimed to be too broad, taking in areas which the state Health Division has declared to be free from any radioactive contamination.

Part of the land involved is an area zoned Industrial, and earmarked for industrial development. But under the provisions of the program, if the land remains classified as part of the tailings site, development could be halted or at least slowed considerably.

Lakeview Mining Company was one of many in the United States to process uranium ore in the decades from 1942 to 1970. The local plant operated from 1958 to 1950. After processing operations ceased and many mills shut down, including that in Lakeview, tons of uranium mill tailings remained at the inactive sites. The Lakeview tailings were located on a four-acre parcel nearly one-half mile west of the mill.

In 1966, the Colorado Department of Health found that the mill tailings from the Climax Mill, located south of the Grand Junction metropolitan area, had been used extensively in Grand Junction for the construction of homes, schools and other buildings. The principal hazard was in the form of radon gas.

This finding spurred the Oregon Healt Division to investigate the conditions of the Lakeview uranium mill site. Work began here in 1972.

Radon is what is called a daughter of uranium. Uranium tailings, as they give off radioactivity, break down into radium, which further breaks down into radon, a gas. That gas can escape from the site into the air. The hazard comes in possible inhalation of radon, which can

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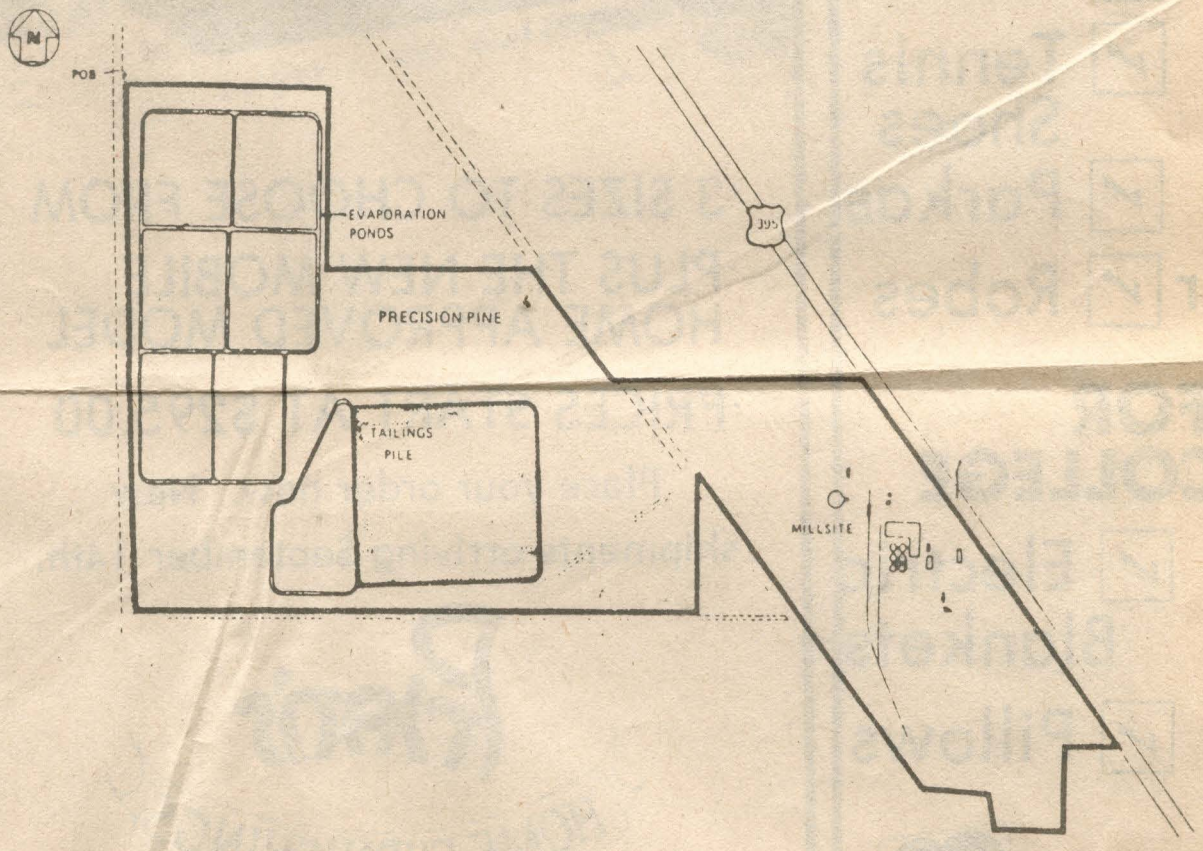

TAILINGS SITE--This map shows the various components of the property now owned by Precision Pine. All of the area enclosed by the line is currently classified as part of the tailings site. Mill owners and others in Lakeview are contesting that definition.

Tailings site contested

(Continued from Page 1)

cause lung cancer.

Through several investigations, the Health Division discovered no tailings had been used in building sites in Lakeview. It also participated in a clean-up program with ARCO, which then owned the property. Nearly all radioactive material at the mill and surrounding property was gathered and placed at the old tailings pond, which was then covered with 18-24 inches of earth, and planted with wheat.

Then in 1978 Congress passed the Uranium Mill Tailings Radiation Control Act to stabilize, control and dispose of the radioactive mill tailings at 22 sites in the nation, including Lakeview's. These sites are eligible for federal funding for the clean-up and stabilization.

The 1979 Oregon Legislature authorized the state Department of Energy to enter into agreements with the federal department to implement the act at the Lakeview site. The Lakeview hearing was for the purpose of identifying the boundaries of the site. All written comments about the boundary identification must be submitted to the Oregon Department of Energy by September 14. The department will then make a recommendation to Governor Atiyeh, which he will use in making a recommendation to the U.S. Department of Energy.

In 1976, as part of the federal investigation of the tailings situation, the firm of Ford, Bacon and Davis surveyed the Lakeview site. On the basis of that survey, it recommended that all property owned by Precision Pine be included in the boundaries. That designation drew fire from Nat Stock, co-owner of Precision Pine and his attorney Wally Ogdahl.

"That doesn't have anything to do with radiation levels," Stock said, referring to the definition of the site along property ownership lines. He claimed that the Act states that sites are defined as the area where tailings are actually stored, plus any area which is contaminated, but Robert Overmyer of Ford, Bacon and Davis said the wording is ambiguous.

Ogdahl said the designation of the 258 acres as the tailings site would impose an economic hardship on the owners and on the community as well.

Under the provisions of the Act, he said, Precision Pine and any other businesses on the site would have to sign a waiver of liability concerning any remedial action taken at the site. This means, among other things, that if the mill were shut down during the clean-up operations, Precision Pine could not hold the government liable for losses.

Ogdahl also pointed out that such provisions might inhibit industrial development on the site, one of two sites where such development may occur in Lakeview.

"We oppose the inclusion of the rest of the site under any definition," Ogdahl said, pointing out that the Health Division's monitoring had revealed that radiation levels there are no higher than normal background levels elsewhere in the Lakeview area.

Overmyer encouraged Ogdahl to make his comments in writing to the Department of Energy before the September 14 deadline.

Don Goddard and Michael Pollock of the Oregon Department of Energy said comments would be considered by them in making a recommendation to Governor Atiyeh. After Atiyeh makes his recommendation to the federal department, all eligible sites will be designated in November.

Following that designation, the sites will be classified by priority, based on the level of public health risks involved. Goddard said the Lakeview site would probably have a medium priority, which would mean no action would be taken for several years.

The state energy department intends to acquire the tailings site, and to take whatever steps it deems necessary to limit the public health risks, Goddard said. The state's actions will not be limited to the recommendations of the federal government, if it feels further actions are necessary.

In addition, any person who knows of property which may be contaminated by tailings may apply to the state department for inclusion in the remedial action program. Forms for application are available at the County Commissioners' office in the courthouse.

All written comments on the designation process should be sent to the Department of Energy, Labor and Industries Building, Room 111, Salem, Oregon 97310.

Tailings, mill receive 'clean bill of health'

The uranium tailings site, lumber mill and property owned by Precision Pine in Lakeview have received what amounts to a clean bill of health from the Oregon Health Division.

At a hearing Wednesday, August 29, statistics quoted showed that the local population does not face any appreciable health risk from the tailings storage site, despite the worry over the site on the part of the federal government.

In fact, the risk from the tailings is less than the apparent risk of merely living in Lakeview.

The statistics compiled by both state and federal sources bely the designation of some 258 acres owned by Precision Pine as a tailings site by the federal government--a designation Precision representatives are interested in changing (see related story, page one).

The uranium tailings, a gravelly substance left over after the uranium ore is processed, contain some radioactivity. What probably amounts to several tons were left over when the Lakeview uranium processing plant shut down in 1960. For a dozen years, they lay, exposed to elements, in the old settling pond about a half-mile west of the plant.

Discoveries of improper use of tailings in Colorado, as construction fill in homes and other sites, prompted concern about the local tailings. In 1972 the Oregon Health Division began a program which eventually led to the cleaning up of the entire site.

George Toombs, supervisor of the Radiation Control Section of the Health Division's Environmental Radiation Surveillance Program, has said that the tailings site is stabilized to his satisfaction, and that all appreciable radiation elsewhere on Precision Pine property has been cleaned up.

While a federal consultant designated the entire property as affected by the tailings on the basis of a 1976 survey, Toombs, who monitored the property as recently as August 21, said it is clean.

"We found the entire area to be essentially background," he said, meaning that no radiation beyond normal background levels is present.

Robert Overmyer, of the firm which did the 1976 survey, said the risk of "health effects" from the tailings is negligible.

The consultants from Ford, Bacon and Davis, under contract with the federal Department of Energy, found the Lakeview site in "relatively good condition compared with the other inactive sites," at that time, he said.

What risk exists to local residents from radon, a radioactive gas which the tailings dump emits. Some gas escapes from the soil into the air, and can be inhaled. Inhalation can cause lung cancer.

But the 18-24 inch earth covering placed on the tailings ponds has effectively curtailed radon emissions, according to Ford, Bacon and Davis study. That study showed that the risk of contracting cancer from the radon in the tailings is less than the risk from merely living in Lakeview.

The study covered land and residences within five miles of the site. On the basis of that monitoring, it found no levels of randon of sufficient quantities to cause concern.

The study concentrated on a population of 2,280 persons who lived within five miles of the site. Of those 2,280 persons, assuming they each lived 100 years, one person could be expected to contract lung cancer from the radon. Among the same population in the same 100 years, 14 would probably contract lung cancer from the background radiation levels.

About 150 persons would contract cancer from all causes, out of that population, Overmyer said.

"That shows that we are still talking about less than one percent of cancer cases in this area what would be attributed to the pile," he said.

(Continued on Page 2)

Site said clean

(Continued from Page 1)

And those figures could actually be high, he said, because of the way the statistics were figured. The numbers used were based on a known incidence of lung cancer among uranium miners, who breath known amounts of radon during the course of their work. The process used to arrive at the above figures is known as "linear extrapolation."

Overmyer and Don Goddard of the Oregon Department of Energy said that such linear extrapolation may actually overestimate the effects. Because inhalation among the 2,280 population is at random and very low levels, the radon may not have near the effect that it would on miners. There may be some "threshold" for radon inhalation, below which the effect is not nearly as great, they said.

Goddard said that, while there is a continuing debate about the effects of low level radiation on humans, the levels at the Lakeview site are far below the levels usually referred to in such discussions.

"There is more radiation there than before the tailings were put there," Goddard said. "How much, I don't know. My general feeling is it's very, very low."

To refer to studies on the effects of low level radiation in connection with this site is "misleading," he said. The levels present at the tailings site are "ultra-low, if you will."

Usually, in such discussions, figures of several thousand millirems (a unit for measurement of radiation exposure) are used, while exposure from the local site amounts to perhaps dozens of millirems.

The officials testified that radon emissions at the tailings pond are higher than in areas where no tailings exist, but that some radon is emitted by the earth everywhere under certain conditions.

"Uranium is found to some extent in soils everywhere," said Overmyer. "It is a trace element." He said that radon levels within the five mile radius of the tailings were "generally very low," and that readings returned to background levels within one-half mile of the site.

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Max	Min	Prec
80	45	–
86	48	–
84	48	–
86	52	–
86	48	–
86	50	–
87	48	–

plant and equipment, but an engineering study will be made this year to determine the mechanical condition of the mill.

Atlantic-Richfield is a major oil and gas producing corporation which also is engaged in uranium exploration.

The uranium reduction plant was built in 1958 at a cost of about $2,800,000 to produce uranium oxide (U-308) from the ores of the White King and Lucky Lass mines which the plant builder, Lakeview Mining Company, had leased.

The plant, using the acid leach process, went on stream in November, 1958 and was operated by that company until November, 1960, when it was shut down and it has not operated since that date.

On March 27, 1961, Kerr-McGee Oil Industries of Okla-

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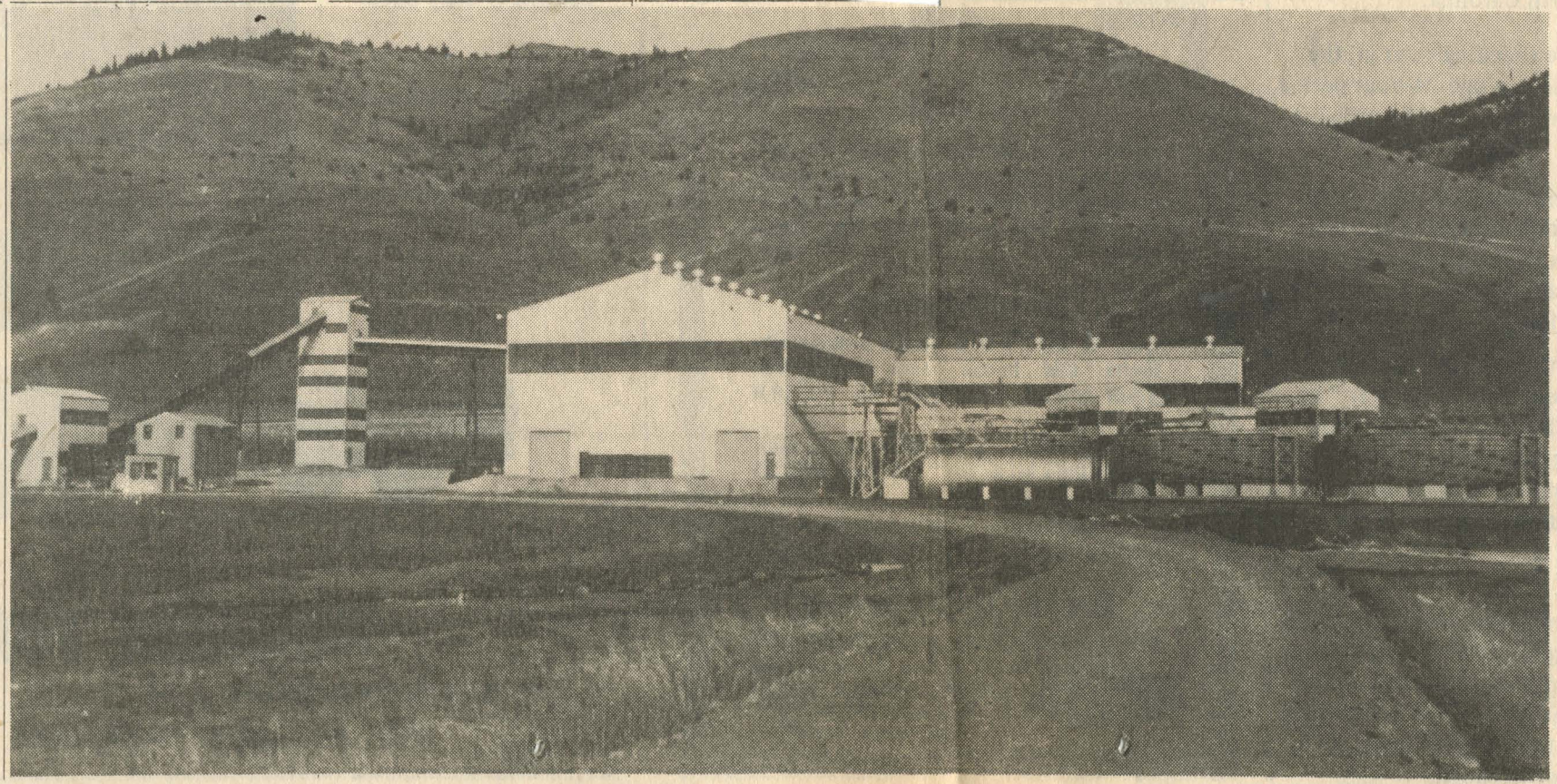

THE URANIUM REDUCTION PLANT north of Lakeview has been purchased by Atlantic-Richfield Company. The plant was built in 1950 by Lakeview Mining Company at a cost of about $2,800,000, and Atlantic-Richfield becomes the sixth owner. (Examiner Photo, 1959)

Uranium Reduction Plant Sold to Atlantic-Richfield

The Atlantic-Richfield Company as of July 17 has acquired the uranium mill located just north of Lakeview, from Commercial Discount Corporation of Chicago, it was announced last week in a brief statement by Chick Chaloupka, local counsel for Commercial Discount. The consideration was not disclosed.

A spokesman for Atlantic-Richfield told Chaloupka that no immediate plans have been made for utilization of the plant and equipment, but an engineering study will be made this year to determine the mechanical condition of the mill.

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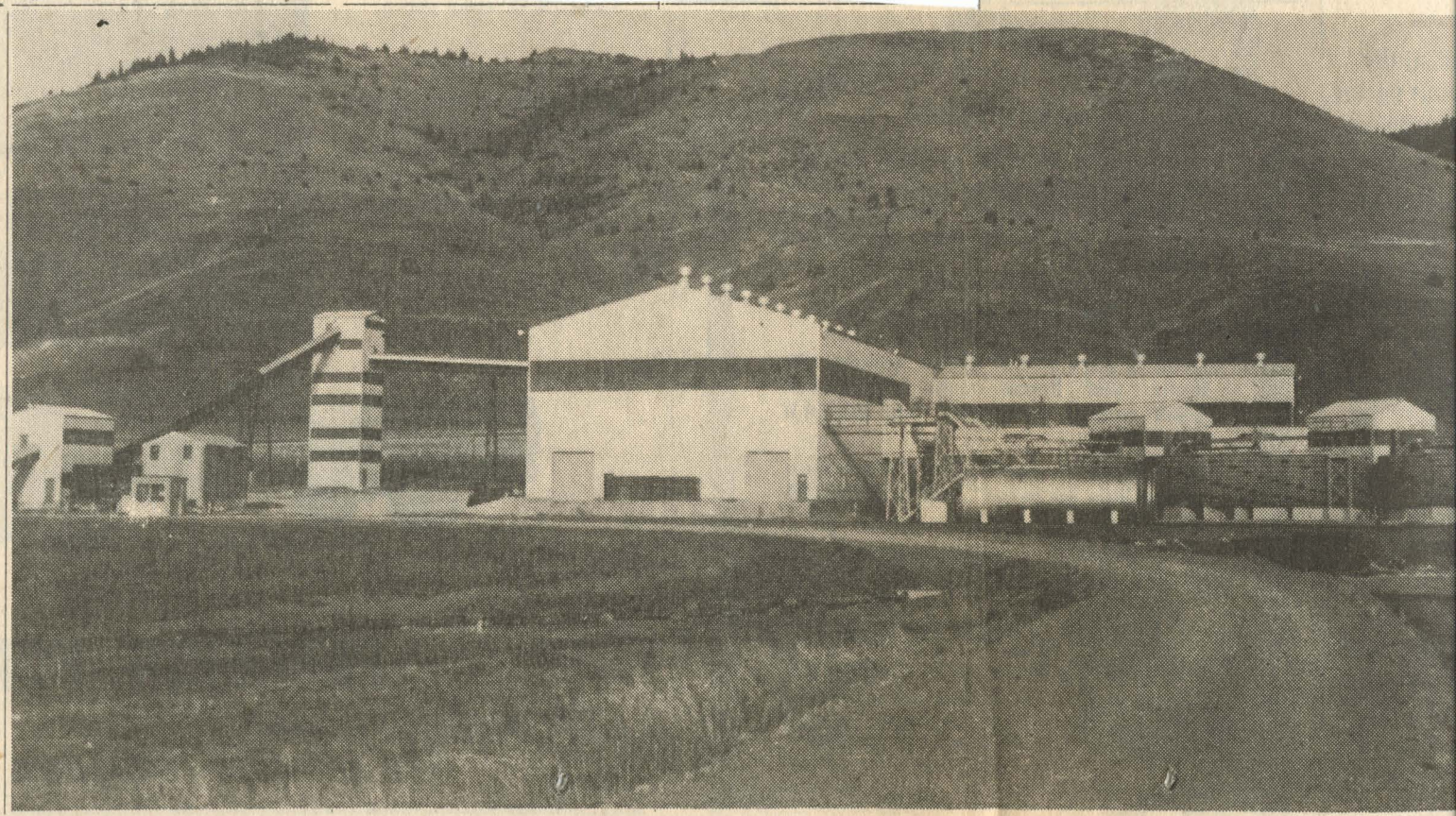
(Continued on Page 10)

WEATHER

	Max	Min	Prec
July 17	80	45	–
July 18	86	48	–
July 19	84	48	–
July 20	86	52	–
July 21	86	48	–
July 22	86	50	–
July 23	87	48	–



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Uranium Reduction Plant Sold to Atlantic-Richfield

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homa City announced its subsidiary, Kermac Nuclear Fuels, had obtained ownership of the plant, and on November 12, 1964, a group of Lakeview Investors organized as Oregon Pacific Industries bought the plant with the intent of getting an industry into it. This group included Don Clause, Jim Farleigh, Jim Olson, Roy Matchett and Nancy and Ed Taylor.

On March 10, 1966, sale of the plan by Oregon Pacific to Continental Mining and Milling Company of Chicago was announced. The latter firm announced extensive plans for processing uranium plus other circuits for a number of minerals. These plans did not materialize, and a mortgage against Continental was foreclosed in 1967 by Commercial Discount Corporation which took ownership and has now sold to Atlanta-Richfield.

The uranium story in Lake County began in 1955. In July discovery of the White King on Augur Creek, 12 miles northwest of Lakeview, was announced by Don Tracy, Wayland Roush, John Roush, Walter Leehmann Sr. and Jr., the prospect having been found in March by Tracy. The following week, Don Lindsey, Bob Adams, Clair Smith and Choc Shelton announced discovery of the Lucky Lass, about one mile from the King.

These events set off wholesale prospecting and claim taking in wide areas of the county, with upwards of 3000 claims filed. That fall, both of the original discoveries were leased to Thornburg Brothers of Grand Junction, Colo. The latter, Dr. Garth W. Thornburg and Vance Thornburg, joined with the Richarson-Bass interests of Fort Worth, Tex., and the Murchison Trusts of Dallas, Tex., to form Lakeview Mining Company which explored the properties and in 1958 built the reduction plant.

The plant initially processed ore from the King and some fror the Lass. When underground mining operations at the White King proved difficult and expensive, the operation shifted to open pit and this method produced all the ore it could by late 1959. The King was shut down then, and the mill continued operating for about one year, using ores shipped in from Nevada and California.

The Lucky Lass owners did some extensive open pit work in 1964, shipping its ores to Salt Lake City for processing.

In July, 1966, the White King group of 19 claims was leased to Western Nuclear, Inc., of Denver, and in December of that year, Don Tracy announced he had leased his Lucky Lass group of claims on Thomas Creek to that firm. Since taking the King lease, Western Nuclear has done extensive core drilling, which is still going on.

EFSC visits Lakeview

754

'Remedial action' plan outlined

Based on what the state knows at this time about the former uranium processing plant and the tailings burial site north of Lakeview, the public is safe for now from the materials there, but the state and federal governments are in the midst of a program intended to ensure the long-term safety of the local public regarding those sites.

By the end of 1983, a "remedial action" program will have been completed at Lakeview, it was announced at a meeting of the energy Facility Siting Council April 11 at Lakeview. But in the meantime, in the opinion of those who have studied the problem for the state and federal governments, the Lakeview public is reasonably safe from any effects of the uranium tailings.

The council, a seven-member, unpaid committee which has jurisdiction over the placement of energy facilities such as power plants, power lines and, significantly, uranium mills, toured the facilities and land in question Thursday, April 10, and met for a regular business session Friday morning.

The focus of local concern was two-fold: The council recently adopted standards for siting of uranium processing plants in Oregon; and the council will have some involvement in the "remedial action" program relating to the local tailings and mill site.

Concerning the facility standards, the only action at the Lakeview meeting was public testimony both in favor of and against them.

The council and Department of Energy staff assigned to it dealt extensively with the ongoing program of ensuring that the public is protected from radiation from uranium tailings left at the disposal site.

Several thousand tons of mildly radioactive tailings, the waste product of about a year's uranium milling at the nearby plant, are buried under some 18 inches of earth on a 40-acre field about two miles north of Lakeview proper. This field is now the focus of activity which is part of a vast federal program to clean up such sites.

Several years ago, it was discovered that uranium tailings had been used as construction fill in Colorado. The tailings are not highly radioactive in themselves, but the material does emit by-products, among them radon, a radioactive gas. This gas, when released into the air, becomes attached to dust particles and can be inhaled into human lungs, where the radioactivity can produce cancer.

When it was discovered that tailings were being used and otherwise were presenting hazards to humans, the federal government embarked on a program to clean up the potential hazard. What is happening currently is the result of this process.

In 1978, Congress passed the Uranium Mill Tailing Radiation Control Act. One part of that act extends the authority of the Nuclear Regulatory Commission over the disposal of tailings, and allows the states to assume that authority, as Oregon has through the EFSC. Another part of that act established a "Remedial Action Program," in which the U.S. Department of Energy, in conjunction with the state, determines the required actions at each known tailings site, and does what is necessary.

So far, the state Department of Energy has entered into cooperation with its federal counterpart to accomplish the goals of this act; the local site has been identified; it has been given a priority listing; and preliminary studies have

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So far, the state Department of Energy has entered into cooperation with its federal counterpart to accomplish the goals of this act; the local site has been identified; it has been given a priority listing; and preliminary studies have been made. What remains is for detailed studies to be made and action to be taken on the basis of those studies.

The entire property, some 250 or more acres, was once owned by the Lakeview Mining Company. It processed uranium ore from local mines for about one year, then went out of business. The property has passed through several changes of ownership, and finally was bought by the Atlantic Richfield Company (ARCO).

In 1973 it was discovered by the Oregon Health Division and other agencies that the tailings pile was uncovered to the elements, poorly fenced and was being used by motorcycle riders. In addition, the tailings were exposed to wind and were blowing into the air when the wind was strong.

At that time, the Environmental Protection Agency used a mobile scanner to attempt to pick up readings or radio-activity from 1,345 structures in Lakeview, finding no tailings anywhere but at the mill site.

In 1974 ARCO removed much of the equipment that had been used in the uranium mill from the site, covered many "hot spots" and covered the tailings pile with about two feet of earth under governmental supervision. Several surveys of the entire area were made in the next few years.

In 1978, Precision Pine bought the property, and completed much of the clean-up work which had begun, under the direction of the Oregon Health Division.

These previous cleanup measures were intended, said Don Goddard of the Oregon energy department, to provide for the "short-term safety" of local residents, and they have done so. The remedial action program is intended to ensure the long-term safety of the area, taking into account any possible future changes in land use, geology or hydrology, he said.

In light of studies made so far, the state has designated the entire parcel to be a "tailing site," for the purposes of the program, and it has been rated a medium priority project for remedial action.

The site designation, as well as any future actions in the program, hinges on standards for clean-up of tailings sites being developed by the Environmental Protection Agency (EPA). Those standards, originally scheduled to be published last fall, have been repeatedly delayed.

(Continued on Page 2)

EFSC outlines plan for tailings clean-up

(Continued from Page 1)

Michael Pollock, energy department staff member who conducted much of the Lakeview meeting, said those EPA standards are now tentatively scheduled to be published this month.

The energy department has developed a list of recommendations for further actions at the mill and tailings site, as a means of preparing for future actions to be taken under the program.

The first recommendation is that the mill buildings be scanned for measurements of radon concentrations, especially in poorly ventilated rooms. No records exists of such measurements, and levels above normal background ranges may indicate the presence of tailings under or around the structures. Such details are important to the future actions.

Also at the mill site, the department recommends that any sumps, drains or septic systems be identified and if they exist, the material in them should be identified.

At the tailings pile and mill site, the staff recommended more surveys to identify any buried radioactive materials and to determine radon emanation rates. At the mill, some small hot spots have been discovered last fall, and the intent of the program is to completely eliminate any such problems once and for all so that no more action is ever needed.

At the tailings pile, radon measurements have only been taken a couple of times, and more complete studies are felt to be necessary.

Another recommendation concerning the tailings pile is that the possibility of land disturbance or migration through water tables be studied. Because there is water near the site, and it is in a geothermal area with several faults, a study of these factors will be important in determining what course of action to take.

Finally, land use and land values need to be studied. Lake County has limited areas available for industrial development, the department's recommendation points out, and the tailings site is on or near one such area.

All these studies are for the purpose of eventually deciding whether to try and take care of the tailings by covering and stabilizing them, or by moving them. Presumably, if water leaching or faulting action could move the radioactivity about, and if future use of the land is deemed necessary, the recommendation will eventually be to remove the tailings.

A cost-benefit ratio study of moving the tailings would be part of an eventual environmental impact study done of the site.

The department has recommended what it sees as minimum standards to be followed in either case, if the tailings stay or are removed. If the tailings are to remain, all radioactive materials outside the present tailings spot should be buried in the tailings pile and the rest of the property declared clean and released to any and all possible uses; and the tailings site itself should be deeded to the state of Oregon, no use of it permitted in any way, and a perpetual care fund used to cover cost of monitoring the land.

In deciding whether to remove the pile of tailings, standards in making the decision will include:

--No future degradation of ground or surface waters would be allowed.

--Radon emanation rates would have to be reduced to a very low level.

--No areas larger than 100 square meters with gamma radiation levels more than twice background levels would be acceptable; and no individual measurements more than four times background would be permitted.

The department has plotted a timetable for actions to occur under the program.

This year, all estimates of what will be the required actions will be established, through extensive studies as outlined above. During fiscal year 1981, the geologic and hydrologic evaluations will be conducted, an environmental statement published and preparations for the eventual remedial action begun, including acquisition of property where such action would be appropriate.

During fiscal year 1982 and 1983, the final remedial action plan will be adopted and completed. The department will probably ask the Oregon Legislative Assembly in 1983 to appropriate the necessary funds.

Other items were discussed at the Energy Facility Siting Council meeting, including whether the Trojan nuclear power plant is endangered by the eruptions of Mt. St. Helens. Department of Energy officials said there was no danger. Also discussed was an application by a power company to transport a used atomic generator up the Columbia River to the Hanford Nuclear Reservation, the suitability of uranium processing for the Lakeview area's economy and ecology, and the plans of Northwest Geothermal Corp., in the Lakeview area.

Sentiments high on mining issue despite lack of definite

GRAND TOUR--Nat Stock of Precision Pine pointed out features of the former uranium mill, now a lumber mill, to members of the Energy Facility Siting Council last week, when the council met in Lakeview for a hearing on past and possible future uranium mining.

The Oregon Energy Facility Siting Council (EFSC) expects soon to receive an application for siting of a uranium processing plant at McDermitt, but does not expect any such applications for the Lakeview area; nevertheless sentiments here remain high over the issue.

Such sentiments were in evidence at a meeting of the EFSC at Lakeview Friday morning, April 11, in which several members of the public spoke on both sides of the issue.

The council held its meeting at Lakeview in order to view the old uranium mill facilities and tailings pile, and in order to take comments from local residents and members of the public about the possible cleanup of the tailings and possible resumption of mining and milling here.

During the public comment portion of the meeting, for which an hour was allowed, several people spoke against any uranium mining or milling activity in Lake County and for the total cleanup of the tailings site, while others voiced sentiments in favor of activity in the field here.

One Lakeview resident, Tom Pence, probably best summed up the collective state of mind of the local population when he confessed he was confused about the whole matter, especially the safety of the tailings dump. He ask about the use of phrases "short-term" and "long-term" when the government describes the safety of the tailings, to which a Department of Energy official responded.

"In the absence of any changes, things are okay," said Don Goddard, energy department staff member assigned to the siting council, explaining what the term "short-term safety" meant. He said the tailings are in a safe state now, assuming no changes in the present physical situation. But studies need to be done to determine whether present and possible future conditions lend themselves to the long-term safety of the pile.

One person who attended the meeting from out of Lake County, Dennis Igou, member of the Uranium Resistance Coalition from Bonanza, challenged Goddard's statement that the tailings were safe, insisting that the presence of those tailings has been slightly responsible for an allegedly high cancer rate in Lake County.

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"It's obvious that the presence of radon gas and the nuclear industry" have contributed to the cancer and other health problems here, Igou said. He "demanded" that the cleanup of the site be given the utmost priority, saying the 1983 date for "remedial action" is unacceptable to his group.

"There is people in this county that are dying from what has been done in the past," Igou said. "We don't need any more of it," he said, indicating opposition to any future mining or milling of uranium here.

Igou's flat statement that radiation from uranium activity has caused high incidences of cancer in Lake County was refuted and debated by several other speakers, however.

Lake County Commissioner Leslie Shaw was one such speaker, and he pointed out that, while a study is soon to be undertaken into the cancer rates in Lake County, it has not been definitely established that rates here are inordinately higher than elsewhere in the state, much less that uranium activity has been the cause.

"It's probably true," Shaw said of the statement that cancer rates, particularly those of breast and pancreas cancer, are higher here. "But it's also been flatly stated that this was the result of the

(Continued on Page 7)

Uranium mining sentiments high

(Continued from Page 1)

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"In my opinion, if such a study does etermine that we have higher cancer tes than the rest of the state, it is very ely because we're closer to the sun an the rest of the state," Shaw said.

His statements were echoed by James gle, Lake County rancher who is involved in various aspects of public service, including a state health advisory board.

"I would just hope that you wouldn't jump to any conclusions before we have some facts," he cautioned the Energy Facility Siting Council concerning the possible health effects of uranium mining or milling.

Concerning standards adopted recently for the siting and operation of uranium mills in Oregon, Gordon Tracy of Lakeview, who is administrative assistant to the county commissioners and who also is involved in mining, said the standards are adequate.

"You should know that part of our community does have confidence in these standards," Tracy said.

He was responding to statements by Igou and others, notably Tess Thomas and Chris Platt of Lakeview, Radiation Education Council representatives, to the effect that mining and milling of uranium would be disastrous to Lake County.

Platt said the rules were inadequate at several points, including those provisions for tailings pile safety.

She also pointed out several things she said would happen to the area should such activity take place. Among them were decreases in land values; various health problems associated with radio-activity, including higher cancer rates; decreases in tourism; contamination of farm land and livestock with a subsequent inability to market local products; and the long-term pollution of the area's land, water and air.

"I don't believe this is the time for the multi-national companies to come here, to strip our land of its non-renewable resources and leave us with 99 percent of the waste material for us to deal with for thousands of years," Platt said.

Sally Bourgeois, another Radiation Education Council member, said she was concerned about the effect uranium mining could have on local water tables. Other instances of such mining have drastically lowered water tables, she said, and that could compound an existing problem in Lake County.

Tracy said he saw no conflicts with real estate values, and no hazards posed to land, crops and livestock from the siting standards. He said he was concerned about the possible dangers from uranium mining and processing, but urged the EFSC to proceed on as swift a course as is safe.

Frank Vaughn of Lakeview voiced similar opinions, and pointed out that if Lake County water contains some radon levels, it is because the water sources have always been in contact with naturally-occurring uranium ore bodies.

"The ore bodies are here, and through percolation methods, this water has passed through these ore bodies for thousands of years," Vaughn said.

Michael Pollock, another energy department staff member working with the EFSC, said the state knows of substantial exploration going on at the present in Lake County, especially by Western Nuclear Corp., which holds the White King and Lucky Lass leases, but there are no plans for beginning uranium mining locally in the near future.

The state is not aware of any plans for development of uranium mines in Oregon except those of Placer-Amex in Malheur county, Pollock said.

A company has to submit an application to the state before it can process any uranium in the state, under current law. The siting council has authority to accept or deny any application, based on the standards recently adopted.

Brother Raphael Wilson, chairman of the Energy Facility Siting Coiuncil, said written comments, statements or material are welcomed by the council from the public at any time.

Uranium mining sentiments high

(Continued from Page 1)

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Uranium mining measure planned for November vote

By CLAY EALS
Correspondent, The Oregonian

EUGENE — Members of a coalition of anti-nuclear and humans rights organizations announced Monday an initiative petition campaign to place on the November ballot a measure to ban uranium mining and milling in Oregon.

Lynne Lahr, spokesman for the Uranium Resistance Coalition, said the group needs the validated signatures of 54,600 registered voters.

The 1979 Legislature excluded uranium mill tailings from a previous ban on radioactive waste storage in Oregon, and the state Energy Facilities Siting Council recently adopted rules and regulations for uranium mill siting in Oregon.

Ms. Lahr said Placer-Amex and other companies are interested in uranium milling and mining in Southeastern Oregon. She said a citizens group in Lake County is also circulating petitions to put an ordinance on the ballot to prohibit uranium mining in the county.

She said the coalition is opposed to uranium mining and milling because of its release of radioactive particles into the atmosphere and groundwater and its "integral role" in nuclear power and weapons programs. Also, she said the uranium mining and milling "has traditionally been carried out at the expense of native American land, where large deposits of the resource are found.

Sponsors of the petition drive are Lloyd Marbet of Boring, and Kenneth Bender and Ted Whitney of Portland. Groups in the coalition include the American Indian Movement, Clergy and Laity Concerned, Forelaws on Board, the Lake County Radiation Education Council and the Trojan Decommissioning Alliance.

Or 3/4/80

Ask Andy: Radioactive carbon 14 tells fossil age

Andy sends a complete 20-volume set of the Merit Students Encyclopedia to Eddie Claus, 11, of Pittsburgh, Pa., for his question: **Can carbon be used to tell the age of a fossil?**

The element carbon occurs in several different forms called isotopes. One of these isotopes can be used to reveal the age of an old bone or an ancient log. It works because it is radioactive, and all radioactive substances decay at a steady, unchangeable rate.

All living cells contain carbon, and the carbon remains when long-dead plants and animals become fossilized. Most of this material is ordinary carbon, which has an atomic weight of 12.

However, in every sample of ordinary carbon there are a few isotope atoms. One of the heavier isotopes is carbon 14, which loses its extra weight by radioactive decay. There is one of these radiocarbon atoms among every trillion atoms of ordinary carbon atoms.

While they live, plants and animals consume a one-in-a-trillion ratio of radiocarbon, along with ordinary carbon. When they die, the intake stops, but the radiocarbon continues to decay at a precise rate. During the first 5,680 years, exactly half of the original material disappears. During the next 5,680 years, half of the remaining quota disappears, and so on.

The half-life of radiocarbon is 5,680 years, during which time half of any sample decays. Naturally, this changes the one-in-a-trillion ratio of radiocarbon and ordinary carbon. This gives the key to the carbon-dating of fossils.

For example, suppose archeologists find fossil bones and logs in an ancient campsite. They test to find the ratio of ordinary carbon to radiocarbon. Let's suppose that there is one radiocarbon atom per two trillion ordinary carbon atoms. This would mean that half the original radiocarbon has decayed, which must have taken 5,680 years. Hence, the campsite fossils date back 5,680 years.

Naturally, most samples involve complicated fractions of the half-life period. What's more, after 60,000 years, only a 1,000th part of the original radiocarbon remains. This tiny quota is too hard to detect, which is why carbon cannot help to date fossils older than half a million years or so.

Andy sends a 7-volume set of the Chronicles of Narnia to Clint Snyder, 10, of Boardman, Ohio, for his question: **How come a fish never blinks?**

In order to blink, one needs movable eyelids. A fish's eyelids are sealed shut, which is why he cannot blink them open and shut. If his eyelids were like ours, he would be unable to see. However, they are made of glassy skin which acts like windows. He needs eyelids of this sort to protect his eyes from floating objects in the water. However, his special eyelids give him a fixed glassy stare, and when he takes a nap he cannot shut out the sights.

Do you have a question to ASK ANDY? Send it on a post card with your name, age and complete address to ASK ANDY in care of The Oregonian. Entries open to girls and boys 7 to 17.

No on mines

Dear Editor

There is a statewide voter initiative petition circulating now that will have significant impact on the health and safety of Harney, Lake and Malheur County residents. It simply states: "Prohibits uranium mining or milling in the state of Oregon."

Last October, the Burns Times-Herald reported that ten companies have staked more than 5,000 claims on BLM land all along the McDermitt Caldera, including the Trout Creek Mountains, a major watershed supplying South End cattle operations. In Lake County, indications are that uranium mines and mills near Lakeview, which have already had disastrous impact on residents there, may be re-opened.

This past January, the Energy Facility Sitting Council approved rules and regulations for uranium mining, so little recourse remains to stop the energy companies but the will of the people.

Why stop uranium mining and how will it affect us? Here are a few points to consider:

(1) The Lakeview area is the only place in Oregon to have a uranium mill site. Although the mill ran for only two years, 130,000 tons of poisonous radiocative tailing (waste material from the refining process) were left to blow around for 15 years Lakeview has the highest breast, lung and pancreatic cancer rate in the state.

(2) Eastern Oregonians are accustomed to making a living from the renewable resources of the land. If we allow uranium mining, it will endanger not only lives, but also the quality of our water and grasslands. South End ranchers are squaring off with the BLM over temporary range curtailment. But uranium mining and milling could permanently destroy these same lands.

(3) The risk among miners of death and cancer far out-weighs the advantage of having a job. A government study of 3,500 Utah miners showed a lung cancer rate five times the national average. The United Mine Workers estimate 80-90 percent of all uranium miners will die of lung cancer.

(4) Nuclear power plants, which are fueled by uranium, are an insane and short sighted gamble of lives for the sake of electricity. Accidents and terrorist sabatage are a direct and daily threat to anyone within 200 miles of a nuclear power plant. The Bonneville Power Administration recently chalked up an 88 percent increase in the cost of its power. The reason? Cost over-runs on two Washington state nuclear plants.

Americans all across the country have come out to protest the nuclear power gamble. The Nuclear Age has finally come to Harney County, or at least it has been placed at our door step. The grim facts on nuclear power are clear - extreme danger to life, high cost, unmanageability - the list goes on.

We would be wise to ban the profit-hungry energy multinationals and maintain what we have now - clean water and air, good grass and forest lands and uranium atoms spinning peacefully far below the earth's surface.

We need 65,000 signatures to place the Ban Uranium Mining and Milling Measure on the November Ballot. Anyone interested in adding their name to the side of life may call 573-7470 to sign the petition.

R. Bruce Bartley
P.O. Box 1011
Burns, Oregon 97720

July 2, 1976

Mr. William F. Jud, Geologist
Atlantic Richfield Company
1500 Security Life Building
Denver, Colorado 80202

Dear Bill:

Thank you for your letter of June 15 concerning uranium deposits in Oregon.

Only two mines ever operated in Oregon - the White King and Lucky Lass - and both of these shut down more than 15 years ago.

We feel that we do have some occurrences that should be re-examined and re-evaluated, and I hope that your company would be willing to spend some time in our State.

Mr. Norman V. Peterson, who works out of our Grants Pass office, has spent the most time on uranium deposits in our State and is in the best position to answer the questions you sent to me. I am therefore sending your letter on down to Norm and I think he will contact you very shortly.

For your information I am enclosing a copy of our February 1959 ORE BIN which contains a report by Norm on the Lakeview uranium deposits. I would also recommend that you purchase a copy of our Bulletin 66 (Geology and Mineral Resources of Klamath and Lake Counties, Oregon) - price $6.50.

I hope that you will be able to take the time to come to Oregon this summer and meet with us personally so we can give you a better idea of uranium exploration activities and mineral potential.

Sincerely yours,

Raymond E. Corcoran
State Geologist

REC:jr
Encl.
cc Norman V. Peterson

AtlanticRichfieldCompany

Synthetic Crude and Minerals Division
Resource Development Group-U.S.
1500 Security Life Building
Denver, Colorado 80202
Telephone 303 573 3533

H. S. McAlister
Exploration Manager
Uranium and Other Minerals

June 15, 1976

Mr. R. E. Corcoran
State Department of Geology and Mineral Industries
1069 State Office Building
1400 S.W. Fifth Avenue
Portland, Oregon 97201

Dear Sir:

Atlantic Richfield Company is compiling data on uranium deposits, uranium research, and exploration activity. Will you tell us about the uranium situation in your State?

Several categories of information are of particular interest. These include the following:

Known Radioactive Mineral Occurrences

Where are the radioactive minerals in your State? What kind and size are the deposits? Are any of the deposits commercial or being mined?

Ideas For Prospecting

Where do you recommend looking for uranium, and in which geologic environments? Is uranium associated with particular host rocks or indicated by other geologic features such as large areas of uranium-poor rocks upstream from geochemical traps?

Is uranium associated with lineaments or other surficial features? What features do you consider to be guides for uranium prospecting?

How do you recommend looking for uranium? Does geochemistry, airborne radiometrics, or another technique work in your area? Which techniques are usually tried for uranium exploration in your geologic environment and which seem to work?

Studies

What programs are underway in your State to study uranium? Is work underway or already accomplished by the U.S.G.S., E.R.D.A.,

your own State Survey, schools and universities, or others? Who is a good source for information on these programs? Will you give me names and addresses of people researching uranium in your State?

Activity

Without violating confidentiality, will you give me an idea of the exploration activity going on in your State? Which areas are receiving exploration effort, what is being done, and what geology is under examination?

References

Bibliographic and reference information on your State's uranium will be appreciated.

I will appreciate all the information you are able to give.

Sincerely,

W. F. Jud

WFJ:cr

Wm F. Jud

Agencies Drag Feet On Uranium Claims

By JACK ANDERSON

WASHINGTON — Powerful mining companies have hustled off with more than $9 million in uranium ore from public lands while our federal protectors have twiddled their thumbs. Much of the illegally mined ore was sold right back to the government.

This sad news for the taxpayers is revealed in a suppressed report to Interior Secretary Walter Hickel's office from his Bureau of Land Management. The report presents stark evidence that the BLM has fallen down badly in supervising public uranium lands, but succeeded well in sheltering the giant mining companies.

THIS column was explicitly refused access to files containing the report, but obtained a copy anyway from under Secretary Hickel's nose. The report states that on "16 claims ... preliminary examination indicates lack of a valid discovery." This makes illegal all ore taken from the claim.

"The value of ore produced from these claims is estimated to be $7.5 million," the report goes on. "Another 20 to 184 claims may also be in this category. We do not have the production figures for these."

Besides these 16 claims, there are another 59 — accounting for $1.5 million more in illegally taken ore — "known to have been located and developed (but) null and void" from the start. Finally, "there may be another 50 to 100 claims in this category" where mining did not begin. Interior officials privately confirmed that the $9 million estimate was given them by Atomic Energy Commission specialists.

UNDER law, the government can file suit up to July, 1972, to get back the $9 million. But unless action is taken swiftly, the Nixon administration, so touchy in public about the national purse, will watch the funds drain out the bottom of it.

At the AEC, which shares blame for the dawdling, the talk is of go-and-sin-no-more legislation instead of a vigorous effort to recover some of the $9 million.

Here is the shoddy story of how the public has been short-changed:

In the late '40s and early '50s, the U.S. was buying uranium wherever it could. Mining companies dug ore from publci lands on which the claims were questionable or illegal, but the AEC was glad to get it.

FROM 1948 to 1955, the AEC put aside land to make sure of a uranium reserve. Gradually, the desperate need for ore ended. But some companies were already mining on the public lands, both legally and illegally, and the mining went right on.

Some of the ore was handled by Union Carbide and Vanadium Corporation of America, two mineral giants. Whether they knew claims were suspect has never been determined.

In 1963, Interior won an administrative test case involving another mineral firm, Climax Uranium Co. After backing and filling for two years, Interior asked the Justice Department to try to get back some of the value of the illegally taken ore.

For three more years, Justice, Interior and the AEC shuffled papers, but no court action was taken. All the while, the ore kept coming out — $1.1 million in fiscal 1968, for example, from dubious or illegal claims.

AT LAST, in November, 1968, Justice conceded there had been "extensive removal" of ore from the public lands, but suggested some kind of legislative remedy. Since then, the three agencies have been "considering."

The confidential report to Hickel's office says $525,000 is needed to press the whole $9 million claim. On the $7.5 million portion, "no funds have been budgeted or are presently available for investigations and contests."

As for the additional $1.5 million loss, only $35,000 has been programmed by Interior "for uranium trespass work in fiscal year 1970." Even if action is started, chances of recovering the taxpayers' millions are iffy.

House Interior Chairman Wayne Aspinall has proved a beloved friend of mining interests, particularly in his native Colorado, site of most of the illegal claims.

American Mining Congress
RING BUILDING • WASHINGTON, D. C. 20036

J. ALLEN OVERTON, JR.
EXECUTIVE VICE PRESIDENT

It occurred to me you would be interested in seeing the attached ——

Allen

Lag in Uranium Ore Supervision Cited

By Jack Anderson

Powerful mining companies have hustled off with more than $9 million in uranium ore from public lands while our federal protectors have twiddled their thumbs. Much of the illegally mined ore was sold right back to the government.

This sad news for the taxpayers is revealed in a suppressed report to Interior Secretary Walter J. Hickel's office from his Bureau of Land Management. The report presents stark evidence that the Bureau has fallen down badly in supervising public uranium lands, but succeeded well in sheltering the giant mining companies.

This column was explicitly refused access to files containing the report, but obtained a copy anyway from under Secretary Hickel's nose. The report states that on "16 claims . . . preliminary examination indicates lack of a valid discovery." This makes illegal all ore taken from the claim.

"The value of ore produced from these claims is estimated to be $7.5 million," the report goes on. "Another 20 to 184 claims may also be in this category. We do not have the production figures for these."

Besides these 16 claims, there are another 59—accounting for $1.5 million more in illegally taken ore—"known to have been located and developed (but) null and void" from the start. Finally, "there may be another 50 to 100 claims in this category" where mining did not begin. Interior officials privately confirmed that the $9 million estimate was given them by Atomic Energy Commission specialists.

$9 Million Drain

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Legal Runaround

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Anti-Smog Move

Several congressmen are preparing to jump into the California antismog case with a petition opposing the federal governments proposal consent agreement and asking for a public trial of the antitrust conspiracy suit against the four major auto companies.

The automakers, and their politically powerful Washington lobby, have been accused of conspiring over a 16-year period to delay research, development and installation of effective air pollution control equipment on motor vehicles.

The congressional intervention is being organized by Rep. Ed Roybal (D-Calif.), who has written a private letter to his colleagues urging their support.

"From a nationwide public health standpoint," Roybal wrote, "we know that deadly car exhaust fumes cause more than 50 per cent of America's total air pollution, and medical evidence has associated these toxic substances with higher rates of serious illness and mortality from asthma, emphysema, lung cancer, chronic bronchitis and heart disease.

"In addition," the private letter continues, "federal authorities estimate that nationwide property damage caused by corrosive pollutants contaminating the atmosphere amounts to some $13 billion a year.

"The offer to settle out of court, and avoid an open trial, threatens to forfeit the public's right to know and be fully informed of the true facts about this alleged conspiracy."

Sunday, Oct. 5, 1969 THE WASHINGTON POST
B1

Oil Shale Giveaway Feared

Hickel Denies Sen. Hart's Charge on Aluminum Ore Lease

By Spencer Rich
Washington Post Staff Writer

Sen. Philip A. Hart (D-Mich.) charged yesterday that the Interior Department "may be about to give away a huge portion of the Government's oil shale land."

The charge, which was immediately denied by Interior Secretary Walter J. Hickel, involves about 20,000 acres of government-owned shale lands in Colorado. This acreage may hold as much as 70 billion barrels of potentially recoverable shale oil, worth more than $200 billion at today's market prices.

One of the firms seeking to obtain the land has been represented for several years in the proceedings by Mudge, Rose, Guthrie and Alexander, the former law firm of President Nixon and Attorney General John N. Mitchell.

The land to which Hart referred is part of 11 million acres of shale-bearing lands containing perhaps 2 trillion barrels of potentially recoverable oil within the shale rock. (Annual oil use in the U.S. is about 5 billion barrels.)

Oil is worth about $3 a barrel in the United States, but so far a way to squeeze the oil out of the rock at a low enough cost to make the operation profitable has not been found. About four-fifths of the shale land — including the richest portions — is owned by the United States.

No Policy Set

Up to now, the government has never developed a final policy on what to do with its shale lands, and since 1930 it has barred all leasing and claims on the shale in order to hold it as a public asset until a policy is set.

In 1966, a number of mining firms made applications to lease portions of the shale lands in order, they said, to get at another mineral contained in the lands — dawsonite, an aluminum-bearing ore. A decision on these applications has never been issued to date and will be up to Hickel.

The basic question is what would happen to the shale in these areas if the dawsonite leases are issued. In most of eight leases, the dawsonite and the shale are intermingled and it would probably be impossible to remove the dawsonite without removing the shale rock also.

Hart, who is chairman of the Senate Antitrust subcommittee, said yesterday that if Hickel rules that the dawsonite leases may be issued — despite the existing 1930 prohibition against the leasing of shale — the applicants for the eight leases involved in the proceedings would realize what amounts to an enormous windfall by getting the shale also.

Head Start Feared

While they might eventually have to pay royalties on whatever shale oil they realized from the leases, they would have the advantage of obtaining the shale by the back door, before anyone else had an opportunity to get it, in advance of the establishment of any general policy for lease of shale resources, and without the competitive bidding which is expected to characterize the government's shale disposal policies when they are formulated at some time in the future.

"This could cost the public untold millions of dollars," said Hart.

Hart said he had heard rumors that the Interior Department was considering canceling a scheduled series of hearings before a hearing examiner in Denver and simply granting the leases. He said the department's reply, dated Sept. 18, "was not encouraging since it indicates that the department is seriously considering dispensing" with the hearing.

Question Under Review

Interior officials conceded that the records in the case had been "pulled back" from Denver last summer but said they had since been returned and that the purpose had been to review new information. The department's Sept. 18 letter to Hart said, "We are now considering whether the factual information presently available to the department and developed by it over the past years is sufficient to warrant a final departmental decision without recourse to a hearing."

Hickel said yesterday that "no decision has been made" on whether to issue the leases, that "nobody is going to give away oil shale or any other valuable resources in our custody as long as I am Secretary of Interior." He said the decision to be made was basically a legal one of whether the companies seeking the leases were entitled to them under the law.

The argument usually made against granting the leases is that the lands involved must be considered essentially as shale lands — rather than anything else — and therefore absolutely governed by the 1930 executive order against shale leases. Thus, the argument runs, no leases could be issued on the basis of dawsonite or other minerals being present.

Law Firms Involved

Of the eight lease applications, three are held by companies called Wolf Joint Venture, Ridge Minerals and Rock School Joint Venture. A major interest in these firms is held by the Advance Ross Corp., one of whose lawyers in the case is the law firm of Mudge, Rose, Guthrie and Alexander. A spokesman for the firm said last year — when the President was still with the firm — that Mr. Nixon was not personally involved in that case.

Another attorney of record for Advance Ross is Chapman, DiSalle and Friedman, the law firm of former Interior Secretary Oscar Chapman (under President Truman).

Martin L. Friedman (former counsel to the Democratic National Committee) said Friday that the basic work in the case is being handled by Tom Nicholson of the Chicago law firm of Mayer, Friedlich, Speiss, Tierney, Brown and Platt. Reached by phone, Nicholson said he knew of no proposed decision at present by the Interior Department. Friedman also said he knew of no decision on the leases.

The approximately 20,000 acres covered by the eight proposed leases (the companies linked to Advance Ross are asking for about 7,100 of the 20,000 acres are in one of the richest shale areas.

Interior officials told The Washington Post last year the 20,000 acres might hold as much as 35 billion to 70 billion barrels of oil. The latter, if it could be recovered economically now or (as is more likely) at some time in the future, would be worth $210 billion in the market place.

M E M O R A N D U M

September 29, 1965

To: H. M. Dole

From: R. S. Mason

Subject: Oregon Pacific Industries Meeting at Department of Planning and Development, September 21, 1965.

Present were: Senator Gordon McKay
James Farleigh
Donald Clause
Allen Bruckner, P.P.&L.
Bob Drager
Don Costello
R. S. Mason

Officers and principals (all of Lakeview) are: James Olson
Roy Matchett
Nancy Taylor
Donald Clause
James Farleigh

The meeting was called for the purpose of bringing Farleigh and Clause together with representatives from the Department of Planning and Development, Pacific Power & Light Company, and the Department of Geology and Mineral Industries. No copies of any reports were available, although Clause did pass one or two around for inspection. Copies of parts of several reports and a contract were made available subsequently.

Here is a quick summary of events. Oregon Pacific Industries acquired interest in the Lakeview mill in November 1964, and after a brief interlude during which a New York group known as RIMSCAP agreed to advance money to put the mill in operation - and subsequently backed out - OPI regained control and

now is in a position to deal with anybody. The First National Bank holds a mortgage of $150,000 against the property, but other than this there is no indebtedness. OPI has put up $60,000 of their own.

Galligher Corporation has surveyed the mill and has agreed to an operating contract, if the financing can be secured, by which they will place the mill in operation within 30 days and operate it on a fixed fee plus percentage of the profits arrangement. Galligher estimates that the ore can be milled for $5.75 a ton. Various reports by consulting engineers indicate that $750,000 is required to put the White King back into operation, refurbish the mill, and acquire and outfit several other mercury and uranium properties which would be tributary to the mill.

Although the White King produced only 131,355 pounds of U_3O_8 during its three years of operation and the average grade was 0.15 percent U_3O_8, the OPI people maintain that the grade of the remaining ore is considerably higher. Howard Dutro has reported to them that the White King has 811,000 pounds of 0.25 percent U_3O_8 remaining.

Oregon Pacific has a contract with the AEC to deliver yellow cake at $8.00 a pound through January 20, 1967. The contract is a peculiar one in that the Lakeview mill can treat only those ores which come from mines which have an allotment, and the AEC has told the Lakeview people that if they get rolling they will divert mining production from several California and Nevada properties to their mill rather than continue to ship it to Moab. Apparently the uranium ore at these various mines is compatible with the Lakeview flow sheet. Unfulfilled allotments for the White King amount to 240,000 pounds and the Lucky Lass 40,000 pounds of U_3O_8.

The OPI people feel that they are on firm ground in attempting to reactivate the mine and mill since the value of the mill building and utilities

alone is sufficient to cover any expected indebtedness (see attached letter from Galligher, 6-3-65). Apparently the junk value is high, and a Canadian firm has indicated that they would buy them out if and when.

As to the economics of the proposed venture, the following comments are offered. If the operation is to be restricted to the current AEC contract which expires January 20, 1967, the time table is exceedingly cramped, since in my opinion no steady production can be expected from the mine until the spring of 1966. This leaves less than a year to pay off any indebtedness. The OPI people also contemplate buying, outfitting, managing, and mining ores from four or five other scattered properties. This will be expensive, difficult to supervise, and of doubtful economics. Production from the AEC allocation mines in California is hopefully about 100 tons per day. This is probably a maximum and leaves the balance of a hundred tons which must come from the White King-Lucky Lass properties.

Present plans call for revising the flow sheet at the mill so that lead, mercury, silver, and molybdenum may be recovered in addition to the uranium. This new circuit will require an appreciable time to install and to run in - perhaps too much time to make it feasible in view of the January 20, 1967, deadline.

The operators are contemplating reprocessing the mill tails to recover mercury and molybdenum. Whether this would be profitable or not remains to be seen. There would be no mining cost, and recovery of the tails ponded adjacent to the plant should not be expensive. Any recovery above cost of production would, of course, help the situation but this is a completely untried procedure.

Oregon Pacific Industries admittedly knows nothing about mining and milling. They are anxious to develop payrolls for Lakeview and to earn some money for

themselves. They would welcome (a) financing to get them rolling, but (b) would also welcome a joint venture which would bring in management and know-how for the operation. A third possibility would be an outright sale to an operating company. Failing in all this they can junk the mill.

In reviewing the information supplied by Messrs. Farleigh and Clause at the meeting on September 21 and at two subsequent visits by them to the Department the next day, and after examining copies of various reports and contracts provided by them, the following comments are offered. The only information on the ore reserves apparently is that by Howard Dutro, who has told OPI that 811,000 pounds of U_3O_8 remain at the White King in ore averaging 0.25 percent. No mining engineering reports have apparently been made and no data exists which shows mining costs, ore-to-waste ratios for either underground or open pit operations, costs for eeopening the mine, lead time necessary to get into production, and rate of production. In the conferences and also in the copies of the reports the recovery of other metals besides uranium is discussed. No geologic data has been presented to indicate the abundance of these ancillary metals at the White King and exactly how they occur. The thought here is that a possibility exists that in order to hold up the grade of the U_3O_8 a considerable amount of these metals might have to be wasted. In other words, no metallurgical balance has been worked out - or even thought of by OPI - for the raw ore at the White King. OPI has submitted a memorandum on the White King ore reserves prepared by Clemons M. Roark, President of Lakeview Minerals, Inc. Certain figures on the grade and tonnage at White King are contained in the memorandum, but the overall conclusions are suspect not because of their content but rather because of possible bias introduced by the author who at that time had an interest in the proposed operation.

Howard Dutro, a geologist on the original Thornburg mine staff, and now a consultant at Denver, has prepared a report on reserves at the White King and a copy has been promised us by OPI. Unfortunately Dutro is rumored to have some tie-in with Galligher Corporation and apparently was instrumental in securing the attention of Phillips Petroleum as a possible operator. Phillips has met with OPI but has taken no announced action.

Other companies which have been approached to date, through suggestions made by Planning and Development and Pacific Power and Light are General Machinery and General Chemical. Several other companies, including Hecla and Cordero, have also been suggested to OPI.

The role played by Planning and Development in this matter is quite similar to that of this Department. P.&D., along with P.P.&L. and G.M.I., is trying to put the OPI people in contact with possible investors or operating companies. In doing this, care is being taken to make no representations of any sort. Caution is also being exercised in dealing with all parties to point out that the agencies are acting as liaison agents only. Considerable advice has been given OPI by the Department of Geology and Mineral Industries concerning the need for factual material, mine reports, etc., which they lacked.

Bendix
Field Engineering Corporation
Grand Junction Operations

P.O. Box 1569
Grand Junction, CO. 81501
Tel (303) 242-8621

A Subsidiary of
The Bendix Corporation

August 30, 1977

State of Oregon
Department of Geology and
Mineral Industries
1069 State Office Building
Portland, Oregon 97201

Attn: Norman V. Peterson

Reference: Unsolicited Proposal entitled "Exploration for Uranium and Geology of the Bear Creek Valley-Sams Valley Areas of Southwest Oregon (BFEC file #NFCP10074)

Dear Mr. Peterson:

The referenced proposal has been evaluated by the cognizant technical personnel of Bendix Field Engineering Corporation (BFEC) and a joint ERDA/BFEC review committee. A decision has been reached not to include your proposal in the current program plans of the National Uranium Resource Evaluation (NURE) as the areaof interest offered by your proposal is not considered a priority area and therefore cannot be considered for funding at this time. If this project is included in future program plans your organization will be contacted.

We have retained your proposal for our files, but will return it upon your request.

We appreciate your interest in the NURE program and thank you for your efforts.

Sincerely,

BENDIX FIELD ENGINEERING CORPORATION

Richard E. Tobias
Subcontract Administrator

RET:lf

cc: JGriggs- BFEC/PISD
RBarnett - ERDA/NPO

~~DAN~~
CLIFF

ROBERT W. STRAUB
GOVERNOR

OFFICE OF THE GOVERNOR
STATE CAPITOL
SALEM 97310

December 13, 1977

To All Agency Heads:

CHRISTMAS AND NEW YEAR'S SCHEDULE FOR STATE EMPLOYES

This is a reminder that the legal state holidays for Christmas Day and New Year's Day will be observed on Monday, December 26, and Monday, January 2. State offices will be open to the public on Friday, December 23, Tuesday, December 27, Friday, December 30, and Tuesday, January 3 with staffing on those four days arranged in such a manner as to allow a maximum number of employes to enjoy extended time off by using the additional day of leave provided for in many collective bargaining agreements while maintaining adequate public service.

In accordance with Personnel Rule 74-100(7), I hereby authorize one additonal day of leave with pay for employes of record as of December 23 who are excluded or unrepresented in collective bargaining matters. This additional day of paid leave may be taken at an employe's option on the workday before or after Christmas Day or the workday before or after New Year's Day. This authorization is subject to the minimum staffing requirements cited above.

In those cases where an employe must work during this additional day of paid leave to provide necessary services, the employe shall be credited with compensatory time off at the straight time rate. Such compensatory time may be utilized by the employe at any time during 1978. The Personnel Division will answer any questions you may have.

I would like to take this opportunity to thank all of you for the past year of service to the people of the state of Oregon and to extend best wishes for the holiday season and the coming new year from my family to you and yours.

Sincerely,

Governor

RWS/js

OREGON PROJECT NOTIFICATION AND REVIEW SYSTEM

STATE CLEARINGHOUSE

Intergovernmental Relations Division
240 Cottage Street S.E., Salem, Oregon 97310
Leslie Lehmann, Coordinator Ph: 378-3732

STATE A-95 REVIEW CONCLUSIONS

APPLICANT: Ore. Dept. of Geology & Mineral Industries

PROJECT TITLE: Exploration for Uranium & Geology of the Bear Creek Valley-Sams Valley Areas of S.W. Ore.

DATE: January 19,1977

The state has reviewed your project and reached the following conclusions:

- [x] No significant conflict with the plans, policies or programs of state government have been identified and your proposal is endorsed as presented.
- [ ] Relevant comments of state agencies are attached and should be considered in the final design of your proposal.
- [ ] Potential conflicts with the plans and programs of the state agency(s) have been satisfactorily resolved. No significant issues remain.
- [ ] Significant conflicts with the plans, policies or programs of state government have been identified and remain unresolved. The final proposal has been reviewed and the final comments and recommendations of the state are attached.

NOTICE TO FEDERAL AGENCY

The following is the officially assigned State Identifier Number:

7612 2 750

This number should be used on all correspondence and particularly on SF 240 as required by OMB A-98.

A copy of this notification and attachments, if any, must accompany your application to the federal agency as required by OMB A-95. Comments of the appropriate local reviewing agencies must also be included.

OREGON PROJECT NOTIFICATION AND REVIEW SYSTEM

STATE CLEARINGHOUSE

Intergovernmental Relations Division
240 Cottage Street S.E., Salem, Oregon 97310
Leslie Lehmann, Coordinator Ph: 378-3732

PNRS STATE REVIEW

Project #: 7612 2 750 Due Date: JAN 14

To Agency Addressed: If you intend to comment but cannot respond by the return date, please notify us immediately. If no response is received by the due date, it will be assumed that you have no comment and the file will be closed.

PROGRAM REVIEW AND COMMENT

To State Clearinghouse: We have reviewed the subject Notice and have reached the following conclusions on its relationship to our plans and programs:

(X) It has no adverse effect.

( ) We have no comment.

( ) Effects, although measurable, would be acceptable.

( ) It has adverse effects.

( ) We are interested but require more information to evaluate the proposal.

( ) Please coordinate the implementation of the proposal with us.

( ) We request review of the final application.

( ) State agency permits are required to implement this project. (list below)

( ) Additional comments for project improvement. (Attach if necessary

- - - - - - - - - - -

REMARKS (Please type or print legibly)

RECONNAISSANCE EXPLORATION FOR URANIUM AND GEOLOGY IN THE BEAR CREEK AND SAMS VALLEY AREAS OF JACKSON COUNTY.

HISTORIC PRESERVATION OFFICE
STATE PARKS & RECREATION BRANCH
525 TRADE STREET SE
SALEM, OREGON 97310

Agency _____ By _____

Bendix
Field Engineering Corporation
Grand Junction Operations

P.O. Box 1569
Grand Junction, CO. 81501
Tel (303) 242-8621 x 358
A Subsidiary of
The Bendix Corporation

December 15, 1976

Department of Geology and Mineral Industries
1069 State Office Building
Portland, Oregon 97201

Attn: Mr. Raymond E. Corcoran

1-00-74

Subject: Unsolicited proposal, entitled "EXPLORATION FOR URANIUM AND GEOLOGY OF THE BEAR CREEK VALLEY--SAMS VALLEY AREAS OF SOUTHWEST OREGON"

Dear Mr. Corcoran:

Thank you for the subject proposal, which was forwarded by Mr. C. L. Greenslit to the Subcontracts Section of Bendix for processing. A comprehensive evaluation by our cognizant technical personnel is required to properly assess the merits of your proposal, as applied to ERDA operations in Grand Junction. This evaluation may require consultation with ERDA or other U. S. Government agencies and personal contact with you or your organization.

You may be assured that the information contained in your proposal will not be disclosed by BFEC to anyone other than representatives of the U. S. Government and will not be duplicated, used, or disclosed in whole or in part by BFEC for any purpose other than evaluation. Any disclosure of this proposal by BFEC to the Government will be on the same conditions as agreed to herein. However, to avoid misunderstandings which could arise now or in the future, cited below are the conditions under which BFEC will evaluate your proposal:

1. By evaluating this proposal, neither the Government nor BFEC assumes any obligation to contract with you or your organization to pursue work in accordance with or related to the referenced proposal.
2. If this proposal is deemed to be meritorious with respect to the National Uranium Resource Evaluation (NURE) program, and funds are made available for its undertaking, BFEC reserves the right to determine whether such undertaking will be accomplished by accepting your proposal or by accepting another proposal secured after competitive solicitation, following generally the policy expressed in ERDA Procurement Regulation 9-4.52.
3. Unless a formal written contract is entered into, no obligation of any kind is assumed by, nor may be implied against, BFEC or the United States Government.

Any correspondence concerning these guidelines and other associated business matters should be addressed to this office.

Please communicate your agreement in the above conditions by signing and returning a copy of this letter for our files. If you are unable to agree with these conditions, we will, upon receipt of such notice, return your unsolicited proposal without further action. Your interest in the NURE program is appreciated.

Sincerely,

BENDIX FIELD ENGINEERING CORPORATION

Carolyn Griffin

Carolyn Griffin
Subcontract Administrator

CG:lf

DICK TOBIAS
(303) 242-8621 x 358

AGREED:

R. E. Corcoran — Dec. 21, 1976

State of Oregon — Date
Department of Geology and Mineral Industries

December 9, 1976

Mr. Charles L. Greenslit, Manager
Grand Junction Operations
Bendix Field Engineering Corporation
P.O. Box 1569
Grand Junction, Colorado 81501

Dear Mr. Greenslit:

I am enclosing six copies of a proposal to conduct a uranium exploration survey in Bear Creek and Sams valleys of Jackson County, Oregon.

I believe that the study outlined in the proposal would complement ERDA's National Uranium Resource Evaluation (NURE) program as I have seen it described in a number of ERDA news releases.

As we note in the proposal, the Bear Creek Valley - Sams Valley sedimentary rocks have many geologic characteristics that are indicative of uranium deposits in other areas. So far as we know, there have not been any previous field studies in this area to determine its uranium potential.

If you have any specific questions concerning our proposal, please feel free to call me.

Sincerely yours,

Raymond E. Corcoran
State Geologist

REC:jr
Encl.
cc Eugene Grutt
cc Donald L. Curry
cc Norman V. Peterson

OREGON PROJECT NOTIFICATION AND REVIEW SYSTEM

STATE CLEARINGHOUSE

Intergovernmental Relations Division
240 Cottage Street S.E., Salem, Oregon 97310
Leslie Lehmann, Coordinator Ph: 378-3732

PNRS STATE REVIEW

Project #: 7612 2 750 Due Date: JAN 14

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PROGRAM REVIEW AND COMMENT

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( ) We request review of the final application.

( ) State agency permits are required to implement this project. (list below)

( ) Additional comments for project improvement. (Attach if necessary)

- - - - - - - - - - -

REMARKS (Please type or print legibly)

1-12-77

Agency Geology By R. L. Carcoran

OREGON PROJECT NOTIFICATION AND REVIEW SYSTEM

NOTIFICATION OF INTENT TO APPLY FOR FEDERAL AID

For Internal Use Only	1-8] PNRS # 7612 2 750	Page One

02 12] APPLICANT [45: Oreg. Dept. Geol. & Mineral Industries | 46] DIVISION [79:

03 12] APPLICANT ADDRESS STREET [45: 1069 State Office Bldg | 46] CITY [60: Portland | 76] ZIP [80: 97201

04 12] CONTACT PERSON [45: R. E. Corcoran | 46] AREA CODE [48: 503 | 49] PHONE [55: 229-5580 | 56] EXTENSION [59:

01 12] PROJECT TITLE [71: Exploration for uranium and geology of the Bear Creek Valley-Sams Valley areas of southwest Oregon

11 12] PROJECT LOCATION—CITY: | PROJECT LOCATION—COUNTY: Jackson | PROJECT LOCATION [79: SEC: T: R:

05 SUMMARY PROJECT DESCRIPTION (ATTACH SUPPORTING DOCUMENTS AS NECESSARY—SEE INSTRUCTIONS ON BACK)
The proposed study will consist of a reconnaissance exploration of about

06 12] [71: 150 square miles in the Bear Creek Valley and Sams Valley in Jackson County, Oreg.

07 12] [71: The study will include a radiometric reconnaissnce of all accessible outcrops

08 12] [71: and a soils test for radon gas using the Track Etch, Terradex method.

09 12] [71:

10 12] [71:

12

AMOUNT REQUESTED—FEDERAL FUNDS		NON-FEDERAL MATCHING FUNDS		OTHER	TOTAL
12] (A) Grant [19	20] (B) Other [27	28] (C) State [35	36] (D) Local [43	44] (E) FUNDS [51	52] (F) FUNDS [60
$22,400.00		2,060.00			

13 12] TYPE OF OTHER FEDERAL FUNDS (See 12B) [45: | 46] TYPE OF OTHER NON-FEDERAL FUNDS (See 12E) [79:

14 12] FEDERAL **PROGRAM TITLE** [71: National Uranium Resource Evaluation (NURE)

15 12] FEDERAL **AGENCY NAME** [45: Energy Research and Development Admin. | 46] FEDERAL **SUB-AGENCY NAME** [79:

17 **(A) TYPE OF APPLICANT:** (Check (X) the single most applicable box)

STATE	INTER-STATE	COUNTY	CITY	SCHOOL DISTRICT	SPECIAL DISTRICT	COMMUNITY ACTION	SPONSORED ORGANIZATION	OTHER
[X] 12	[ ] 13	[ ] 14	[ ] 15	[ ] 16	[ ] 17	[ ] 18	[ ] 19	[ ] 20

(B) TYPE OF ACTION: (Check (X) as many boxes as apply to this action)

NEW GRANT	CONT. GRANT	SUPPL'T GRANT	INCREASE DURATION	DECREASE DURATION	CANCELLATION	INCREASE DOLLARS	DECREASE DOLLARS
[X] 21	[ ] 22	[ ] 23	[ ] 24	[ ] 25	[ ] 26	[ ] 27	[ ] 28

(C) HAS DISTRICT CLEARINGHOUSE BEEN NOTIFIED? Yes [ ] 29 No [X] 30 Date: _____

(D) REVIEW REQUIRED by A-95: Yes [ ] 31 No [X] 32

(E) ENVIRONMENTAL IMPACT: Yes [ ] 33 No [X] 34

(F) HOUSING RELOCATION REQUIRED: Yes [ ] 35 No [X] 36

(G) ESTIMATED APPLICATION FILING DATE: Jan. 1, 1977 | 41] MONTH [42: Jan. | 43] DAY [44: 1 | 45] YEAR [46: 1977

ADDITIONAL INFORMATION—ALL APPLICANTS

I. A. Is the project consistent with the city or county comprehensive plan, zoning and subdivision ordinance? No ☐ Yes ☐ NA

I. B. Is the proposal consistent with statewide land use goals? No ☐ Yes ☐ NA

I. C. Is the proposal consistent with state and regional plans? No ☐ Yes ☐ NA

II. Will the project have an impact on a neighboring jurisdiction? No ☐ Yes ☐ NA

If so, is the project consistent with the comprehensive plan for that jurisdiction? No ☐ Yes ☐

III. Explain deviations if any, from pertinent plans.

IV. Federal Catalog number (or Public Law no. and title)

V. Has funding agency been notified? No ☐ Yes ☒ Date: 12/9/76

VI. If project includes state funds (12C), identify agency Geology & Mineral Industries

STATE AGENCIES ONLY

VIII. (a) IS PROGRAM BUDGETED ☒ NON-BUDGETED ☐

(b) STATE SHARE

GENERAL FUND CASH	OTHER FUND CASH	IN KIND
$	$	$ 2,060.00

(c) FUNDING METHOD

	FEDERAL SHARE		STATE SHARE		TOTAL	
First Year	% 88	$ 22,400.00	% 12	$ 2,060.00	% 100	$ 24,460.00
Second Year	%	$	%	$	%	$
Third Year	%	$	%	$	%	$

(d) WILL PROGRAM REQUIRE HIRING OF NEW STATE EMPLOYEES? No ☒ Yes ☐ Number

(e) Will accounting for this grant be administered by the Executive Dept. Accounting Division? Yes ☐ No ☒

PLEASE ATTACH ANY ADDITIONAL NARRATIVE OR REMARKS

Norm
Back to
you.

UNITED STATES
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
GRAND JUNCTION OFFICE
GRAND JUNCTION, COLORADO 81501

March 29, 1976

Mr. Raymond E. Corcoran
State Geologist
Dept. of Geology & Mineral Industries
1069 State Office Building
Portland, Oregon 97201

Dear Andy:

Your recent letter has been referred to me for response. As I promised in our telephone conversation of March 18, 1976, I am enclosing copies of news releases describing most of our geological contracts and agreements. Those in which State Surveys are involved are checked with a pencil. You will find our National Uranium Resource Evaluation (NURE) program briefly described in these news releases.

Since the inception of the NURE program three years ago, we have let only one agreement that includes the State of Oregon; that is an agreement with Lawrence Livermore Laboratory (LLL) for water and stream-sediment sampling of several western states. In addition to sampling by LLL as part of our national hydrogeochemical survey, work contemplated in Oregon includes coverage as part of our national aerial radiometric survey, which is being contracted to private service firms.

During the past few months, we have been in the process of transferring the ERDA Grand Junction Office contracting function to Bendix Field Engineering Corporation, our prime contractor. Correspondence regarding contract matters, and particularly unsolicited contract proposals, should be directed to the following, with a copy to Mr. Grutt:

Mr. Charles L. Greenslit, Manager
Grand Junction Operations
Bendix Field Engineering Corporation
P. O. Box 1569
Grand Junction, Colorado 81501

It would be helpful to receive a summary of your department's capabilities and interests. Much of our future contracting will be accomplished by Bendix requests for proposals, either of single organizations having a unique appropriate capability, or of multiple organizations.

It was good chatting with you again.

Sincerely,

Donald L. Curry

Donald L. Curry, Assistant Director
Resource Division

Enclosures:
PR No. 14, dtd 6/18/76
PR No. 29, dtd 8/8/76
PR No. 76-2, dtd 1/14/76

UNSOLICITED URANIUM EXPLORATION PROPOSAL

Submitted to

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

by

STATE OF OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
1069 State Office Building
Portland, Oregon 97201

TITLE OF PROPOSED PROJECT:

EXPLORATION FOR URANIUM AND GEOLOGY OF THE BEAR CREEK VALLEY - SAMS VALLEY AREAS OF SOUTHWEST OREGON

Principal Investigator: Norman V. Peterson, Economic Geologist
Department of Geology and Mineral Industries
P.O. Box 417
Grants Pass, Oregon 97526

PROPOSED STARTING DATE: May 1, 1977

PROPOSED COMPLETION DATE: December 31, 1977

AMOUNT REQUESTED FROM ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION	$ 22,400
OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES.	2,060
TOTAL PROJECT COST.	$ 24,460

E N D O R S E M E N T S

Principal Investigator:

Name: Norman V. Peterson

Signature: Norman V. Peterson

Title: Economic Geologist
State of Oregon Department of Geology and Mineral Industries

Date: December 9, 1976

Approving Administrative Official:

Raymond E. Corcoran

R. E. Corcoran

State Geologist
State of Oregon Department of Geology and Mineral Industries

December 9, 1976

EXPLORATION FOR URANIUM AND GEOLOGY OF THE BEAR CREEK VALLEY - SAMS VALLEY AREAS OF SOUTHWEST OREGON

The proposed study will consist of a reconnaissance exploration of about 150 square miles in the Bear Creek Valley and Sams Valley in Jackson County, Oregon (see index map) to determine the potential for uranium mineralization. Bear Creek Valley and Sams Valley are underlain by a thick sequence (8,000 feet to 9,000 feet) of early Tertiary continental sediments including shales, sandstones, and conglomerates. Cross-bedding, cut and fill structure, and the lenticular nature of the sediments indicate a low relief, fluvial environment, and the abundant carbonaceous material (sub tropical flora) indicate a moist- humid-climatic environment. The lowermost sediments tend to be arkosic with a change to tuffaceous sandstones and shales in the upper part of the section. The Ashland granite pluton and early Western Cascade Volcanics (Little Butte) are presumed to be the source rocks for the sediments.

A survey of the literature about sandstone type uranium deposits in general (Craig, Brooks, and Patton, 1975) shows that the Bear Creek Valley - Sams Valley sedimentary rocks have many of the characteristics that are indicative of uranium deposits in other areas.

Fischer (1975) in a paper at the 1975 Uranium and Thorium Research and Resources Conference at Golden, Colorado, summarized the "exploration guides to new uranium districts and belts" as follows:

"The principal U.S. source of uranium is deposits in continental, lenticular sandstone beds. Beds of this type are probably the best hunting

ground for groups of significant new deposits - in reality, new districts and belts - that will be needed to satisfy future requirements for uranium. A model, evolved from the major productive districts and belts, presents geologic relations that may be useful as guides in selecting the beds and areas most likely to contain significant deposits.

"Host rocks favorable for large uranium deposits are sandstone lenses interbedded with mudstone; these mudstone beds or some overlying beds commonly contain volcanic ash. Sedimentation on a low-lying terrane with a high water table, yielding nonoxidizing conditions of water-saturated beds, is indicated by the preservation of coalified fossil plants, which are present in almost all host beds. During ore formation the host beds dipped gently, owing to initial stream gradient or slight tectonic tilting. The ore-forming solutions were ground waters that moved downward by gravity. The ore formed slowly under stable conditions, at shallow to moderate depths, in zones a few miles to a few tens of miles from the depositional or erosional edges of the host beds, at places where adequate reducing conditions were encountered. The reducing agents are obscure and perhaps varied. Roll-type deposits seem to have formed relatively late after accumulation of the host beds, whereas tabular-type deposits may have formed relatively soon after sedimentation.

"Sandstone units having some or all of the lithologic characteristics favorable for uranium deposits are numerous and widespread in the United States and they occur in areas of different geologic setting and history. If new districts are to be found at tolerable costs, geologic guides will have to be used to select for exploration the sandstone units and areas most likely to contain groups of significant deposits."

The Bear Creek Valley and Sams Valley sedimentary rocks have many of the physical properties and geologic relations listed above that would indicate a favorable environment for uranium deposits and are deemed worthy of a preliminary evaluation. There are no records to indicate that any exploration for radioactivity has ever been done.

Two radioactive occurrences are reported in the presumed source rocks - one a short distance to the northeast in rhyolite tuffs of the Little Butte volcanic rocks, and the other in pegmatite dikes of the Ashland granite pluton.

Previous work

Wells (1956) mapped the sedimentary rocks as Umpqua Formation of Eocene age. He suggested that the lower part were of marine origin, grading upward into continental deposits, water-transported, and air-transported clastic rocks of volcanic origin. The stratigraphy of the sediments in the Bear Creek Valley has been described in a PhD thesis by McKnight (1971). However, the continuation of the sediments northwestward into Sams Valley has not been described in any detail.

Work proposed

The proposed study will consist of the following:

(1) A ground (foot and vehicle) radiometric reconnaissance of all accessible outcrop areas in Bear Creek Valley and Sams Valley using a sensitive detection device (Gamma Ray Scintillometer or portable Gamma Ray Spectrometer). The readings will be used to make an isorad map of the area.

(2) Make a grid survey for radon gas using the Track etch, Terradex method. This technique involves placing a small radiation sensitive plastic detector

housed in a small sampling cup in shallow holes (2½ feet deep) in the ground. These detectors measure the concentration of radon gas and where measured can be used to indicate the presence of anomalous uranium mineralization. A detailed description of the track etch technique is attached. The materials, analysis of the exposed detectors as well as contour maps showing radon gas concentrations will be furnished by the Terradex Corporation.

(3) Collect and analyze 10 water and stream sediment samples from strategic locations to determine uranium content.

(4) In conjunction with 1, 2, and 3 above, we will do a geologic reconnaissance to correlate the little known stratigraphy in Sams Valley with the already described Payne Cliffs Formation in the Bear Creek Valley. The information from this part of the study will be incorporated in a preliminary report and geologic map.

Organization and Facilities

The State of Oregon Department of Geology and Mineral Industries has complete office, accounting, editing, drafting, analytical facilities and staff to carry out the proposed work, except as noted in (2) above. The material, readout, and interpretation of the radon gas grid survey will be contracted to the Terradex Corporation. All parts of the proposed work will be carried out concurrently and the project would begin May 1, 1977, and be completed by December 31, 1977.

Principal investigators will be Norman V. Peterson, Economic Geologist, State of Oregon Department of Geology and Mineral Industries, Grants Pass Field Office, P.O. Box 417, Grants Pass, Oregon 97526, and Monty Elliott, Assistant Professor, Southern Oregon State College, Ashland, Oregon 97520. A resume' for each is attached.

Selected References:

Boberg, W. W., 1975, Exploration for uranium in Wyoming, in Craig, L. C., Brooks, R. A., and Patton, P. C. (eds.), Abstracts of the 1975 Uranium and Thorium Research and Resources Conference: U. S. Geol. Survey Open-File Report 75-595. 54 p.

Fischer, R. P., 1975, Exploration guides to new uranium districts and belts, in Craig, L. C., Brooks, R. A., and Patton, P. C. (eds.), Abstracts of the 1975 Uranium and Thorium Research and Resources Conference: U. S. Geol. Survey Open-File Report 75-595. 54 p.

McKnight, B. K., 1971, Petrology and sedimentation of Cretaceous and Eocene rocks in the Medford-Ashland region, Southwest Oregon, Oregon State Univ. Ph.D. Thesis. 177 p.

Peterson, N. V., 1959, Preliminary geology of the Lakeview uranium area, Oregon: The Ore Bin vol. 21, no. 2, p. 11-16.

Wells, F. G., 1956, Geologic map of the Medford quadrangle, Oregon - California: U. S. Geol. Survey Map GQ-89.

ESTIMATED PROJECT COSTS

Field supplies: maps, sample bags, bottles, etc.	$ 250
Analytical work for 10 water and soil sediment samples.	200
Material, interpretation, reports, and maps for radon gas survey (500 cups).	8,900
Rental of scintillation counter or gamma ray spectrometer (Geometrics 408-734-4616 6R 101A) - 2 months	500
Salaries:	
Principal Investigator, N.V. Peterson - 4 mos.	6,400
Principal Investigator, M.A. Elliott - 1½ mos.	2,100
Field Assistant - 3 mos.	1,800
Field expenses - per diem	850
Transportation (5,000 miles).	750
Drafting - base maps, geologic map.	650
Administrative costs (20 percent of Salaries & Wages).	2,060
TOTAL.	$ 24,460

NORMAN V. PETERSON

Norman V. Peterson: Age 52. Present position: District Geologist, Grants Pass Field Office, State of Oregon Department of Geology & Mineral Industries.

Educational history: University of Oregon: 1956 - Bachelor of Science, Geology; 1957 - Master of Science, Geology; 1957 - Graduate Assistant.

1957 - present: Field Geologist for the Oregon Department of Geology & Mineral Industries. Have spent all of these 16 years in the Grants Pass Field Office. Geologic studies at the Grants Pass field office have been of a great variety and include academic as well as economic oriented projects. Commodity studies include uranium, limestone, and geothermal resources. Main responsibility has been as a volcanologist in studying the varied and interesting volcanic history of Oregon.

PUBLICATIONS

Peterson, N. V., 1957, The geology of the southeast third of the Camas Valley quadrangle, Oregon: Univ. Oreg. master's thesis, 89 p., 5 figs., 21 pl. incl. geol. map, 1957.

_____ and Mason, R. S., 1958, Limestone occurrences in western Oregon: The Ore Bin, v. 20, no. 4, p. 33-39, illus., April, 1958.

_____ 1958, Oregon's Uranium picture: The Ore Bin, vol. 20, no. 12, p. 111-117, illus., Dec. 1958.

_____ 1959, Preliminary geology of the Lakeview uranium area, Oregon: The Ore Bin, v. 21, no. 2, p. 11-16, illus. incl. geol. map, Feb. 1959.

_____ 1959, Lake County's new continuous geyser (Oreg.): The Ore Bin, v. 21, no. 9, p. 83-88, geol. map, Sept. 1959.

_____ 1960, Preliminary geology of the Lakeview uranium area, Oregon: (abst.): Mining Eng., v. 12, no. 6, pt. 2, p. 534, June 1960.

_____ 1961, Perlite occurrences in southeastern Klamath and southwestern Lake Counties, Oregon: The Ore Bin, v. 23, no. 7, p. 65-70, illus., July 1961.

_____ and Groh, E. A., 1961, Hole-in-the-Ground, central Oregon, meteorite crater or volcanic explosion?: The Ore Bin, v. 23, no. 10, p. 95-100, 4 figs., Oct.1961.

_____ 1962, Geology of Collier State Park area, Klamath County, Oregon: The Ore Bin, v. 24, no. 6, p. 88-97, 4 figs., geologic map, June 1962.

Ramp, Len, and Peterson, N. V., 1963, An occurrence of lazulite in Oregon (abs.): Oregon Acad. Sci. 21st Ann. Mtg., Corvallis, Feb. 23, 1963, p. 19, 1963.

Peterson, N. V., and Groh, E. A., 1963, Recent volcanic landforms in central Oregon: The Ore Bin, v. 25, no. 3, p. 33-45, 10 figs., March 1963.

_____ and Groh, E. A., 1963, Maars of south-central Oregon: The Ore Bin, v. 25, no. 5, p. 73-88, 8 figs., May 1963.

_____ and Groh, E. A., 1964, Diamond Craters, Oregon: The Ore Bin, v. 26, no. 2, p. 17-34, 12 figs., 1 plate, Feb. 1964.

_____ and Groh, E. A., 1964, Crack-in-the-Ground, Lake County, Oregon: The Ore Bin, v. 26, no. 9, p. 158-166, 4 figs., geologic map, Sept. 1964.

_____ and Groh, E. A., editors, State of Oregon Lunar Geological Field Conference guidebook: Oregon Dept. Geol. and Mineral Indus. Bull. 57, 51 p., 34 figs., geologic maps, 1965.

_____ and Groh, E. A., editors, State of Oregon Lunar Geological Field Conference, Bend, Oregon, 1965, Guidebook; Oregon Dept. Geol. and Mineral Indus., Bull. 157, 2nd ed.: Portland, Schultz-Wack-Weir, Inc., 51 p., illus., geologic maps, 1965.

_____ 1965, Newberry Volcano area field trip -- geologic summary, in Lunar geological field conference guidebook; Oregon Dept. Geol. and Mineral Indus., Bull. 57, p. 11-18, illus., geologic map, 1965.

_____ 1965, Hole-in-the Ground - Fort Rock - Devils Garden area field trip - geologic summary, in Lunar geological field conference guidebook: Oregon Dept. Geol. and Mineral Indus., Bull. 57, p. 19-28, illus., geologic maps, 1965.

Peterson, N. V., and Groh, E. A., 1967, Geothermal potential of the Klamath Falls area, Oregon, a preliminary study: The Ore Bin, v. 29, no. 11, p. 209-231, 10 figs., 2 plates, 2 tables, geologic map, Nov. 1967.

Walker, G. W., and Peterson, N. V., 1969, Geology of the Basin and Range province, Chapter in Mineral and water resources of Oregon: Oregon Dept. Geol. and Mineral Indus., Bull. 64, in coop. with U. S. Geol. Survey, p. 83-88, 2 figs., 1969.

Peterson, N. V., 1969, The geothermal potential of the Klamath Falls, Oregon area - a progress report (abs.): Oregon Acad. Sci. Proc. for 1967, v. 4, p. 12-13, 1969.

_____, and Groh, E. A., 1969, The age of Recent lava flows of the Northwest Rift Zone of Newberry Volcano, Deschutes County, Oregon (abs.): Oregon Acad. Sci. Proc. for 1967, v. 4, p. 13, 1969.

_____, 1969, Uranium, in Mineral and water resources of Oregon: Oregon Dept. Geol. and Mineral Indus., Bull. 64, in coop. with U. S. Geol. Survey, p. 180-184, 1 fig., 1 table, 1969.

Godwin, L. H., and Peterson, N. V., 1969, Geothermal energy, in Mineral and water resources of Oregon: Oregon Dept. Geol. and Mineral Indus., Bull. 64, p. 299-304, 1 fig., 1 table, 1969.

Peterson, N. V., and Groh, E. A., 1969, The ages of some Holocene volcanic eruptions in the Newberry Volcano area, Oregon: The Ore Bin, v. 31, no. 4, p. 73-87, 10 figs., 1 plate, 2 tables, April 1969.

_____, and McIntyre, J. R., The reconnaissance geology and mineral resources of eastern Klamath County and western Lake County, Oregon: Oregon Dept. Geol. and Mineral Indus., Bull. 66, 70 p., 30 figs., 8 tables, 2 plates, geologic map.

_____, and Groh, E. A., 1970, Geologic tour of Cove Palisades State Park near Madras, Oregon: The Ore Bin, v. 32, no. 8, p. 141-168, 19 figs., geologic map, August 1970.

Bowen, R. G., and Peterson, N. V., 1970, Compilers, Thermal Springs and wells in Oregon: Oregon Department Geol. and Mineral Indus. Misc. Paper 14.

Peterson, N. V., 1971, Waste, a mineral resource and a geologic problem: The Ore Bin, v. 33, no. 3, p. 45-58, March, 1971.

Friedman, Irving, and Peterson, N. V., 1971, Obsidian hydration dating applied to dating of basaltic volcanic activity, Science, vol. 172, pp. 1028.

_____, and Peterson, N. V., 1971, Obsidian hydration dating: Ore Bin, v. 33, no. 8, p. 158-159, August 1971.

_____, and Ramp, Len, 1971, Green Diamond abrasives: The Ore Bin, v. 33, no. 9, p. 182-183, Sept. 1971.

_____, and Groh, E. A., Geology and origin of the Metolius Springs, Jefferson County, Oregon: The Ore Bin, v. 34, no. 3, p. 41-51, March 1972.

Peterson, N. V., 1972, Oregon "Sunstones": The Ore Bin, v. 34, no. 12, p. 197-215, December 1972.

_____, and Mason, R. S., 1974, Pumice, pumicite, and volcanic cinders, Chapter in 4th edition Industrial Mineral and Rocks, AIME, Editor Stanley J. Lefond.

Bowen, R.G. Blackwell, D. D., Hull, D. A., and Peterson, N. V., 1976, Progress report on heat-flow study of the Brothers Fault zone, central Oregon: The Ore Bin, v. 38 no. 3, pp. 39-46, March 1976.

DATA SHEET

Monty Arthur Elliott

Basic Facts

Age	32	Military	1-Y
Height.	5-8	Handicaps.	Eye glasses
Weight.	190	Police Record. . . .	None
Race.	Caucasian	Credit Rating. . . .	Excellent
Family.	Wife & daughter	Political Party. . .	Republican

Education

Degrees Held

1971 Doctor of Philosophy (Geology), Oregon State University

1966 Bachelor of Arts (Geology), Oregon State University

1962 High School Diploma, Willamina Union High School (Oregon)

Experience

1972-77 Assistant Professor of Geology, Southern Oregon State College; Dr. W. B. Purdom, Chairman, Department of Geology, Ashland, Oregon 97520

1970-73 Visiting Assistant Professor of Geology, Portland State University, Summer Sessions. Dr. Marvin Beeson, Chairman, Department of Earth Science, Portland, Oregon 97207

1970-72 Visiting Assistant Professor of Geology, World Campus Afloat. Dr. Richard J. Sneed, Chairman, Division of International Studies, Chapman College Orange, California 92666

1970 Research Assistant, Oregon State University, conducting X-ray fluorescent chemical analyses of lavas with Dr. E. M. Taylor, Department of Geology, Corvallis, Oregon 97207

1969 Field Geologist, summer of structural reconnaissance and formation sampling in Brooks Range, Alaska for J. P. Chauvel, Union Oil Co. of Calif., 628 East 5th Avenue, Anchorage, Alaska 99501

1966 Field Geologist, summer of base metal exploration in Yukon Territory for J. P. B. Sawyer, Mastodon-Highland Bell Mines, Ltd., #502-1200 West Pender St., Vancouver 1, B. C., Canada

Professional Societies and Acitvities

Member, The Geological Society of America

Active Member, American Association of Petroleum Geologists

Associate Member, The Society of Economic Paleontologists and Mineralogists

Publication and Papers

Elliott, M. A., 1975 "Geology-City of Ashland" in Natural Resources - City of Ashland Planning Unit: Special Report, Soil Conservation Service, Medford, Oregon, pp 37-45, map.

Elliott, M. A., 1974, Late Cretaceous Sublittoral and Fluvial Sedimentation, Klamath Mountains, Oregon: Geol. Soc. America Abs. with Programs, V. 6, No. 3, p. 172-173.

Elliott, M. A. and Bostwick, D. A., 1973, Occurence of Yabeina on the Klamath Mountains, Siskiyou County, California: Geol. Soc. America Abs. with Programs, V. 5, No. 1, p. 38.

In preparation:

Late Cretaceous Superjacent Sedimentation- Klamath Mountains

References

Dr. John Eliot Allen, emeritus, Department of Earth Science, Portland State University, Portland, Oregon 97207

Dr. Harold E. Enlows, emeritus, Department of Geology, Oregon State University, Corvallis, Oregon 97331

Dr. William B. Purdom, Chairman, Department of Geology, Southern Oregon State College, Ashland, Oregon 97520

URANIUM EXPLORATION WITH THE TRACK ETCH TECHNIQUE

H. W. Alter
J. E. Gingrich

Terradex Corporation
1900 Olympic Blvd.
Walnut Creek, California 94596

Presented at the
45th Annual International Meeting
Society of Exploration Geophysicists
Denver, Colorado
October 12-16, 1975

URANIUM EXPLORATION WITH THE TRACK ETCH TECHNIQUE

H, W, ALTER, TERRADEX CORP.

J. E. GINGRICH, TERRADEX CORP.

ABSTRACT

The Track Etch* technique for uranium exploration has been used on a large number of uranium exploration programs representing a wide spectrum of geological environments. Initial results have been promising in most of these surveys and new uranium ore bodies have been found by using this relatively new technique.

The Track Etch method utilizes small solid state alpha track detectors to measure the radon gas emitted by uranium ore bodies and it can thus detect uranium mineralization buried at depths too great to be measured with surface or airborne scintillometer techniques. The method is also simpler, more reliable and more sensitive than the emanometer methods previously used for radon detection.

The environments in which the Track Etch technique has been employed have included sedimentary deposits in New Mexico and Wyoming, vein-type deposits in Colorado and Australia, and deposits covered with glacial till in Canada. This paper will discuss the basics of the Track Etch technique, how it is being applied in the field, and will review some case histories from several field surveys.

* Track Etch is covered by U.S. and Foreign Patents of Terradex Corporation, Walnut Creek, California.

Introduction

The natural radioactivity associated with uranium makes it possible to prospect for uranium ore bodies using radiometric measurement methods. The instruments usually employed (scintillometers or Gieger counters) do not measure the uranium radioactivity directly but are sensitive to the gamma radiation in the natural radioactive decay products (primarily Bismuth-214) which are present in all rocks and soils containing uranium mineralization. Because these instruments are sensitive to gamma rays they must be used relatively close to the source of radiation or the radiation becomes so attenuated by the intervening materials that it cannot be measured accurately. Airborne gamma-ray surveys are normally conducted at altitudes of a few hundred feet and they detect only surface or near-surface mineralization buried less than one foot. Portable hand-held gamma detectors must also be used within a foot of buried uranium mineralization to adequately detect its presence. When prospecting for deeply buried uranium with gamma sensitive instrumentation it is necessary to first drill an exploratory hole to the desired depth and then probe the hole with a gamma detector to determine the presence of uranium mineralization. Because of the gamma attenuation characteristics of soil and rock the drill hole must be in, or very close to, the uranium mineralization in order for it to be detected. Thus sub-surface mineralization becomes much more expensive to locate using gamma ray detection techniques.

Uranium also produces several alpha emitting radioactive decay products which are not directly detected by gamma-sensitive instrumentation. (Figure 1) One of these alpha emitting decay products is radon gas. A small amount of radon is continuously released from all uranium mineralization and this radon can move from significant depths through the covering rock and soil to the surface where it can be detected with the proper equipment. The mechanisms which cause radon movement to the surface are not well understood but its transport is related to meteorological "pumping action" that occurs due to variations in barometric pressure and air temperature changes which cause sub-surface gases to move considerable vertical distances. These mechanisms however also cause wide variations in the radon concentrations at the surface and some researchers have found changes of as much as a factor of 100 in a twenty-four hour period at a single location. It is this variation in radon concentrations at the surface that makes it difficult to use radon concentration measurements as a guide to buried uranium mineralization.

The possibility of using radon as a uranium prospecting tool was first suggested nearly 50 years ago but it has only been in the last 20 years that it has been used to any appreciable extent. This is partly due to the fact that earlier exploration efforts were concentrating on the more easily found surface or near surface deposits where gamma sensitive instrumentation is effective. As the discovery of new ore bodies at greater and greater depths has become increasingly expensive using gamma sensitive instrumentation, new and improved methods including those utilizing radon measurements have been increasingly used.

During the last few years several types of radon measuring instruments (sometimes called emanometers or "sniffers") have been developed. They usually consist of a small gas chamber covered with an alpha-sensitive phosphor which is optically coupled to a photomultiplier. The chamber is filled with soil gas pumped from a shallow hole in the surface soil. Each scintillator pulse from the phosphor is counted for a short period of time. The equipment thus measures the total alpha radioactivity from the radon in the soil gas sample.

These instruments are relatively complex both electrically and mechanically and the phosphor coated sample chamber is subject to surface contamination from radon daughter products. The biggest problem with the radon emanometer however is that it measures only a short-term soil gas sample which is usually not indicative of the average radon concentration in the immediate area. Because of these factors and others many users of radon emanometers have achieved only limited success in locating new uranium ore bodies on the basis of the instantaneous radon measurements.

The Track Etch System

A new technique called Track Etch for radon measurement has recently been developed which eliminates the major problems of the emanometers. It is also very simple and easy to use in the field. The Track Etch technique is based on the utilization of a newly discovered radiation sensitive plastic detector. These detectors are placed in small sampling cups that are placed in shallow holes in the ground where they measure the soil gas radon concentrations. (Figure 2) The detectors are sensitive to the alpha particles emitted by radon and they are processed in an etching solution to provide visible track-like images of the alpha particles, hence the name Track Etch. The detectors are unique in that they are not sensitive to light or to the gamma or beta radiation produced by the various elements in the soil and in the way they are used in the sampling cups they are only sensitive to the alpha emitting radon isotopes within the sampling cup.

In a typical uranium exploration program, sampling cups containing Track Etch detectors are placed in holes, about 2½ feet (70 cm) deep over the area being explored. (Figure 3) The sample holes are located in a grid pattern between 30 and 1000 meters apart depending on the size of the area being explored, and the dimensions of the expected ore bodies. After the cups are in place, the holes are covered and the cups are left undisturbed for several weeks. By leaving the sample cups undisturbed for this period of time, a meaningful average radon concentration can be measured. At the end of the sample measuring period, the cups are recovered and the detectors are processed and read to determine the number of alpha tracks recorded and hence the average radon level at the sample location. To obtain the maximum amount of information from the Track Etch readings, the data are usually presented in the form of radon contour maps or graphs.

The Track Etch system like other radon detection methods can also indicate the presence of near-surface thorium mineralization since thorium produces the alpha emitting thoron gas (Radon-222). (Track images in the detectors are essentially the same for any gaseous emitter.) Since thoron gas is a very short lived isotope (55 seconds) thorium will be detected only if it is present a few feet from the sampling cup. This potential interference problem can be avoided by measurement of each sampling point with a spectral-type scintillometer which detects the presence of thorium.

The Track Etch system like many geophysical and geochemical methods requires the accurate determination of the background (radon) level for the area being surveyed. Thus a minimum of about one hundred sampling stations should be used to statistically determine the general background value with the desired accuracy. Experience with a large number of exploration programs has shown that the background levels can vary by as much as an order of magnitude in different exploration areas around the world. These variations are due to differences in surface and near surface uranium mineralization and in differences in general rock types in the exploration areas.

Field Test Results

The Track Etch methods for uranium exploration have been employed in nearly 200 exploration programs in a variety of geological environments. Some of the initial work was carried out in the sedimentary deposit areas of western United States and the vein-type deposits of Australia. Most recently several successful programs have been carried out in Canada. The following results are typical examples from some of these programs and while they do not discuss details from the full range of Track Etch experience they illustrate a few of the results from varied types of exploration programs.

Sedimentary Basins - Western United States

In one sandstone area of the Western U.S. the usual method for uranium exploration required the drilling of 500 foot exploratory holes on a planned pattern and radiometrically logging the holes with scintillometer probes. There were no surface gamma radiometric anomalies to assist the exploration efforts in this area. The specific area selected for exploration was along a general trend of known mineralization but where no exploratory drilling had been completed on the property of interest. Track Etch sampling cups were placed in a regular square grid pattern on 150 foot centers in an area approximately one mile long and one third of a mile wide. The resulting radon contour map is shown in figure 4. Three anomalies were detected on the property with a number of detectors reading more than three times background. In the follow-up exploratory drilling program over the highest anomaly the third exploratory drill hole produced the first signs of mineralization and the fourth hole which was drilled in the down-dip direction from the anomaly intersected a uranium ore body at a depth of

330 feet. The initial intersection showed 9 feet of ore with a grade of 0.34% U_3O_8. Subsequently more than 40 holes were drilled in the area with most intersecting ore grade material. The ore body has now been delineated to the point that it is known to contain several million pounds of uranium and it is expected to be mined in the near future.

The most significant factor in finding this ore body using the Track Etch radon technique is the fact that it is at depths ranging up to 360 feet and that it is covered by several sandstone sequences with some shale stringers and thin layers (2 - 3 feet) of coal in the intervening beds. The water table in this area is about 350 feet so it can be assumed that the radon is penetrating through essentially dry cover. In addition to the drilling around the primary anomaly some exploratory drilling was done in areas with low radon values and no significant uranium mineralization was found. One test hole drilled into a second anomaly has shown some mineralization but its full extent has not yet been fully evaluated.

Vein-type Deposits - Western United States

Several Track Etch programs have been completed in the hard-rock environments of the Rocky Mountains where the usual targets are vein-type deposits. The Track Etch technique is particularly attractive for these areas because of the rugged terrain usually encountered which makes it difficult or impossible to survey using airborne radiometric techniques and where exploratory drilling is very expensive.

One Track Etch test survey was undertaken in an area of known uranium mineralization surrounding several mines and prospects in the major uranium producing district of the Front Range of Colorado. This is an area of intense surface leaching and associated thick colluvial cover which renders conventional airborne or surface radiometric prospecting techniques inadequate. In addition the terrain relief is extreme and the targets are small, averaging 3 to 5 feet wide by 100 to 200 feet long making it difficult to use conventional exploratory drilling methods to locate the mineralization. The test survey using a random grid on 500 foot centers produced excellent Track Etch anomalies over all of the known significant mineralization in the district. An anomaly over the Schwartzwalder Mine was more than eleven times background where the mineralization was at a depth of approximately 150 feet. Three different surveys conducted in one small area over a span of 18 months identified one large anomaly each time the measurements were made and demonstrated the repeatability of the technique in this environment.

Meta sedimentary Deposits - Northern Canada

An orientation study using Track Etch was conducted in Northern Canada over a known metasedimentary ore body which was covered by glacial till. This program was the first conducted in this environment and it was done for the purpose of determining the applicability of the technique in such glaciated environment. The uranium deposit consists of several pitchblende-bearing lenses associated with gently dipping fracture zones in paragneisses and

granites of Archean or Aphebian age. Mineralized zones were outlined by drilling and they occur at depths ranging from 10 to 60 feet in thickness. Approximately 160 Track Etch sample cups were placed in shallow holes, averaging 2½ feet in depth along grid lines at approximately 200 foot centers. Sampling extended well beyond the boundaries of the known ore zone.

The survey results were plotted on a radon contour map as shown in figure 5. A number of high readings from the Track Etch detectors were found over the ore body with a peak value of more than 50 times the background value measured for the surrounding area. The highest value was obtained where there is known ore grade material in mineralized lenses at several depths ranging from 60 to 260 feet. Other anomalous readings were obtained over ore grade mineralization at depths ranging up to 350 feet.

Recent experience from two other test programs in Northern Canada is worthy of note. Tests were conducted over known ore bodies covered by perma-frost and in both instances significant anomalies were detected. These results tend to confirm the porous nature of the perma-frost cover and suggest the usefullness of the Track Etch technique in this environment.

Australian Experience

A number of exploration programs have been conducted in Australia using the Track Etch method. The environments explored have included several surveys in the Alligator Rivers area of the Northern Territory, the Frome Lake Embayment of South Australia and several sedimentary areas in other parts of the country. One of the earliest test programs was conducted over a known ore body in the East Alligator River uranium district. There was no indication of the presence of this ore body from normal aerial or ground radiometric surveys although the presence of anomalously high radon concentrations in the area was known. Track Etch detectors placed on a 100 by 500 foot grid clearly located an anomaly over the known ore body with the highest reading more than 40 times background. The ore body was at a depth of 250 feet covered pri- by sediments and the water table in the area was relatively near the surface (10 to 80 feet) clearly indicating from the results that the signal was not substantially attenuated by the thick water cover. (Preliminary results from other programs seem to indicate that there may even be an enhancement of the signal in areas with a high water table.)

In another Australian test program in the Frome Lake area of South Australia a survey was made over an ore deposit in a Lower Tertiary paleochannel sand which was at a depth of 330 feet. The ore averaged 12 feet in thickness at an average grade of 0.25% U_3O_8. The whole area was overlain by a sequence of relatively impermeable Upper Tertiary lacustrine clays. The Track Etch radon map of this area identified several low order (2 to 3 times background) anomalies over the known ore body. The anomalies were displaced about 300 feet from the center of the ore body for reasons not yet clear. The low order of the anomalies probably reflects the thickness of the overburden and the impermeable nature of the clay cover.

Regional Surveys

During the last year and a half the Track Etch technique has been used on several regional exploration surveys in the U.S. and Australia by placing the sampling cups on very wide centers (up to 5000 feet between points). These surveys have usually been performed in new exploration areas where there may have been some weak airborne or surface anomalies but where no major mineralized areas had been discovered. In these situations the Track Etch results are expected to be especially valuable since the results can be used to guide the initial exploration drilling which often is done very blindly since little is usually known about the sub-surface geology. Results to date indicate that in the areas tested there are broad anomalies that are due to known increases in mineralization and the variations in readings have been attributed to changes in sub-surface geological units or geological structure. Follow-up surveys using closely spaced sample points around the regional anomalies have further defined the detailed variation in local mineralization and these results are being used to guide detailed exploratory drilling. The promising results from these regional surveys already completed has proven the value of the Track Etch method in this mode of use.

Conclusions

The Track Etch technique for uranium has proven to be a valuable tool for uranium exploration in areas where the more conventional surface radiometric techniques are not effective. The method of sampling eliminates the probelms of variability in radon measurements encountered with other techniques and the simplicity makes it both highly reliable and easy to use in the field. It is particularly attractive for preliminary surveys and for exploring in remote areas where there is usually a limited amount of field support available.

Experience with the Track Etch system has indicated that its use can result in significant savings in exploration drilling costs. Exploration drilling can be reduced by up to 90% by utilizing the Track Etch radon contour maps to guide the initial drilling phases. In addition, valuable information about the sub-surface geology can be obtained which can be very useful not only in uranium exploration but also in exploration for other minerals. Experience has shown that the Track Etch radon technique can operate effectively in most any terrain from tropical areas of Australia to the permafrost covered arctic regions of Canada.

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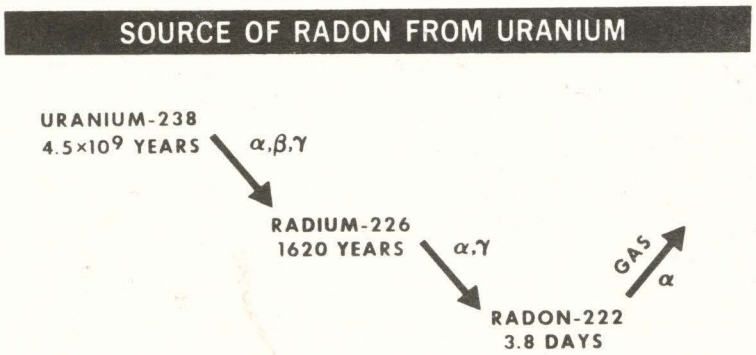

Figure 1. Source of Radon from Uranium

Figure 2. Sampling Cup with Track Etch Detector

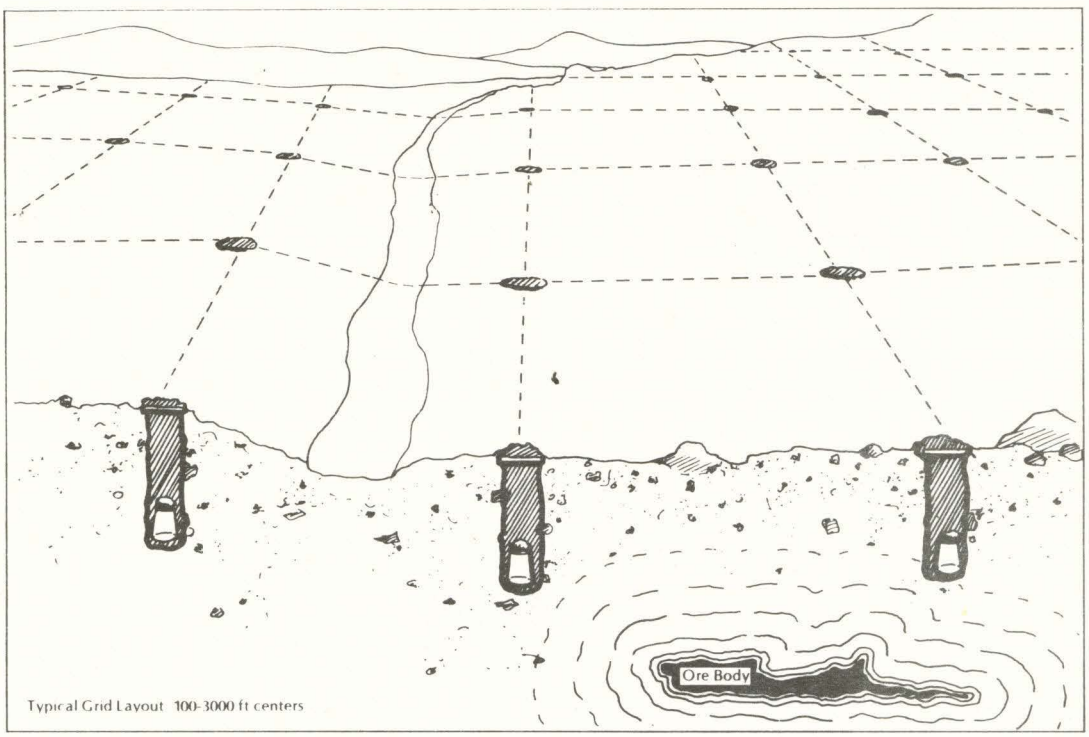

Figure 3. Typical Field Sampling Arrangement

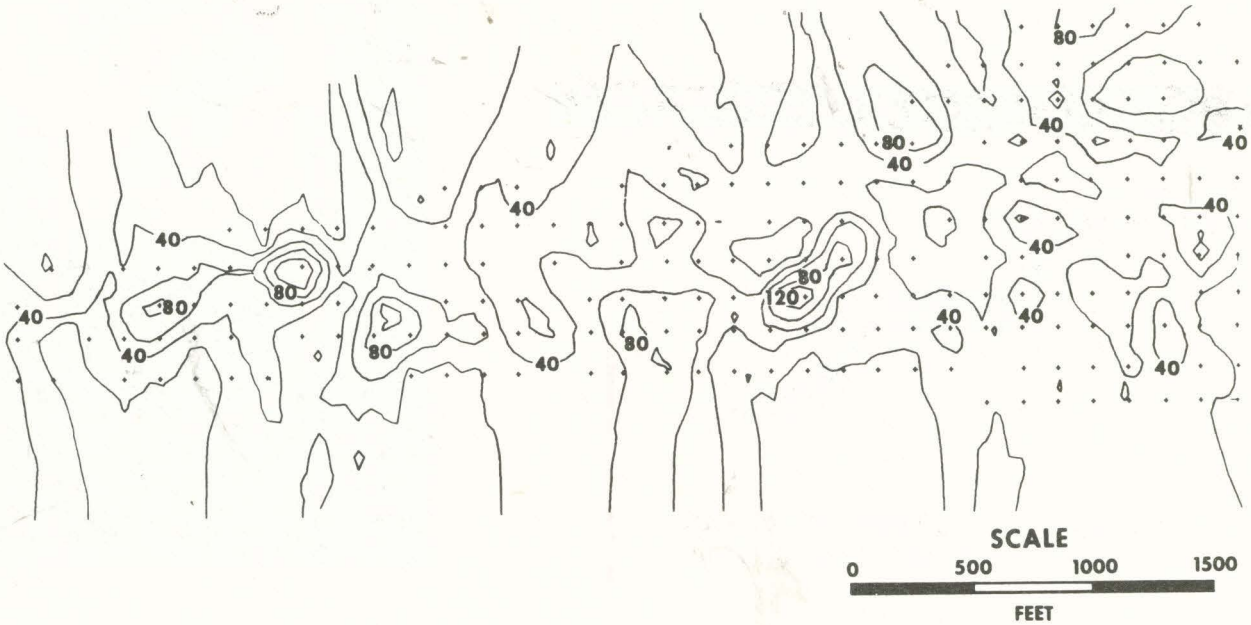

Figure 4. Track Etch Map from Grants Mineral Belt Discovery

Figure 5. Track Etch Map from Northern Canada Survey

State Department of Geology and Mineral Industries

702 Woodlark Building
Portland, Oregon

Uranium

Joe Davis

REPORT ON THE OCCURRENCE OF URANIUM IN MUTTON MOUNTAIN, WASCO COUNTY, OREGON

by
Esther W. Miller
April 23, 1945

Abstract

The reported occurrence of uranium and radium ore in Mutton Mountain in central Oregon was investigated in the laboratories of the State Department of Geology and Mineral Industries. The samples submitted were studied by fluorescent, electroscopic, and spectrographic methods. No ore of commercial value was indicated.

TABLE OF CONTENTS

REPORT ON URANIUM FROM MUTTON MOUNTAIN

I. Introduction

On March 13, 1945, the announcement was made in The Oregonian[1] by Jack A. DeMent of Portland, Oregon, that radium and uranium had been discovered in an ore specimen from Mutton Mountain on the Warm Springs Indian reservation in central Oregon.

The specimen was found by Mr. Joseph Davis of Tigard, Oregon. The specimen submitted to the State Department of Geology and Mineral Industries was mainly chalcedony with a partial coating of opaline material which exhibited pale yellow-green fluorescence.

On April 3rd and 4th, Mr. Davis made a field trip to the locality and brought nine specimens from the surrounding territory to the State Department of Geology and Mineral Industries to be examined for uranium and radium.

The following methods of testing were used:

1. Fluorescent light
2. Electroscope (aluminum leaf)
3. Spectrograph

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1 See clipping in appendix of report.

II. Description of Samples

A description of the samples tested is given in Table I. Since a complete petrographic examination of all samples from Mutton Mountain was not warranted, a description reference is given, which indicates the source of the description of each sample.

Location sec. 28(?) T 6 S, R 13 E. (Dufur Quad.)
Elev. approx. 3000 ft. (Davis estimate)

TABLE I

Ref. No.	General Lab. No.	Description	Description Reference
U-1	P-3499	A vein of grayish rock showing outcrop of about 50 x 100 ft. about 150" down slope directly under field of fluorescent material described under sample U-10.	Howard and Joseph Davis
U-2	P-3500	A visible 6-foot outcrop above and to right of field containing sample U-10.	Howard and Joseph Davis
U-3	P-3501	An outcrop of grayish pebbly material in center of field containing sample U-10, which runs for about 2 miles in a northwesterly direction.	Howard and Joseph Davis
U-4	P-3502	Right alongside of the U-3 material is a sizeable vein of soft rose-tinted rock or sandstone. About a 4-foot showing with a top covering of soil.	Howard and Joseph Davis
U-5	P-3503	Brownish-black dike of material on edge at vein of cliff in a locality about 5 miles to the east of the area described under U-4. However, this area also has some fluorescent agate of a different type from that of sample U-10 - same yellowish fluorescence but not so bright. Vein, or as much of it as is exposed, runs about 10 x 300 ft. Lies on edge.	Howard and Joseph Davis

TABLE I (cont.)

Ref. No.	General Lab. No.	Description	Description Reference
U-6	P-3504	Grayish to green outcrop approximately 100 x 200 ft. Some fluorescent agate on either side.	Howard and Joseph Davis
U-7	P-3505	Resembles obsidian. Outcrops approximately 15 x 100 feet up and down hill. About 50 feet higher up, there occurs a 20-foot caprock composed of what seems to be an unusually yellow lava rock. No fluorescent matter in vicinity.	Howard and Joseph Davis
U-8	P-3506	Found at an elevation of about 3000 ft. Outcrops seem to continue for miles showing same material.	Howard and Joseph Davis
U-9	P-3507	Coal-like material outcrops at a 2000 ft. level on same mountain.	Howard and Joseph Davis
U-10	P-3521	First sample submitted by Joseph Davis. This sample was a geode from the Clarno formation and probably of upper Eocene age. The geode is of chalcedonic material which has a botryoidal structure. The sample possessed a partial coating of material (described under U-11) which fluoresced a pale yellow-green color.	W. D. Lowry
U-11	P-3521-a	Fluorescent coating found on sample U-10. The coating is nearly all opaline material.	W. D. Lowry
		Uraninite (pitchblende) from standard mineral collection of the State Department of Geology and Mineral Industries. Specimen is from Bohemia.	Descriptive list in standard collection.
		Carnotite - Moab district, Utah.	Descriptive list in standard collection.
		Torbernite - Mt. Painter, S. Australia.	Descriptive list in standard collection.
		Opal - semi opal - fluorescent. Nevada	Descriptive list in standard collection.

Uraninite, carnotite, and torbernite are known sources of uranium. Schoeller and Powell[2] describe them as follows:

(1) "Uraninite is a complex mixture of oxides, described by Dana as a 'uranate of uranyl, lead, usually thorium (or zirconium) often the metals of the lanthanum and yttrium groups; also contains nitrogen in varying amounts up to 2.6 percent'. A black, pitch-like heavy mineral; sp. gr. 9.5; H. 5.5 Non-magnetic; brittle; conchoidal fracture. Cubic, sometimes found as octahedra. Streak brown black to olive-green and shining. There are several varieties of this mineral. Cleveite contains about 10 percent of yttria earths; broggorite shows a ratio of UO_3 to other bases of about 1:1; Uraniobite contains much thoria and the maximum observed amount of nitrogen."

(2) "Pitchblende is a black, amorphous, hydrated oxide containing only traces of thoria and rare earths; sp. gr. 6.5. It is found in veins with sulfide minerals, while uraninite occurs in pegmatites."

(3) "Torbernite (copper uranite) copper uranyl phosphate (H. 2.5; sp. gr. 3.5), is a brittle emerald green mineral with pearly to adamantine luster and micaceous cleavage. It is tetragonal, occurring in thin, transparent tables or in micaceous aggregates."

(4) "Carnotite, hydrous potassium uranyl vanadate, consists of a yellow crystalline powder or incrustations on sandstone and quartz and in crevices of rocks."

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2 The Analysis of Minerals and Ores of the Rarer Elements (J.B. Lippincott Co., 1940. pp. 129, 220-222.)

Fluorescent opal was studied because it is believed that its fluorescence is caused by small amounts of uranium[3].

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3 Deco Trefoil, Denver Equipment Company publication, vol. 8, no. 3, March, 1944, p. 10.

III. Experimental Procedure

lines were sensitive to 0.1% uranium when a 50 mg sample was used:

	Arc Intensity
4244.4	25
4246.3	30

The 4241.7 A line was eliminated because of the interference of zirconium at the same wavelength.

Analyses were then made of the following samples:

U-1	U-8
U-2	U-9
U-3	U-10
U-4	U-11
U-5	Carnotite
U-6	Torbernite
U-7	Fluorescent opal

Following are the conditions under which the spectra of the samples were recorded:

1. Plate Nos.: 837 and 839
2. Range: 3650-5000 A
3. E-33 plate
4. 220 volts - 5 amps for 30 secs. then 13 amps to completion
5. 5% light
6. Iron standard - 5 amps for 30 secs.
7. New uppers
8. 50 mg sample
9. Carriage at 10
10. Develop 5 min. at 70° F.

The results are given in Table II.

TABLE II

Sample No.	Fluorescent Light	Electroscope	Spectrograph
10% uranium	Bright yellow	7.75 div./min	Strong
1% uranium	Bright yellow, but less than 10%	0.75 div./min	Medium
0.1% uranium	None	Not tested	Weak
0.01% uranium	None	Not tested	Not detected
U-1	None	No radioactivity	Not detected
U-2	None	No radioactivity	Not detected
U-3	None	No radioactivity	Not detected
U-4	None	No radioactivity	Not detected
U-5	None	No radioactivity	Not detected
U-6	None	No radioactivity	Not detected
U-7	None	No radioactivity	Not detected
U-8	None	No radioactivity	Not detected
U-9	None	No radioactivity	Not detected
U-10	Pale yellow in parts, but none when crushed	No radioactivity	Not detected
U-11	Pale yellow, but none when crushed	No radioactivity	Not detected
Pitchblende	None	14.5 div./min	Not tested - insufficient sample
Carnotite	None	15 div./min	10-1% uranium
Torbernite	None	3.3 div./min	10-1% uranium
Fluorescent opal	Bright yellow	No radioactivity	1-0.1% uranium

IV. Discussion

The results obtained by each of the three methods when the standard samples were tested for each sample are in agreement. The same sample was used in each method and the results are as would be expected.

It is evident that there is no detectable uranium and hence no radium in samples U-1 to U-9.

The fluorescence of the coating of sample U-10 and the coating itself, sample U-11, is undoubtedly due to a surface or particle size effect or to activation by a minor constituent and the uranium content, if such is the cause of the fluorescence, is much less than might be supposed. This fact is supported by spectrographic results.

Since crushed samples of uraninite (pitchblende), carnotite, and torbernite were not available in sufficient quantity for electroscopic determinations, the indication of radioactivity in these specimens is qualitative only. Thus it is not expected that electroscopic and spectrographic results should be correlative for these materials.

The fluorescence of the opal is undoubtedly due to the uranium content,* but the ratio of radium to uranium is so low as to render the sample incapable of affecting the electroscope.

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* Ibid. P. 10.

V. SUMMARY

1. The uranium standards (10% and 1%) and specimens known to contain uranium (pitchblende, carnotite, torbernite, and fluorescent opal) varied in their reaction to fluorescent light. All of the above-mentioned materials except the fluorescent opal reacted to the electroscope, and all except uraninite, which was not tested, contains some uranium, according to spectrographic results. Therefore, the fluorescent light cannot be considered a specific test, the electroscope provides a measure of radioactivity, while the spectrograph determines uranium only.
2. None of the samples from Mutton Mountain were indicative of uranium ore of commercial value. That the fluorescent coating of the chalcedony is an indication of a nearby uranium deposit is a possibility, but until samples are obtained which indicate some radioactivity, the report of the discovery of uranium in Mutton Mountain must remain of academic interest only.

THE OREGONIAN
March 13, 1945

ORE SPECIMEN HAS RADIUM

Discovery of radium and uranium in an ore specimen from Mutton Mountain on the Warm Springs Indian reservation in central Oregon was announced Saturday by Jack A. Dement, Portland research chemist.

Dement said the radioactive elements were found in a fragment of chalcedony, which he described as "an agate-like silica material." Presence of the elements was indicated by an electroscope, ultra-violet light, spectroscope, peracid reaction and the fluoride bead test.

The specimen examined by Dement was found by Joe Davis, Tigard, who turned it over to Dr. H. C. Dake, editor of "The Mineralogist." Davis said the material is to be found in abundance in the locality where he picked up the specimen.

Uranium Amount Vital

Dement said the quantity of radioactive material in the specimen had not been determined, since the richest part of the fragment was in the nature of a coating over material which showed less radioactivity.

Fay W. Libbey, acting director of the Oregon State department of geology and mineral industries, points out that chalcedony is not ordinarily found with uranium. The radioactive substance would be expected to be an accidental coating or deposit over the core of chalcedony.

In that case the abundance of chalcedony in the area would be no indication of the amount of uranium to be found.

If the uranium is abundant, or relatively abundant, Dement's discovery is of supreme importance, he indicated; but if it is found only in minute quantities, it is merely one more interesting item to add to Oregon's geological wonders.

COPY

"ASTRALITE" FLUORESCENT AGATE

Explanatory Notes

"Astralite", so named because of its vivid fluorescent qualities was discovered in August 1944 by Joseph and Howard Davis in the Mutton Mountain district adjacent to the Deschutes River, Wasco County, central Oregon.

Material is black agate in nodule and geode form found only in one area covering about fifty acres. Occurs on surface and under soil - some specimens measuring two or three feet across. All of it is highly fluorescent (uranium yellow and a dark green - the latter wherever black inclusions show.)

No claim is made by discoverers that this material contains radium - this report being an independent observation by party unknown to writer.

Finders would have preferred to keep location secret and feel that newspaper publicity was unfortunate, for the reason that if the location goes onto public record it would result in an influx of amateur rock collectors to the area who would destroy much of the rare material out of curiosity.

Due to publicity of the radium report and the stimulus of official interest, the undersigned decided to make a field trip to the locality for the purpose of finding pitchblende and to bring back samples of same if possible - or if no pitchblende to be found, to bring in any other samples of outcrop occurring along with the fluorescent agate. Field trip was made on April 3rd and 4th and the following specimens brought back:

#1 - A vein of grayish rock showing outcrop of about 50 x 100 ft. about 150" down slope directly under field of fluorescent material described above.

#2 - A visible six foot outcrop above and to right of same field.

#3 - An outcrop of grayish pebbly material in center of same field which runs for about two miles in a northwesterly direction.

#4 - Right alongside of the foregoing grayish material, is a sizable vein of soft rose tinted rock or sandstone. About a four foot showing with a top covering of soil.

#5 - Brownish black dike of material on edge at rim of cliff in a locality about 5 miles to the east of the area mentioned above. However this area also has some fluorescent agate of a different type from the above described - same yellowish fluorescence but not so bright. Vein, or as much of it as is exposed, runs about 10 x 300 feet. Lies on edge.

#6 - Grayish to green outcrop approximately 100 x 200. Some fluorescent agate on either side.

#7 - Resembles obsidian. Outcrops approximately 15 x 100 feet up and down hill. About fifty feet higher up there occurs a twenty foot caprock composed of what seems to be an unusually yellow lava rock. No fluorescent matter in vicinity.

#8 - Found at an elevation of about 3000 feet. Outcrops seem to continue for miles showing same material.

#9 - Coal-like material outcrops at a 2000 ft. level on same mountain.

Note: Special attention should be given to specimens 1 to 5 as these were taken from heaviest fluorescing area. An odd fact noted was the constant occurrence of all kinds of rocks in the creek running below for a distance of several miles - or all the way to the Deschutes. This seemed to be a coating left by water or possibly a molten substance which covered not only agates, but common basalt rocks with a thin veneer of uranium salts. One specimen noted seemed to be a conglomerate shot through with bright kernels of fluorescing matter about the size of almonds. A specimen of this rock was turned over to Smith's Agate Shop about two months ago and they may still have it on hand.

Howard S. Davis
Joseph Davis

Rt. 1, Box 501
Tigard, Oregon

THE OREGONIAN
March 29, 1954 (evening edition)

Harper A-Energy Ore Wealth Dreams Fade

ASSAYS COOL OFF RUMORS

BY PAUL F. EWING
Staff Writer, The Oregonian

HARPER (Special)—Dreams of wealth from Malheur county's "uranium" strike appeared premature Monday on the basis of preliminary reports from the state department of geology and mineral industries.

F. W. Libby, director, said radioassay tests show .005 to .01 per cent U-308 equivalent in rock samples and .05 per cent in sands concentrated by panning in the area.

At present, .1 per cent U-308 equivalent is the lowest radioactivity considered of commercial value. U-308 equivalent is a standard of measurement established by the atomic energy commission.

Radioactive elements present remain to be determined by spectrographic analysis—if in sufficient quantity so technicians can isolate them.

Find Intrigues Geologists

However, Libby said the find still is of interest. It is only the second time radioactive materials have been checked in place in Oregon.

Geologists are intrigued by another factor. They would normally not expect to find measurable radioactivity in the Harper formation.

Meantime, Harper's "uranium" strike continued to draw eager prospectors, most armed with Geiger counters, from all over Oregon and southern Idaho.

Geigers Sold to Prospectors

Rumor merges into rumor to produce some startling tales. Many appear as apocryphal as the report of a sign in a Harper store window: "For Sale: Geiger counters, tents, flour, bacon, burros."

Harper has one store, owned by G. B. McClure, and the only sign in McClure's window advertises a neighborhood social. Besides, prospectors say they can't find an unsold Geiger counter in Harper, Vale, Ontario or vicinity.

Rumor says radioactivity in the neighborhood of the discovery claim is so high that "it blew a tube in a Geiger counter." Actually, counters react only mildly.

Story Adds to 'Rush'

Also, a mystery is the most quoted "prospector" in those hills. He flew over the area with scintillator, found a reaction in an area 12,000 feet wide, a "hot spot" in the neighborhood of the discovery claim, and returned to drive his stakes beside it, the story goes.

The trouble is that no one knows his name, where he is from or whom he represents, although a good many prospectors recount that he is from "Idaho" and works for "a big company."

They add that the scintillator is a device activated by "gas" emanating from radioactive deposits.

Skeptics Scoff at Claims

Geologists in the area who are acquainted with the scintillometer, of which the scintillator is a form, are somewhat skeptical of the mystery man's findings.

They point out that the scintillometer is an instrument to measure radioactivity. It is used in aerial surveys for gas, oil and water, depending upon a number of closely controlled factors for its accuracy.

They don't believe one has been available for use in the Harper area. If so, it definitely does not measure "gas emanations" from radioactive rock.

Activity in the barren, sagebrush-covered hills south of the Harper basin bears little resemblance to an old-fashioned gold rush.

Prospectors swarm into the hills on week ends but at other times only one or two rock hounds can be found. Nonetheless, an estimated 300 to 350 claims have been staked.

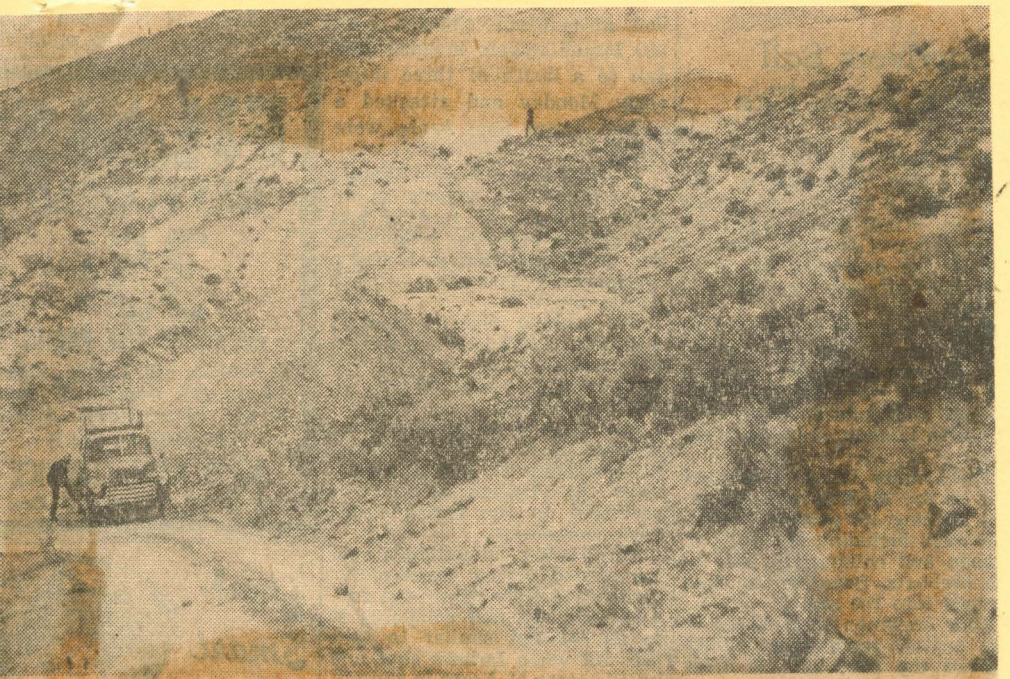
Additional details on page 6, section 2.

THE OREGONIAN
March 20, 1954 (evening edition)

Art Kegler, recent graduate of the University of Oregon and a uranium prospector part time, works Geiger counter along face of the cut on discovery claim. Counter reaction is not high.

The Colemans, cattle ranchers of Malheur county, stake claim near Harper. From left, J. E., Keith and Emery prop up fence posts to mark boundaries they hope delineate an ore deposit.

THE OREGONIAN - March 29, 1954 (evening edition)



Blue Moon No. 1" is name of this claim which laun
ows radioactivity, but state geologists say insu

Jim Gardiner, self-styled rock hound from Parma, Idaho, exhibits samples of rock located in prowl through hills already staked by hopeful uranium hunters above Harper basin ranches.

OREGON JOURNAL
March 28, 1954

Cold Water Thrown on Malheur Uranium Rush; State Still Lacking Samples of Ore

The state department of geology Saturday threw some cold water on the uranium rush under way in Malheur county of eastern Oregon.

No samples of uranium ore have been received from the Harper field near Ontario, according to Fay W. Libbey, head of the department's Portland office.

Meanwhile prospectors are trampling over the hills with Geiger counters, sounding for likely places to stake out uranium claims. Louis Hall of Ontario recently filed claims near the village of Harper on what he thinks is uranium land.

LAURENCE L. Hoagland, assayer and chemist in Libbey's office, advised would-be prospectors heading for the "uranium boom" to "take it easy." He said his department has had reports of such findings before and they have been found to be erroneous.

Libbey has assigned an investigator to make a report on the Harper field. He said prospectors should be very cautious about accepting first reports and should verify all verbal reports of uranium strikes.

HOAGLAND said it is possible there may be a small vein of thorium or some other radioactive element showing on Geiger counters.

Only three uranium samples have been checked by the department of geology since the atomic material [illegible] tant in national defense, but none of the samples showed enough uranium to be of any value. Two of the uranium samples came from the Snake river canyon area in Baker county and another came from the Pueblo mountains near the Oregon-Nevada line.

THE OREGONIAN
March 29, 1954 (evening edition)

Markers Dot 'Strike Area'

Prospectors Stake Numerous Claims

See story on Page 1, Also

HARPER (Special) — Fence posts erected as claim markers ot hillsides and canyons in Malheur county's "uranium" strike area south of here but there is no tent city.

Prospectors who have staked an estimated 300 to 350 claims have 60 days in which to register them in Vale, the county seat.

So far only 33 have been registered, with claimants of the rest aparently waiting at home for developments before filing.

The only claim work to date has been done by Louis E. Hall and Lormand O. Wise, Ontario, who made the discovery. They have run a bulldozer across the face of a hill to make a few cuts and extract rock samples.

Claims Staked on Chance

Hall has moved a trailer house to the claim and plans to live there with his wife while determining possibilities for commercial production of radioactive material.

Few of the prospectors have any technical knowledge. As one wind-burned cattle rancher put it, "I'm just staking a claim on chance. If there is anything here I want to be in on it."

Virtually all of them have Geiger counters of various kinds, but most rely on word-of-mouth statements from "experts" as to what the counters show.

Hall and Wise, both Ontario mechanics, say they are hopeful commercial concentrations of radioactive ore will be found if they dig deep enough.

Herder Makes Find

Wise first locatde the light-colored sedimentary deposit with streaks of dark material a year ago while herding sheep, he said.

Hall, a "rock hound" spurred on by his wife, daughter of a mining engineer who once operater the Signal Peak gold mine at Lovelock, Nev., became interested.

In January, the Halls and Wise visited the area and collected samples for assay.

Wise said the report showed traces of uranium, cobalt, nickel, alumina, manganese, silver, gold and other elements.

Between them, Hall and Wise staked 40 to 45 claims in February. Word of the "strike" got out when they registered five of them at Vale, launching the rush.

Two Quit Garage Jobs

Since then, Hall and Wise have quit their Ontario garage jobs to devote full time to their claims. Wise said they arranged to give a 10 per cent interest to Harvey Schaefer, Ontario, for use of his bulldozer and other machinery.

Hall said he has panned sand from the lower slope of their discovery claim which reacts "best" to a Geiger counter. This concentration is about half the amount needed for minimum commercial exploitation.

Norman S. Wagner, Baker, field geologist for the state department of geology and mineral industries, said when he visited the "Sand hill" claim which Hall and Wise have named "Blue Moon No. 1," he found a massive counter reaction of about triple normal background.

Cosmic Rays Common

"Background" reaction is caused by cosmic rays and can be found everywhere. "Massive" reactions are those found in a general area of radioactivity, as distinguished from reaction excited by a specific piece of material.

"From what I saw there was no ore anyone is going to dig and ship tomorrow," Wagner told The Oregonian.

"On the other hand, there is a little counter reaction that is all out of proportion to the fuss that is being kicked up. There is little regular reaction—no specific high grade that could be classified as conventional ore."

Other geologists in the area have a theory that traces of uranium have been concentrated by leaching out of the formation and washing down into an underground pocket of water.

Readings Require Contacts

If a scintillometer has been flown over the strike area, they say, it is possible that readings showed a "halo" effect common to underground gas, oil and water deposits concentrating hydrocarbon atoms.

However, scintillometer readings require controls, numerous flights over an area, a constant altitude above the ground and other factors to be worth while.

They say the sedimentary deposit giving the radioactive indications "look like medium to coarse-grain quartz reworked sandstone—a typical continental deposit. There is nothing to indicate thorium (uranium) or secondary carnatite deposit."

Counters Show 'Something'

Nevertheless, geologists concede Geiger counters "show something" in the area.

Radioactivity in the past has been associated with old rock and the Harper deposit is a middle tertiary formation of relatively recent times, they point out.

This could revise current concepts of where radioactive materials might be found. Geologists won't close the door on the possibilities, but they remain to be convinced.