mbk

OCT 5 - 1960

Those Listed Below

Duncan Clark, Director
Office of Public Information

PRS MEMORANDUM RELATING TO SHIPROCK (KERR-MCGEE) MILL INCIDENT

SYMBOL: OPI:WH

Attached for your information is a copy of a report to the Public Health Service, Washington, from one of its representatives in the Shiprock, New Mexico, area.

We obtained a copy of this report after we were told by the public information office at HEW that the report had been shown to Helene Nusberg, a correspondent for a number of papers in the mill area, including the Farmington, New Mexico, paper.

Your attention is called particularly to the statement in the third paragraph on Page 1 that "any AEC licensee is required by law to report such 'incidents' immediately" and to the paragraphs on Page 10 under the heading "Questions Remaining." These statements, if given currency by Miss Nusberg, may raise both public information and administrative problems.

For your further information, we were told by HEW that while it is the agency's practice, ordinarily, to treat reports of this sort as internal documents not available to outsiders, in this case Miss Nusberg was so insistent that it was believed desirable to depart from practice and allow her to see a copy.

Attachment

Addressees:
Dwight Isk, AGM
William Finan, AGM/RS
Harold Price, L&R
David Low, CO
Nathan Woodruff, M&S
Neil Naiden, OGC
Jesse Johnson, EM
Mack Corbett, IDOO
Richard Elliott, ALOO

RECEIVED
OCT 10 1960
ID COMPLIANCE

A/95

Robert A. Taft Sanitary Engineering Center
4676 Columbia Parkway, Cincinnati 26, Ohio

UNITED STATES GOVERNMENT

Memorandum

TO : Chief, RMEPC, PHS, Washington, D.C.
Attn: K. S. Krenzke, Chief
Technical Services Branch

DATE: September 23, 1960

FROM : E. S. Tsivoglou, In Charge
Radiological Pollution Activities
Field Oper. Sec., Tech.Ser.Br., RMEPC

SUBJECT: Detailed Report of Data Regarding Shiprock Accident.

This memorandum is to supplement the Summary statement recently transmitted and to provide the detailed data available. As you may see from attachments, there has been a great deal of speculative comment from various quarters, including the press. As a result, it was felt here highly desirable to refrain from reporting until adequate factual information could be available. This occurred with completion this week of the fish toxicity tests of the waste involved, and the accumulated data and conclusions are herewith transmitted.

The Accident

Date and Time. On August 22, 1960, at 11:30 PM or earlier, a tailings pond wall at the Shiprock, New Mexico, uranium mill (Kerr-McGee) broke, releasing the contents of two out of a series of ten ponds to a wash, or ditch, leading to the San Juan River. Mill personnel estimate that the release occurred from 11:30 PM until 1:30 AM on August 23. An observer from the Navajo Plant just downstream noted that the San Juan was milky at 7:00 PM on the 22nd of August and reported the likelihood that one of Kerr-McGee's dikes had broken. At 4:00 PM on August 22, a U. S. Geological Survey worker (Mr. Orville McCoy) noted that the river three miles downstream was clear, and also noted in a pool a number of fish, all apparently healthy. At 8:00 AM on August 23 he observed "many" dead or dying fish at the same location. The exact duration of the release is not known.

Reporting. It has been verified both by this office and by personnel of the Division of Compliance of the Atomic Energy Commission that the mill management did not report the release to any official or unofficial agency. (Note: Any A.E.C. licensee is required by law to report such "incidents" immediately). Neither the A.E.C., the Public Health Service, the State of New Mexico, nor the San Juan County Health Department were notified, nor were any of the downstream water plant operators. First reports of a fish kill appeared in the local press (see attachments) on August 27 or 28, some five or more days following the release. Individual observers noted dead fish beginning on August 23.

The release was thereafter reported rapidly by local P.H.S. Division of Indian Health personnel to Regional and other P.H.S. units, and through them to the State of Utah and the Division of Licensing and Regulation, A.E.C.

K.S.Krause --- 9/23/60

Quality and Quantity of Waste Released. Initial estimates were that some 200,000 gallons of waste were released; later estimates place the figure at about 250,000 gallons. These are the figures supplied by mill personnel and later estimated by P.H.S. and A.E.C. observers. The attached sketch map indicates the general area and route of the released material.

As indicated in the attachments, the waste was an organic raffinate, highly acid, and similar to that produced in the V.C.A. plant at Durango, Colorado. The pH was about 1.7, and the liquor contained kerosene, an organic phosphoric acid and tributylphosphate. Its radioactivity and radium contents are presently being determined, but they can be estimated roughly from prior experience with the V.C.A. waste. A.E.C. initial estimates were that the waste contained from 3 to 4 millicuries of Ra-226 and Th-230. Our own estimate is that the total Ra-226 released might have been roughly 300 microcuries or about 0.3 millicuries. Later A.E.C. estimates (by phone) are more in agreement with our figure.

Ra-226 determinations require several weeks, hence the need to estimate here. The exact figures will be transmitted as soon as available.

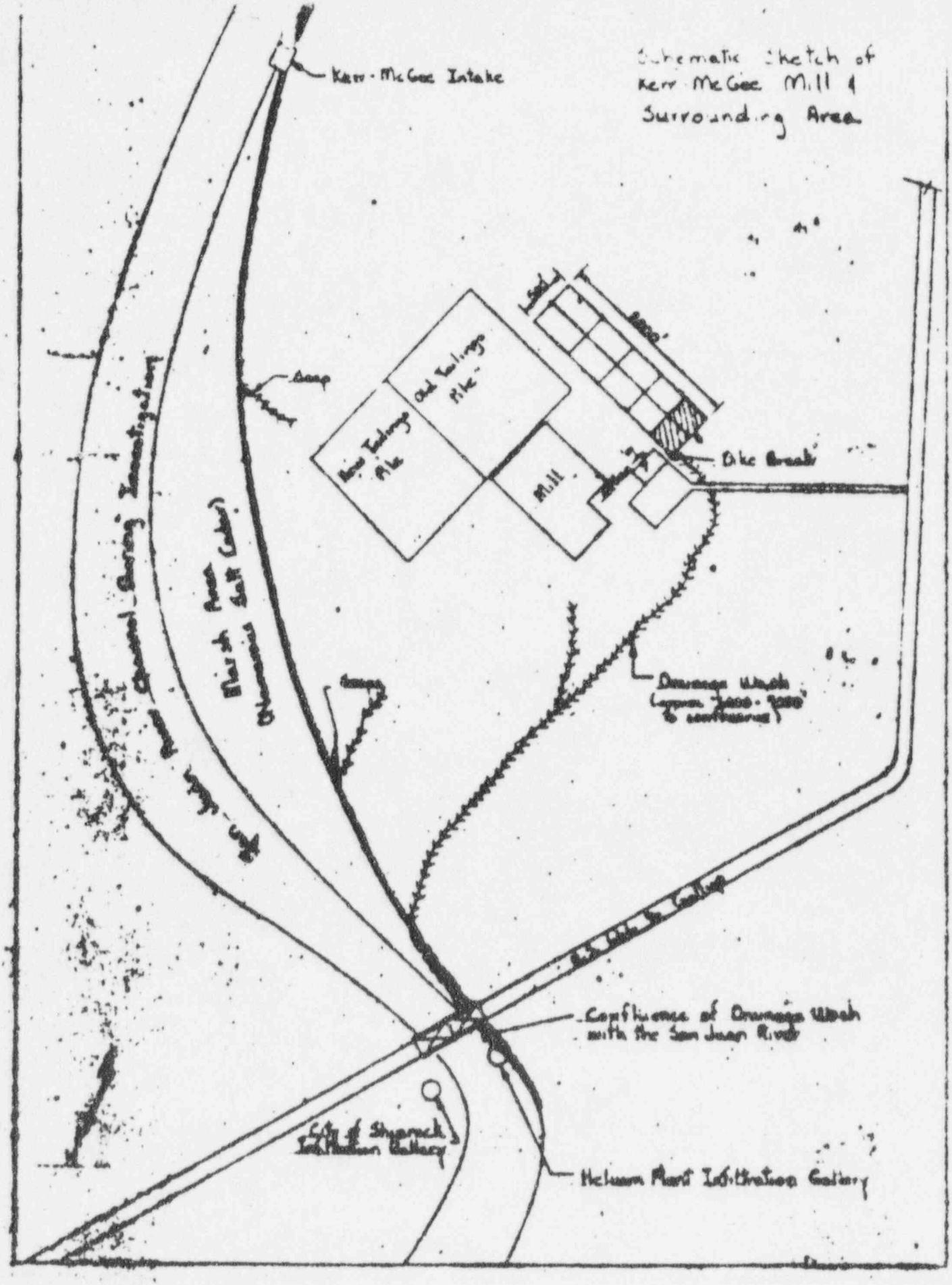
Field Observations

Upon learning of the accident late on August 30, this office notified A.E.C's Division of Licensing and Regulation at once. Arrangements were made for joint field observation and sampling by Mr. Lammering of this office, A.E.C. Division of Compliance personnel from Idaho Operations Office, Drs. McMartin and Thompson of D.R.H., and Mr. McKifrish of the San Juan County Health Department. The field inspection was carried out during August 31 and September 1 and 2, and samples of a variety of media were obtained. First-hand reports were also gathered at this time from Kerr-McGee personnel, Helium Plant observers, and other local witnesses.

Downstream Water Users

Several downstream water supplies are taken from the San Juan River. A Helium Plant located immediately below the mill takes its water supply from the river on the mill side at a point only a few hundred feet below the point at which the raffinate entered the river. The intake is a tile underdrain in the river bed. This in effect gives pretreatment so far as turbidity is concerned. The supply is then filtered, softened by zeolite units and chlorinated.

Shiprock's water supply is taken at times from an irrigation ditch that carries water taken from the San Juan some miles above the mill, and at times from the San Juan via an infiltration gallery located below the mill opposite the Helium Plant intake. Our information is that at the time of the Kerr-McGee


Schematic Sketch of
Kerr McGee Mill &
Surrounding Area
Kerr-McGee Intake
Ramp
New Tailings Pile
Old Tailings Pile
Mill
Dike Breach
Marsh Area
Drainage Wash
Confluence of Drainage Wash with the San Juan River
Helium Plant Infiltration Gallery

spill water was being taken from the irrigation canal and not directly from the river. This supply receives only filtration (anthrafilt) and chlorination.

The Mexican Hat, Utah, water supply also is drawn from the San Juan River. Details of intake construction and treatment are not immediately available.

The area below Shiprock is part of a large Navajo Indian Reservation, and it is believed that the San Juan is used untreated by a significant number of Indians, as reported in the recent Animas River investigations.

Chemical Data

Although actual data for the time of the spill is sparse, because of the lack of information that a spill had occurred, certain useful data for that period does exist.

pH. First, according to Dr. McMartin, and as shown by Helium Plant data, the Helium Plant was called by mill personnel and asked to watch the pH of their water supply on the morning of August 23. No explanation was given. The pH dropped from 7.8 to 7.4, and soon rose again to its original level of 7.7 or 7.8. The total dissolved solids changed as shown below:

Table 1

Total Dissolved Solids, Helium Plant

Date	Total Dissolved Solids, Raw Water
July 21	400 mg/l.
August 22	not reported
August 23	1492
August 24	2088
August 25	2160
August 26	2192

These data from the Helium Plant, while not conclusive, do seem to indicate change in quality due to the spill.

Conductance. The U. S. Geological Survey samples the San Juan River routinely at the gaging station three miles below Shiprock, as well as at Mexican Hat, Utah. Information obtained by telephone from their Albuquerque office (Mr. C. E. Sponagle in a conversation with Mr. Stowe of U.S.G.S.) regarding samples at Shiprock gage is as follows:

Table 2

Conductivity of San Juan River at Shiprock *

Date	Time	Specific Conductivity, Micromhos
August 19	7:30 PM	1940
August 20	6:30 PM	1940
August 21	12:05 PM	1820
August 22	11:15 AM	1860
August 23	8:00 AM	4390

These data indicate a sharp change in specific conductivity at the same time the pH change was observed at the Helium Plant, and considerably strengthen the evidence that the spill reached the river in considerable quantity during the early hours of August 23.

Color. The U. S. Geological Survey also noted that their sample for August 22 was clear and uncolored, whereas the sample for the 23rd of August (8:00 AM) was orange reddish in color. This led them to suspect the presence of iron.

Considered collectively, these chemical and physical data appear to leave little doubt as to the presence of the mill wastes in the river at Shiprock. Some color change was also noted on two separate days by an observer at Mexican Hat, Utah. The first occasion was August 24. However, as will be seen below, there is some evidence also of a rain below Shiprock at about this time, and some doubt remains regarding the cause of the unusual color at Mexican Hat.

River Flow and Rainfall

Early reports from persons at the mill and others indicated that a local shower might have caused a sudden rise and fall of the San Juan at Shiprock, as well as a sharp change in turbidity. There was speculation that excessive turbidity may have killed the fish, or that they may have been stranded by the sudden flow change. Accordingly, Mr. Lammering of this office gathered

* See page 11.

all available local rainfall data, and flows for the U.S.G.S. gaging station three miles below the mill were obtained. The flows were as follows:

Table 3

Flow in San Juan River at Shiprock, New Mexico

Date	Flow, cfs
August 18	71
" 19	82
" 20	72
" 21	66
" 22	80
" 23	82
" 24	255
" 25	260
" 26	275
" 27	285
" 28	195
" 29	175
" 30	137
" 31	100

These data, obtained by Mr. Sponagle from Mr. McCoy (U.S.G.S. worker for the area involved), show clearly that, although the river did rise, the rise did not begin until late on August 23 or early on August 24. In contrast, chemical changes and dying fish were observed at 8:00 AM on August 23, or clearly before any rise in river stage. Mr. McCoy further stated his opinion that much of the rise on August 24 was due to upstream release of impounded irrigation water, rather than heavy rain.

Rainfall is collected and measured at the Helium Plant. During the night of August 22 there was some rain, but the amount collected was small. Personnel there stated that it was less than 0.10 inches. They also indicated that it was the only rain in a week.

A rain gage at Fruitland, New Mexico, (about 15 miles upstream from Shiprock) indicated that no rain occurred during the entire month of August except for 0.02 inches on August 1. This gage recorded in addition 0.04 inches on September 1, and 0.15 inches on September 2.

Mr. John Blaeske, Division of Indian Health worker at Shiprock, indicated that on August 22 a heavy rain did occur in the Sanostee area, but not at Shiprock. Surface flow from this rain would enter the San Juan via the Chaco Wash about one mile above Shiprock. One wash was stated to be flowing on the morning of August 23. However, the downstream flow record indicates that apparantly any increase in river flow due to this rain was minor.

This evidence, then, indicates clearly that neither excessive turbidity nor sudden changes in river stage was responsible for the fish kill, which was observed as early as 8:00 AM, August 23.

Fish Kill

Various newspaper and other statements regarding the occurrence of dead fish below Shiprock have been gathered. In addition, a sample of the type of waste involved was obtained on September 1 by Mr. Lemmering, and has been tested at the Sanitary Engineering Center by the standard bioassay technique. An attachment reporting the fish bioassay results is included, as are the newspaper references that could be obtained, and a memorandum on this subject by Dr. McMartin.

Eyewitness Accounts. At 8:00 AM on August 23, in connection with his usual duties, Mr. McCoy again visited the U. S. Geological Survey gaging station on the San Juan about three miles below the mill. At that time he observed that "many" fish in the pool were dead or dying, that catfish especially were trying to surface and that the fish were clustered near the stream's edges in an apparent effort to avoid the main flow. He noted a "methyl" smell in the river at the gaging station.

A second eyewitness report was made by Mr. Sam Kapatan, Health Educator, who observed numbers of dead fish near Aneth, Utah, some 40 or 50 miles below Shiprock. (Maps for this general area are limited in detail, and mileages given in this report are necessarily only estimates. They are believed to be not grossly in error). This kill was observed on August 24.

A third witness, Mr. Ralph Harmon, night foreman at the Helium Plant, observed large numbers of dead fish ("hundreds") on August 24 in the morning. The location was approximately five miles downstream from the point where the waste entered the river.

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Unfortunately, by the time (September 1) P.H.S. personnel from this office arrived on the scene the remaining dead fish that could be found were in bad condition due to decay and due to being eaten by birds and/or animals. Otherwise specimens might have been collected and autopsy attempted at the Sanitary Engineering Center.

Two newspaper articles referring to the fish kill are attached. We understand that there were several other such articles, possibly one in an Albuquerque newspaper, but we have been unable to obtain copies at this writing.

In summary, the various accounts establish that large numbers of fish were killed over at least 60 miles or so of the San Juan below Shiprock immediately following the release of raffinate at the Kerr-McGee mill.

Fish Toxicity Tests. As noted above, samples of the kind of waste that was spilled to the river were obtained on September 1 by Mr. Lammering. They were taken from the pond immediately adjoining the one from which the spill occurred, and it was thoroughly verified with mill personnel that this was the same waste.

Upon receipt at the Sanitary Engineering Center, fish bioassay tests were commenced at once using the waste. Attached are the detailed results of the tests, as reported by Mr. Henderson of the Aquatic Biology Section.

In brief, the wastes were tested for their toxicity to fathead minnows and bluegills. Dilution water was made up to be similar to that in the San Juan River, based on chemical data obtained from local water plants. The tests indicate that the waste was "highly toxic" to the fish. Its 24-hour TL_m (Median Tolerance Limit) was 0.41 per cent. This means that a concentration by volume of 0.41 per cent waste in unpolluted water will result in the death of 50 per cent of the fish present within 24 hours.

By direct computations it has been estimated that at the existing river flow of 82 cfs a waste flow in the neighborhood of 0.35 cfs would give a waste concentration in the river equal to the 24-hour TL_m for the test fish. The duration of waste discharge and exact quantity reaching the river are not definitely established. As noted above, the quantity released was about 250,000 gallons, but there exists some speculation that a part of this seeped into the soil before reaching the river. The duration may have been as short as the two hours estimated by mill personnel (11:30 PM August 22 to 1:30 AM August 23) or longer. It would appear to have been not finished by 5:00 AM on August 23, according to the chemical data noted before.

If the 250,000 gallons of waste all flowed into the river in the 2-hour period, it would have amounted to 4.69 cfs, or 13 times the TL_m noted above.

This appears unlikely. However, even if the duration was a full 24 hours, which appears unlikely, an average of 0.39 cfs would have resulted, which is essentially the 24-hour TL_m at which 50 per cent of the fish might be expected to die. Undoubtedly, the actual duration was between these two extremes. Also, of course, averaging the flow over the period of discharge is fallacious - most probably there was an early surge of waste to the river, resulting in a relatively high cfs rate for a short time, with the flow of waste diminishing thereafter. This would result in a "slug" discharge and peak waste concentration passing downriver.

There seems little doubt that the TL_m itself was exceeded (probably by several times) in the river. Of course, the TL_m refers to a concentration at which many fish will die. A safe concentration, at which fish will be protected and not die is estimated by various authorities to be at the most 1/3 of the TL_m, and most authorities agree that an "application factor" of 1/10 is more likely to be safe. In other terms, according to best authority, at the existing 82 cfs a maximum waste flow that might have been tolerated would have been about 0.12 cfs. This flow was surely exceeded substantially.

One other item of interest emerged from these bioassay tests. The kill that occurred in the tests was all within the first 24 hours of exposure. In other words, fish that survived the first 24 hours survived for the full 96-hour test period, and presumably indefinitely. The toxicity of the waste was therefore seen to be immediate and sharp.

In summary, all available evidence indicates that the extensive fish kill observed on the San Juan was the direct result of the spill of acid organic raffinate that began on August 22. The toxicity of this waste is sufficient many times over to account for the kill, and there is no evidence of any other possible contributing cause.

Some speculation that the fish might have been killed by dynamite has been called to our attention. This is mentioned here only because we have heard it from several Headquarters sources including DMRPC and DRH. We believe its origin occurs in a memorandum from Dr. McMartin (dated September 7, 1960, to E. C. Tsivoglou, copy attached). How it spread to other places we do not know. From the foregoing evidance it seems to be very clearly fallacious, especially as dead fish were observed at a fairly widely separated group of locations.

Radioactivity

Estimates of the amount of radioactivity, specifically Ra-226, that may have been discharged with the spill have been made by both this office and personnel of A.E.C. The A.E.C. estimates are referred to in a memorandum dated September 7, 1960, from Dr. McMartin to Dr. Francis J. Weber (copy attached)

It was estimated by A.E.C. personnel that a total of 3,000 to 4,000 microcuries of Ra-226 and Th-230 could have been released. In another memorandum from Dr. Gerber to Dr. Weber, dated September 2, 1960, (copy attached) it is noted that the A.E.C. personnel estimated that there could have been as much as 15 times the MPC of Ra-226 and Th-230 at the point of flow into the river for a brief time. It should be noted that these are very early estimates.

Our own guess as to the amount of Ra-226 involved has been about 300 microcuries. This does not include Th-230. It was based upon our experience and data regarding the Ra-226 concentrations in other mill effluents that might be similar - for example, the raffinate from the V.C.A. mill at Durango, Colorado. Later, in telephone conversations with A.E.C. personnel, they indicated that they did not disagree widely with our estimate for Ra-226 alone.

A preliminary gross alpha assay of the sample of typical pond contents collected by Mr. Lammering has been partially completed. It indicates a gross alpha activity of about 7,000 μμc/l. From prior experience with other effluents it appears reasonable to estimate the Ra-226 content at 1-10 per cent of this figure. Using the 5 per cent, and the 250,000 gallon estimated release, it is estimated that there would be about 330 microcuries of Ra-226 released. Thus our estimate remains at about 300 microcuries total Ra-226 release.

If this were released over only two hours, at a flow of 82 cfs in the river, and was well mixed with the river, an average concentration of about 18 to 20 μμc/l. of Ra-226 would result, or about five times the continuous lifetime exposure MPC of 4.0 (or 3.3, if ICRP standards are used). The very short duration of such exposure makes it minor in terms of allowable exposures, even though a standard was momentarily exceeded. The only possible exception here is the Helium Plant intake which is located immediately below the discharge (about 300 feet) and on the mill side of the river. As noted before, a tile underdrain is used as the intake. It is possible that the spilled waste passed over the intake and missed it. It is also possible that it did not. In that event the Ra-226 concentration in the Helium Plant intake could have briefly been considerably higher than the estimated 18-20 μμc/l., because the waste was still concentrated and not fully mixed with the 82 cfs of river flow. This cannot be determined now, and must remain in doubt. In any event, even though the Ra-226 MPC was probably exceeded, this was quite brief relative to the fact that the MPC is for lifetime exposures and continuous exposures.

It is therefore estimated that no humans suffered serious overexposure to Ra-226 as a result of the spill from the Kerr-McGee mill.

A large number and variety of samples of water, effluents, river muds and silts from the Kerr-McGee property were collected on September 1 and 2 by Mr. Lammering and others. Also, small aliquots of San Juan River water on each day covering the period of release have been obtained from the U.S.Geological

Survey for their Mexican Hat, Utah, and Shiprock, N.M., sampling stations. (Daily water samples are collected routinely at these points by the U. S. G.S. in connection with their own studies of chemical water quality). All of these samples are presently being analyzed by D. K. Rushing and D. A. Clark for their Ra-226 content. However, this analysis requires a number of weeks to complete, and results are not available now. As soon as they are reported, it will be possible to estimate more precisely the actual Ra-226 release and exposure.

Questions Remaining

As noted in our memorandum of September 22, Summary Statement, certain basic questions remain. First, even though no serious human radiation exposure apparently occurred, the amount that did occur was undesirable. Other effluents also contain more Ra-226 at times. Should such releases occur in the future it seems imperative that the nuclear plant undertake to promptly notify responsible A.E.C. and public health officials. Failing this, it is not inconceivable that more serious incidents may occur in the future. It appears highly desirable that this be brought to the attention of the nuclear industry to assure their more prompt future cooperation.

Secondly, this particular type of incident is not completely uncommon. It has occurred elsewhere - for example, twice at the old Naturita, Colorado, mill (presently not operating). It occurs generally because the tailings pond walls are not compacted or otherwise protected from failure and usually because too much liquor is sent into the ponds. In view of this it seems quite necessary that the several mills of the Colorado River Basin undertake to quickly determine practical methods of preventing this type of incident and place these methods in operation at their respective mills. Otherwise it appears that such failures of tailings pond walls can be expected to occur in the future.

It is suggested here that the Division of Licensing and Regulation of the U. S. Atomic Energy Commission might well be approached by the Public Health Service and requested to assist in finding answers and solutions to the aforementioned questions. The management of the Kerr-McGee mill could not have known a priori that greater human radiation exposure would not occur.

NOTE:

It should be clear from the foregoing that a large number of agencies and individuals have contributed in many ways to develop the foregoing information. The U. S. Geological Survey and U. S. Atomic Energy Commission have been especially cooperative and helpful, as well as personnel from the Helium Plant.

K. B. Krause --- 9/23/60

NOTE:

From "Water Quality Criteria" (1957), Publication No. 3, State Water Pollution Control Board, California, p. 375, the following is taken:

"On the basis of his studies, Ellis concluded that conductances in excess of 1,000 mhos x 10^{-6} (1,000 micromhos) at 25° C. in most types of stream, or in excess of 2,000 mhos (x 10^{-6}) at 25° C. in the alkaline western streams are probably indicative of the presence of acid or salt pollution of various kinds."

L. D. Low, Director, Division of
Compliance, AEC Headquarters

OCT 6 1960

Donald I. Walker, Director, Licensee
Compliance Division, Idaho Operations Office

Original signed by
Richard T. Kent

INVESTIGATION OF THE HOLDING POND RUPTURE AT THE KERR-McGEE OIL INDUSTRIES, INC., URANIUM MILL, SHIPROCK, NEW MEXICO - LICENSE R-137, AMENDMENT 2

LC:GHS

Transmitted herewith are four (4) copies of subject report.

The following items of noncompliance were observed or otherwise noted:

10 CFR 20.103 (b) Concentrations in effluents to unrestricted areas Concentrations of radioactive materials in excess of those specified in Appendix B, Table II, were released.

10 CFR 20.403 (c) Notification and report of incidents As of September 30, 1960, 38 days after the incident occurred, the Manager of Idaho Operations Office had not yet received written notification and evaluation of the incident from the licensee. (This item of noncompliance is cited providing notification has not been received by the Director, Division of Licensing and Regulation, U. S. Atomic Energy Commission, Washington, D. C.)

The rupture of a holding pond at the Kerr-McGee uranium mill, Shiprock, New Mexico, was reported to this office on August 30, 1960, by Dr. Grant Winn, Utah State Health Department, Salt Lake City, Utah. Investigation of the incident revealed the following:

1. The barren raffinate holding pond contents were released sometime between 1900 hours on August 22, 1960, and 0130 hours on August 23, 1960.

2. Mill management did not notify officials of the USAEC, USPHS, or New Mexico State Department of Health of the incident but did notify the U. S. Helium plant superintendent on the morning of August 23, 1960.

(Continued)

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3. An estimated 2,500,000 gallons of raffinate were released, rather than the 250,000 gallons estimated by the licensee.

4. The raffinate would have traveled approximately one mile before entering the San Juan River flow.

5. The appearance of the stream bed, which the raffinate traversed, and the amount of liquor released caused the inspector to estimate that at least 75 per cent of the raffinate reached the river.

6. Concentrations of radioactive materials, namely, radium and thorium, in ponds similar to the pond released indicate that the incident was of a "Type C" classification.

The inspector was hampered by the time lapse (eight days) between the date of the incident and the date of notification to the office. The fact that the incident was reported by a local newspaper, after the finding of a large number of dead fish, tended to cause a great deal of apprehension in the local populace. A "Type A" or a "Type B" incident, if properly handled, could very possibly cause less public indignation than this "Type C" incident.

We are of the feeling that if the mill personnel had taken appropriate action when they apparently first received notification of something being amiss (at 2300 hours, by the acid-truck driver) they could probably have stopped all or part of the raffinate from reaching the river. This could have been accomplished by blocking the mouth of the culvert leading under the road; this would have caused the raffinate to spread out over the area west of the mill and south of the road. The raffinate would then have disappeared by evaporation and percolation, or it could have been released to the river over an extended period of time, thus reducing, by river dilution over a longer period of time, whatever toxic effects it may have had on river life.

In the body of the report, we have not attempted to evaluate the analytical data on samples taken along the stream bed. The inspector is returning to the Shiprock area during the week of October 3, 1960; at this time additional samples will be taken and perhaps a basis for evaluation can be established, particularly with respect to "background" samples.

It is our opinion that the mill management had hoped that the raffinate release would go undetected, but when it was discovered they attempted to play down the quantities released. The misplacing of a decimal point could explain the variation in volume estimates; the inspector will question mill management on this during his pending visit.

(Continued)

We have not attempted to determine the cause of death of the fish, other than to attempt to show that quantities of radioactive materials were such that they would not cause a mass instantaneous death. Possibly the chemical constituents of the raffinate could have killed the fish; however, we do not feel qualified or obligated, on the basis of chemical toxicity, to prove or disprove this. Additionally, no fish samples could be obtained by the inspector.

The investigation findings indicate that the mill management was not in noncompliance with the reporting requirements specified in 10 CFR 20.403(b), but it should be noted that at the time of the incident the mill management did not have sufficient information on the concentration of radioactive materials in the raffinate to define the incident as an "A", "B", or "C" type incident. We are of the opinion that when an incident of unknown magnitude occurs a pessimistic attitude must be taken by the licensee and the most stringent corrective actions must be instituted until such time as the magnitude of the incident is defined. For the above reason, it is our opinion that the licensee should have given immediate notification of the above incident to the Commission.

In view of these investigation findings, we recommend that the Division of Licensing and Regulation contact the licensee through Mr. Dean A. McGee, President, Kerr-McGee Oil Industries, Inc., Oklahoma City, Oklahoma, to:

1. Inform him of the items of noncompliance.

2. Inform him that the investigation indicates that an estimated 2,500,000 gallons of raffinate were released and that a major portion of this material reached the San Juan River flow.

3. Inform him of the necessity and the importance of prompt reporting of incidents.

We recommend that the Division of Licensing and Regulation seriously consider that the licensee be required to install a flood gate on the culvert or a secondary retaining dike to prevent a recurrence of this incident with respect to the same or other ponds. If a flood gate is installed on the culvert, the licensee should be required to keep it closed except when local rains necessitate the use of the arroyo for drainage; at these times, a close watch should be kept on the holding pond retaining walls.

(Continued)

OCT 6 1960

Copies of the above correspondence should be sent to Mr. C. L. Wise, Manager, Navajo Uranium Division, Kerr-McGee Oil Industries, Inc., Shiprock, New Mexico.

Enclosure:
Investigation Report (4 cys)
Kerr-McGee Oil Industries, Inc.

CC: W. B. Carlson, GJ w/1 cy encl.

V. C. Vespe, AL w/1 cy encl.

BCC: L. E. Snyder, ID Liaison Officer,
AEC Headquarters w/o encl.

OFFICE ▶	LC	LC	LC			
SURNAME ▶	RTK GHSmith:lo	WBJohnston	RTK DIWalker			
DATE ▶	10-6-60					

UNITED STATES
ATOMIC ENERGY COMMISSION

DIVISION OF COMPLIANCE
REPORT

Original signed by
Richard T. Kent
By George H. Smith, Inspector
Licensee Compliance Division
Idaho Operations Office

Date: OCT 6 1960

Title: INVESTIGATION OF THE HOLDING POND RUPTURE AT THE KERR-McGEE OIL INDUSTRIES, INC., URANIUM MILL, SHIPROCK, NEW MEXICO - LICENSE R-157, AMENDMENT 2

BRIEF OF FINDINGS

Sometime between 1900 hours, August 22, and 0130 hours, August 23, 1960, a retaining wall on a barren raffinate holding pond at the Kerr-McGee uranium mill ruptured causing the release of the pond's contents into the unrestricted area. Dr. Donald I. Walker, Director, Licensee Compliance Division, Idaho Operations Office, was informed of the incident on August 30, 1960, by Dr. Grant Winn, Utah State Health Department, Salt Lake City, Utah. The only person that licensee personnel notified of the incident was Mr. D. R. Schroder, Superintendent, Navajo Helium Plant, U. S. Department of Interior, Shiprock, New Mexico. Officials of the U. S. Public Health Service, New Mexico State Department of Health, and New Mexico State Department of Game and Fish were notified of the incident through a newspaper article that appeared in the August 28 edition of The Farmington Daily Times, Farmington, New Mexico. This newspaper article concerned "the death of hundreds of fish discovered on sand bars and along the banks of the San Juan River about five miles west of Shiprock."

Licensee personnel estimate that 34,400 cubic feet of raffinate were released. Utilizing licensee's stated measurements of the holding pond complex, the visible water line on the remaining sections of the retaining wall, and the liquid level in the pond that was filled simultaneously with the pond released, the inspector estimated that the quantity of raffinate released was more in the order of 344,000 cubic feet or approximately 2,500,000 gallons.

Samples of liquor remaining in Pond #1, the raffinate in Pond #2, and the raffinate being pumped to the holding ponds were submitted to the Analysis Branch, Health and Safety Division, Idaho Operations Office, for analyses. The results of these analyses indicate that radioactive materials were released to the unrestricted area in the following concentrations:

Radioactive Material	Minimum	Maximum
Natural uranium ($\mu c/ml \times 10^{9}$)	0.08	0.27
Ra^{226} ($\mu c/ml \times 10^{9}$)	440 ± 4 (110)	910 ± 5 (227.5)
Th^{230} ($\mu c/ml \times 10^{8}$)	48 ± 1.2	384 ± 3.4

Note: Numbers in parentheses indicate the number of times the concentrations exceed the MPC as stated in 10 CFR 20, Appendix B, Table II.

It should be noted that none of the above concentrations are 500 times the MPC as stated in 10 CFR 20, Appendix B, Table II.

The general slope of the land, the appearance of the eroded stream bed originating at the dam break, and the dam-like quality of the nearby roadbed indicated that the released raffinate flowed down an arroyo in an established stream bed into the dry river bottom; once in the dry river bottom, it appeared that the raffinate would have continued to follow the established stream bed to its point of confluence with the San Juan River. The distance from the holding pond rupture to the San Juan River via the established stream bed is approximately 5,500 feet. Licensee personnel stated that they felt that most of the raffinate would have been absorbed before reaching the river. The inspector found that the mill cooling water flows in the stream bed and that the area adjacent to the stream is marshy and appeared at the time of the investigation to be saturated. The cooling water stream does not appear to decrease in volume from its inception at the mill to its confluence with the river. For the above-mentioned reasons, the inspector believes that a major portion of the raffinate reached the San Juan River. The confluence of the cooling water stream and the river is approximately 200 feet upstream from the U. S. Government Helium Plant water collection gallery. The inspector obtained three water samples, two after treatment and one before treatment, from the helium plant; the analyses of these samples follow:

Sample Description	Natural Uranium $\mu c/ml \times 10^{6}$	Ra^{226} $\mu c/ml \times 10^{9}$	Th^{230} $\mu c/ml \times 10^{6}$
Raw water	0.02	< 0.2	0.6 ± 0.1
Treated water (men's room)	0.02	< 0.2	< 0.5
Treated water (office drinking fountain)	0.02	< 0.2	< 0.5

Kerr-McGee Oil Industries, Inc.

DETAILS

1. On August 30, 1960, at 1325 hours, Dr. Grant Winn, Utah State Health Department, Salt Lake City, Utah, informed Dr. Walker that a holding tank in the vanadium circuit of the Kerr-McGee Oil Industries, Inc., uranium mill, Shiprock, New Mexico, had broken, releasing its contents into the San Juan River. Dr. Winn said that he had been informed that day of the incident by the New Mexico State Department of Health. Dr. Winn stated that he had no details concerning quantities or concentrations of the material released. Dr. Winn expressed concern over the incident because the Texas-Zinc uranium mill at Mexican Hat, Utah, obtains its drinking water from the San Juan River. Mexican Hat, Utah, is from 110 to 120 miles downstream from Shiprock, New Mexico. Dr. Winn stated that there are no towns between Shiprock, New Mexico, and Mexican Hat, Utah, which use the San Juan River as their source of potable water. Dr. Winn said that he did not know if the river water was used for irrigation purposes between these two localities.

2. At approximately 1330 hours on August 30, 1960, Dr. Walker contacted Frank Hanagarne, Metallurgist, Kerr-McGee Oil Industries, Inc., Shiprock, New Mexico, by telephone. Mr. Hanagarne stated that a retaining wall on the tailings pond containing raffinate from the solvent extraction section of their vanadium circuit had broken sometime between 0000 and 0800 hours on Monday, August 22, 1960. Mr. Hanagarne said that approximately 150,000 to 200,000 gallons of raffinate had been released; he said that this liquor had a pH of 1.7 to 1.8, contained less than 0.5% sulphuric acid, assayed approximately 0.1 gram/liter V_2O_5, and possibly contained a trace of U_3O_8. Mr. Hanagarne stated that they had not analyzed the pond liquor for Ra^{226} or Th^{230} content. Mr. Hanagarne said that it had rained in Shiprock the evening of August 22, 1960, and that he thought that perhaps the rain had weakened the pond's retaining wall. Mr. Hanagarne said that they had not notified the AEC of the incident but that they had notified the New Mexico Public Health Service on Wednesday, August 24, or Thursday, August 25, 1960. Mr. Hanagarne stated that the flow rate of the San Juan River was normally 1,000 cubic feet per second but that the river was very low and that he would estimate that at that time the river flow rate was 200 cfs.

3. In a TWX, dated August 30, 1960, Dr. Walker notified L. D. Low, Director, Division of Compliance, AEC, Washington, D. C., of the incident; a copy of this TWX is attached as Exhibit A. On August 31, 1960, L. D. Low informed A. R. Luedecke, General Manager, through W. F. Finan, Assistant General Manager for Regulation and Safety, of the incident; a copy of this letter is attached as Exhibit B.

4. On August 31, 1960, George H. Smith, Inspector, Licensee Compliance Division, ID, initiated an investigation of the incident. The inspector met with Mr. C. L. Wise, Manager, and Mr. Frank Hanagarne. Mr. Hanagarne said that they thought the pond retaining wall broke sometime between 2330 hours on August 22, 1960, and 0130 hours on August 23, 1960. Mr. Wise stated that he was informed of the accident when he came to work at 0800 hours on August 23, 1960. Mr. Wise said that upon learning of the accident he immediately called Mr. D. R. Schroder, Superintendent, Navajo Helium Plant, U. S. Department of

Interior, Shiprock, New Mexico, and informed him of the accident and asked him to check his plant's water to make sure it had not been contaminated. Mr. Wise said that Mr. Schroder called him the next day and told him that the helium plant water appeared to be unaffected. Mr. Wise said that Mr. Schroder was the only person that had been notified of the accident; he said that the New Mexico State Health Department had not been notified. Mr. Wise stated that he had not notified the AEC because he had not been aware of the reporting requirements specified in 10 CFR 20 until informed of them by V. L. Mattson, General Manager, Minerals Division, Kerr-McGee Oil Industries, Inc., Oklahoma City, Oklahoma, on the morning of August 31, 1960. Mr. Wise expressed concern over the possible effects of the articles which had appeared in The Farmington Daily Times on August 28 and August 30, 1960. Copies of these articles are attached as Exhibit C. The August 28, 1960, newspaper article concerns "the death of hundreds of fish discovered on sandbars and along the banks of the San Juan River about five miles west of Shiprock."

5. Mr. Wise said that the pond contained 34,400 cubic feet of raffinate; the analytical results of this liquor (analyses performed at the mill's analytical facilities) follow:

U_3O_8 - 2×10^{-4} gm/liter (1.1×10^{-7} μc/ml U^{nat})

V_2O_5 - 1.5×10^{-1} gm/liter

Free Acid - 0.5% as H_2SO_4

pH - 1.7 to 2.0

Mr. Shaw, Chief Metallurgist, estimated that the raffinate contained approximately 10 ppm di-2 ethyl hexophosphoric acid. Shaw stated that when they make up the above organic material for use in the plant process they use 92% kerosene to 8% organic.

6. Mr. Hanagarne gave the following brief outline of the mill's process:

a. The ore is run through the U_3O_8 recovery process. The classifier sands are pumped to the new sand tails pond.

b. The barren raffinates from the U_3O_8 solvent extraction circuit are run through the V_2O_5 recovery process.

c. The barren raffinate from the V_2O_5 solvent extraction process are pumped to the holding ponds for disposal by percolation and evaporation.

Mr. Hanagarne said that they began pumping barren raffinate to the holding ponds sometime in July. Mr. Hanagarne stated that before July they had pumped all of their tailings to the new sand tails pond but that it had filled up with liquor so that they were forced to institute their present system. Messrs. Hanagarne and Wise reaffirmed that they had not analyzed the barren raffinate for Ra^{226} and Th^{230} content. Mr. Wise said that he had walked the arroyo, down which the raffinate flowed, and the river bottom, and that it was his opinion that very little, if any, of the raffinate reached the river. Mr. Wise said that it was approximately 6,000 feet from the dam break to the spot where the raffinate

would have entered the river, and that because of the porosity of the soil he felt that the liquor would have been readily absorbed.

7. The inspector asked Mr. Wise what he knew of Dr. Thompson's statement,

> 'the plant officials also had been aware for some time that there was some seepage from the plant's septic system and other areas. But, he added, radio-activity tests showed there is 'nothing to worry about.'"

which appeared in the August 30 edition of The Farmington Daily Times (Exhibit C). Mr. Wise said that he had shown Dr. Thompson the analyses results (for Ra^{226}) of water samples which they had taken from the river and the four seepage areas along the river. Mr. Wise said that Dr. Thompson had read the analytical results and had evidently drawn his own conclusions. The above-mentioned analytical results are contained in a letter dated March 4, 1960, from R. E. Musgrove, Chief Metallurgist, Climax Uranium Company, Grand Junction, Colorado. The analytical results follow:

Location	Ra^{226} $\mu c/ml \times 10^{9}$
Seepage #1	0.78
Seepage #2	11.00
Seepage #3	1.60
Seepage #4	0.95
San Juan River, upstream	0.59
San Juan River, downstream	0.65
San Juan River, midstream	0.58

It should be noted that Seepage #2 is 2.75 x MPC for radium in an unrestricted area.

8. On September 1, 1960, an official AEC announcement of the incident was released by the Office of Information, ID. A copy of this September 1 announcement and a copy of an article that appeared in the September 1 edition of The Farmington Daily Times are attached as Exhibit D.

9. The inspector, Mr. Hanagarne, and Mr. Wise toured the holding pond area. The raffinate holding pond complex is located south and east of the mill buildings; this complex, according to Mr. Wise, is 2,000 feet long and 500 feet wide. The holding pond complex is composed of eight separate ponds enclosed by a common retaining wall (Exhibit E, "Raffinate Ponds"). The northern most pond (Exhibit E, Point A) ruptured at the corner (Exhibit I, Photograph 2, and Exhibit E, Point C). Mr. Wise stated that a bulldozer repaired the rupture in

about an hour on the day following the break. The inspector observed a stream of water originating west of the tailings pond and running down the arroyo north of the holding pond (Exhibit E, Point G); Hanagarne said that this water was the cooling water from the mill's vanadium extraction circuit. The inspector observed that it appeared that the raffinate flowed out of the pond (Photograph 4 and 5) and joined the cooling water stream approximately 250 feet below the retaining wall (Exhibit E, Point E, and Photograph 4). The appearance of the erosion immediately below the dam break (Exhibit E, Point D, and Photograph 5) indicated that a large quantity of raffinate was released. The inspector observed that the cooling water stream flows to a roadbed (this roadbed is approximately 5' high), turns west and flows along the roadbed for approximately 100 feet, and then passes under the road through a culvert (Photograph 6 and Exhibit E, Point F); the stream then flows down an arroyo (Photograph 7 and Exhibit E, Point G) and enters the dry river bottom (Photograph 8). The stream turns west in the river bottom and flows approximately 1/2 mile parallel to the south bank of the river bottom (Exhibit E, Point L, and Photograph 9) before entering the San Juan River west of the Shiprock bridge (Exhibit E, Point K, and Photograph 10) and approximately 200 feet east of the helium plant water collection gallery (Exhibit E, Point H and I). In measuring distance on the aerial photograph (Photograph 1) and the tracing (Exhibit E), the length of the holding pond complex has been used as the basis for measurement; in doing this, the inspector has assumed that Mr. Wise's stated measurement of the pond is accurate. The measured distance from the pond to the confluence of the San Juan, by way of the stream bed, is approximately 5,500 feet. The inspector observed that there was a house trailer on the east side of the arroyo and that there were Indian dwellings on the west side of the arroyo (Photograph 7). The location of the helium plant, the helium plant water collection gallery, and the Bureau of Indian Affairs (BIA) wells in reference to the uranium mill and the cooling water stream should be noted (Photograph 1 and Exhibit E).

10. On September 1, 1960, Willis B. Johnston and A. Wendell Holmes, Inspectors, Licensee Compliance Division, ID, arrived at the Shiprock uranium mill. The inspector, Johnston, and Holmes obtained liquid, sludge, and grass samples from the holding pond complex and surrounding area. These samples were submitted to the Analysis Branch, Health and Safety Division, ID, on September 6, 1960, for analyses. The results of these analyses are attached as Exhibit F. A total of 51 samples was collected in 32 locations; of these 51 samples, 20 were liquid samples, 28 were sludge samples, and 3 were grass samples. Mr. Blaeske, USPHS, Shiprock, New Mexico, obtained one liquid sample for the inspector. Of the 28 sludge samples, there were two samples of synthetic zeolite and one sample of activated charcoal obtained from the helium plant and BIA water treatment systems. Three water samples were obtained from the helium plant; two of these samples were treated water and one sample was raw water; the analytical results of these samples follow:

Sample Description	Natural Uranium $\mu c/ml \times 10^6$	Ra^{226} $\mu c/ml \times 10^9$	Th^{230} $\mu c/ml \times 10^6$
Raw water	0.02	< 0.2	0.6 ± 0.1
Treated water (men's room)	0.02	< 0.2	< 0.5
Treated water (office drinking fountain)	0.02	< 0.2	< 0.5

(The inspector is returning to the Shiprock area, October 3, 1960, to collect duplicate water and sludge samples. A compilation and evaluation of the sample results should be possible after the analytical results of these duplicate samples are received.)

11. The raffinate holding pond that ruptured shall be referred to as "Pond #1" henceforth in this report and the pond adjacent to Pond #1 shall be referred to as "Pond #2". Mr. Hanagarne and a mill employee by the name of Cyova stated that Ponds #1 and #2 were filled simultaneously; they said that the raffinate was being pumped into Pond #2 from the mill circuit, and was then being siphoned into Pond #1. Hanagarne and Cyova said that Ponds #1 and #2 had filled and that they had switched the raffinate to another pond on the morning of August 21. The inspector observed that there was a pool of liquid remaining in Pond #1 (Photo 3); whether this pool was the remains of the pond contents or the result of recent rains could not be determined. Analytical results (Exhibit F) of liquid samples taken from Pond #2, the pool in Pond #1, and the barren raffinate discharge pipe follow:

Location	Ra^{226} µc/ml x 10^{9}	XMPC*	Th^{230} µc/ml x 10^{8}	Natural Uranium µc/ml x 10^{6}
Pond #1 - pool	440 ± 4	110	384 ± 3.4	0.1
Pond #2 - south	900 ± 5	225	159 ± 2.2	0.26
Pond #2 - north	572 ± 4	143	158 ± 2.1	0.27
Barren raffinate discharge pipe	910 ± 5	227.5	48 ± 1.2	0.08

* MPC as specified in 10 CFR 20, Appendix B, Table II

It should be noted that none of the concentrations of radioactive materials listed above are greater than 500 times the MPC. Utilizing the above analytical data from Ponds #1 and #2 and Mr. Wise's estimate that 34,400 cubic feet (9.6×10^{8} ml) of raffinate had been released, the investigator estimates that the following amounts of radioactive materials were released:

Radioactive Material	Maximum	Minimum
Uranium (natural)	259 µc	96 µc
Radium-226	864 µc	422 µc
Thorium-230	3,686 µc	1,517 µc

12. Cyova stated that the first warning that anything was amiss in the holding pond area came about 2300 hours, August 22, when the driver of an acid truck informed the "shifter" (shift foreman) that there was an "awful lot of water" running through the culvert. Cyova informed the inspector that the "shifter" was busy and did not investigate until about 0130 hours, August 23, and at this time all of the liquid had drained from Pond #1. The inspector observed that, when a man walked on the top of the raffinate pond retaining wall, the wall would crumble. The inspector observed that there

was a water line approximately six inches from the top of the undamaged portion of Pond #1's retaining wall (Photograph 3) and that the liquid in Pond #2 was approximately 8 inches from the top of its retaining wall (Photograph 2).

13. The inspector noted that the measurements of the holding pond complex, as stated by Wise (Paragraph 9), indicate that the dimensions of Pond #1 are approximately 185 feet by 500 feet (Photograph 1). Utlizing these dimensions, the inspector has determined that the area of the pond is approximately 92,500 square feet; therefore, if 34,400 cubic feet of liquid were contained in the pond, the depth of the liquid would be 0.37 feet or 4.4 inches. The water line on the pond retaining wall (Photograph 3), the depth of the liquid in Pond #2, and Hanagarne's and Cyova's statements that the pond was full, indicates that the depth of the liquor was approximately 4 feet. Utilizing the above area and depth, the inspector has determined that the pond contained approximately 370,000 cubic feet of liquid. It should be noted that the inspector's estimate of the pond volume is approximately 10 times greater than the estimate made by Mr. Wise; therefore, because of the retaining wall slope and the subsequent decrease in pond volume, the inspector estimates that the pond volume was approximately 344,000 cubic feet. One cubic foot equals 7.481 gallons; therefore, the inspector estimates that approximately 2,500,000 gallons (9.6×10^9 ml) of raffinate were released. Utilizing the above quantities and the concentrations given in Paragraph 11, the inspector estimates that the following amounts of radioactive materials were released:

Radioactive Material	Maximum	Minimum
Uranium (natural)	2,590 µc	960 µc
Radium-226	8,640 µc	4,220 µc
Thorium-230	36,860 µc	15,170 µc

Mr. Hanagarne stated that the ponds were filled at the rate of 200 gallons/minute; that they started pumping raffinate to Pond #2 sometime in July, siphoning from Pond #2 to Pond #1; that they stopped filling Ponds #1 and #2 on the morning of August 21. Assuming the siphon action maintained equal liquid levels in Pond #1 and Pond #2, the volume of the liquid in each pond would be proportional to the pond areas. Utilizing the aerial photograph, the inspector has determined that the area ratio of Pond #1 and Pond #2 is 1.0 to 2.1. Assuming that raffinate was pumped into the ponds only the first 20 days of August at the rate of 200 gpm, a minimum of 5,760,000 gallons of raffinate would have entered the ponds. Utilizing the above-mentioned ratio, the inspector has calculated that a minimum of 1,800,000 gallons of raffinate were in Pond #1. It should be noted that the inspector does not know what day in July the raffinate was started to Ponds #1 and #2, and therefore, the estimate on this basis must be necessarily lower than the preceding estimate of 2,500,000 gallons but considerably greater than the licensee's estimate of 250,000 gallons. Utilizing the above method and information, the volume of Pond #1 would increase 92,160 gallons for every day in July that raffinate was pumped to it.

14. On August 30, Hsnagurne estimated that the flow rate of the San Juan River, at the time of the incident, was approximately 200 cfs (Paragraph 2). Assuming that 100% of the liquor reached the river and that a complete mixing took place at the confluence, the inspector has determined the following dilution factors:

volume of raffinate = 344,000 cubic feet

Time of release	rate of release	dilution factor
1/2 hour (1800 sec)	192 cfs	.49
1 hour (3600 sec)	96 cfs	.31
2 hours (7200 sec)	48 cfs	.19
2-1/2 hours (9000 sec)	38 cfs	.16

15. The inspector, Johnston, and Holmes toured the arroyo and the dry river bottom. The inspector observed that the mill cooling water followed a well-defined stream bed, and that the area bordering this stream bed was marshy. The inspector observed that grass along the stream bank was bent and pointing downstream while grass approximately 4 feet from the stream was standing straight; the grass adjacent to and in the stream bed was turning brown while the grass farther from the stream remained green. The appearance of the grass tends to indicate that perhaps an amount of liquid greater than that which was in the stream at the time of the investigation had traversed the stream bed and the discoloration indicated that this liquid was of such a nature that it may have had a toxic effect on the grass. The stream bed in the river bottom is approximately 4 feet across and 2.5 feet deep.

16. On the morning of September 1, 1960, the inspector; H. L. McMartin, M.D., Senior Surgeon (R) USPHS, Radiation Health Consultant, Region VII, USPHS, Dallas, Texas; Robert D. Thompson, Ph.D., Consultant Chemist, USPHS, San Juan Project, Farmington, New Mexico; John F. Blaeske, Senior Assistant Sanitarian, USPHS, Shiprock, New Mexico; Milton Lammering, Assistant Sanitary Engineer, USPHS, SEC, Cincinnati, Ohio; Dr. John R. Bourne, District Health Officer, District #2, New Mexico State Department of Health, Farmington, New Mexico; Larry H. McElfresh, Senior Sanitarian, San Juan County Health Department, New Mexico State Department of Health, Farmington, New Mexico; and Louis Berghofer, Conservation Officer, Farmington District, New Mexico Department of Game and Fish, Farmington, New Mexico, met with Mr. Wise at the Shiprock mill. Dr. Bourne said that he had been notified of the incident late Friday, August 26, 1960, by the editor of The Farmington Daily Times. Dr. Bourne said that the editor had informed him that a story concerning the dead fish on the San Juan River was going to appear in their Sunday edition and that the editor wanted his opinion of the possible "sensationalism" in the story. Dr. Bourne said that he had not officially informed any other person or agencies of the incident. Dr. Bourne said that the editor of The Farmington Daily Times had told him that an employee of the helium plant had brought pictures of the dead fish to the newspaper office and had informed them of the dam break at the uranium

mill. McMartin, Blaeske, and McElfresh stated that they first became aware of the incident when they read the "dead fish" story in the Sunday paper. Berghofer said that he was attending a meeting of conservation officers on Monday, August 29, when his supervisor came up, put the paper in front of him, and demanded to know what was going on; this was his first notification of the incident. Thompson stated that he was unfortunate in not reading the Sunday paper and was informed of the incident upon reporting to work Monday morning. Thompson, McElfresh, Blaeske and Bourne conducted an investigation of the incident on Monday, August 29, 1960. The following statement appeared in the August 30 edition of the Farmington Daily Times (Exhibit C):

> "However, Dr. R. D. Thompson, consulting chemist with the health service, emphasized that 'a finger can't be pointed at anybody.' He said detection work is underway, adding that it is a difficult job because the contaminated water - if it was contaminated - by this time is long gone and the fish now are nothing more than skeletons."

Dr. Thompson said that he was concerned with the reporter's reference to "contaminated water"; he said that he felt that the word "contamination" held the connotation of "radiation" to many people, and that in his usage of the word "contamination" he had been very careful to stress to the reporter that he meant contamination in any form, e.g., chemical contamination.

17. On September 1, 1960, the inspector, Dr. Bourne, Mr. McElfresh, Mr. Lammering, Dr. Thompson, and Mr. Berghofer met with the following employees of the Navajo Helium Plant: Mr. Schroder, Superintendent; Mr. Scoggins, Chief Chemist; and Mr. Gleaton, plant employee. Mr. Schroder said that Mr. Wise had called him on the morning of August 23, 1960, and told him that a tailings pond dam had broken. Mr. Schroder said that Mr. Scoggins had checked the pH on their raw water to attempt to determine if they were pumping any of the tailings liquor. Mr. Scoggins said that the pH on the raw water for August 22 and August 23, 1960, was 7.4. Mr. Schroder said that, because of these pH readings, he had called Mr. Wise and informed him that they were not detecting a change in their water. Mr. Schroder said that all water for the plant and adjoining housing area is obtained from their own water treatment plant. Mr. Schroder outlined their water collection and treatment system as follows:

a. There are three porous pipes approximately 8 feet below the river bed; the river water filters through the sand, is picked up in the pipes, and is pumped to the plant for treatment. The collection gallery is located on the south side of the San Juan River approximately 100 yards downstream from the Shiprock bridge.

b. The raw water is treated by a synthetic zeolite ion exchange process to decrease hardness.

Mr. Scoggins said that he personally felt that the water was contaminated and that he was drinking "Ca[illegible]cada" water. ("Cascade" water is a commercial brand of bottled water). Mr. Schroder said that

many of the people living in the helium plant housing area were buying "Cascade" water because they claimed that the plant water was causing diarrhea. Mr. Schroder said that a number of his people had had diarrhea all summer and that he thought that many of the new cases were psychological. Mr. Schroder expressed concern over the plant drinking water and said that if there were indications that the water was contaminated he would be forced to develop a new water supply. Scoggins said that the nitrate and total solids content of the river water had been raising over the last three years, but gave no figures. Mr. Schroder said that, at approximately 1900 hours on August 22, 1960, the foreman on the swing shift came to his house and told him that something must be happening at the uranium mill. This foreman, Mr. Rock Harmon, had told Schroder that the water in the uranium mill runoff stream "looked terrible"; it was a reddish-yellow color and appeared to have increased in volume. Schroder said that he and his foreman thought that the uranium mill might have lost a tailings pond at this time. Mr. Schroder said that some of his personnel had made the statement that this wasn't the first time that Kerr-McGee had lost a tailings pond. Mr. Schroder said that many of the Indians in the area have obtained their water from the helium plant; he stated that there is a spigot outside the perimeter fence and that he has allowed the Indians to take water from this spigot. Mr. Schroder said that since the incident at the uranium mill he has not allowed the Indians to take water from the spigot and that he was going to continue this practice until he was sure that the helium plant water was safe.

18. Mr. Gleaton stated that he had discovered the dead fish and had given the story to The Farmington Daily Times. Mr. Gleaton said that on Monday evening, August 22, 1960, he and his grandson went fishing on the south side of the San Juan River approximately 5 miles downstream from the Shiprock bridge; at this time there were no dead fish. Mr. Gleaton said that he and his grandson stopped fishing because of a rain storm; he estimated, and Schroder agreed, that it rained "less than 0.01 of an inch". On Wednesday, August 24, 1960, Mr. Gleaton said that he and his grandson returned to the same spot to fish and that they found "hundreds of dead fish - minners on up". Mr. Gleaton said that the fish ranged in size from fingerlings to "two or three pounders" and that they represented all the species found in the river, i.e., suckers, catfish, carp and perch. Gleaton said that he returned to the spot on Thursday, August 25, 1960, and took pictures of the fish. On Friday, August 26, 1960, Gleaton stated that he took the pictures to the office of The Farmington Daily Times. Gleaton said that he had seen a few dead fish near the Shiprock bridge on the downstream side and that a man who was driving a "cat" on the north bank of the river had told him that there were "thousands" of dead fish on that side.

19. Thompson, McElfresh, and Blaeske said that they had viewed the dead fish on Monday, August 28. Thompson stated that "the birds had done a good job" and that there were only skeletons left. Berghofer stated that, because of the time lapse between the discovery and the reporting of the dead fish, they (the Game and Fish Department) would probably have a great deal of difficulty in determining the cause of death and perhaps would never be able to give a positive

explanation. Berghofer said that when fish die from mud suffocation a selectiveness as to size and species is generally observed; he stated that the youngest fish are usually the first effected and that the trash fish (suckers, etc.) are usually the hardest to kill.

20. Mr. Blaeske stated that approximately from March to October of each year the town of Shiprock obtains their raw water from the Hogback irrigation canal. This canal leaves the San Juan River approximately eight miles upstream from the Shiprock bridge. Blaeske said that for the remainder of the year the town's raw water is obtained from two wells located on the north side of the river bottom; one well is east of the Shiprock bridge and the other well is west of the bridge directly across from the helium plant's collection gallery. Blaeske stated that the water for the Shiprock area is treated by activated charcoal filtration and chlorination. Blaeske said that, because of the high mud content in the canal water, they always use water from the wells to backwash their charcoal filters. Blaeske said that early in the morning of August 23, 1960, an employee of the water treatment plant was backwashing the charcoal filters with water from the west well; he ran a pH on the water and it was 6.4; he assumed that he had made a mistake so he did not recheck the pH or record the results of the analysis. Blaeske stated that the pH for this water is generally 7.4 to 7.8 although he said that they do observe variations in the pH of the well water. Mr. Blaeske said that the records kept at the water treatment plant offices indicated that the pH of the water taken from the wells was lower than the pH of the water taken from the canal. The inspector examined the records of the Shiprock water treatment plant; the pH for the raw water from the Hogback canal for August 22 and August 23, 1960, was recorded as 7.4. Mr. Blaeske said that, immediately upon learning of the uranium mill incident and the dead fish, he notified his immediate superior at the Window Rock Field Office; a copy of his letter of notification is attached as Exhibit G. Mr. Blaeske stated in this letter and to the investigator that "as an added precaution, and until such time as we know, BIA water plant has been instructed to remain on the ditch even should it mean water rationing." Blaeske said that he suspected, but was unable to prove, that the uranium mill frequently allowed raffinates to overflow into the river. Blaeske said that he was very concerned about the possible effects of water contamination, primarily chemical, on the local population; he stated that when the local schools were in operation the population of Shiprock was approximately 3500. Blaeske stated that it was his opinion that the uranium mill should be made to construct a secondary dike, similar to those used in the oil industry, to insure that a similar release of raffinate could not reach the river. Mr. Wise stated that in the future he was not going to pump raffinate into the #1 holding pond but was going to use this pond as a secondary retaining wall in case one of the other pond's walls gave away.

21. Blaeske and Dr. Ottobone, Field Medical Officer, USPHS, Shiprock, New Mexico, stated that there had not been a very heavy rain in the Shiprock area the evening of August 22, but they did state that there had been a very heavy rainfall on one of the San Juan River water sheds. They stated that this water shed entered the San Juan River about 20 miles above the Shiprock bridge and had definitely increased the mud content of the river. Blaeske stated that on September 1, 1960, a Mr. Sam Kapatan reported to him that there were dead fish

at Aneth, Utah. Mr. Kapatan reported to Blaeske that these fish were killed on Wednesday, August 24. Blaeske said that Aneth is approximately 30 river miles downstream from the Shiprock bridge. Blaeske said that Kapatan is the health educator in the area and that he considers him (Kapatan) a very reliable person.

22. In a memorandum (Exhibit H) dated September 7, 1960, to Dr. Walker from John R. Horan, Director, Health and Safety Division, ID, Mr. Horan stated that the velocity of the San Juan River at the bridge at Mexican Hat, Utah, for the period from August 22 to August 26, 1960, ranged between 1 ft/sec and 1.9 ft/sec. Mr. Horan further stated that "it was estimated that it would take between 83 and 143 hours for material to travel from Shiprock to Mexican Hat". Using the above river velocity and the river distance from Shiprock to Aneth estimated by Blaeske in Paragraph 21, the inspector estimated that it would take between 23.2 and 44 hours for material to travel from Shiprock to Aneth.

USAEC, IDAHO FALLS, IDAHO

PRIORITY

USAEC, WASHINGTON, D. C. AUGUST 30, 1960

INFO COPY TO L. W. SNYDER, ID LIAISON OFFICER, WASH.

FOR L. D. LOW, DIVISION OF COMPLIANCE, FROM DONALD I. WALKER, DIRECTOR, DIVISION OF LICENSEE INSPECTION. ON 8/30/60 AT 1325 THIS OFFICE WAS INFORMED OF A POSSIBLE TYPE "B" INCIDENT WHICH OCCURRED AT THE KERR-MCGEE OIL INDUSTRIES URANIUM MILL AT SHIPROCK, NEW MEXICO, BY DR. GRANT WINN, UTAH STATE DEPARTMENT OF HEALTH. ACCORDING TO WINN, HE HAD BEEN INFORMED OF THE INCIDENT BY THE NEW MEXICO DEPARTMENT OF HEALTH. WINN STATED THAT ON AUGUST 22, 1960, A HOLDING TANK IN THE VANADIUM CIRCUIT OF THE MILL BROKE, RELEASING ITS CONTENTS INTO THE SAN JUAN RIVER. DR. WINN HAD NO DETAILS AS TO THE QUANTITY OR CONCENTRATION OF MATERIAL RELEASED TO THE RIVER. HE WAS CONCERNED OVER THE RELEASE INASMUCH AS THE TEXAS-ZINC URANIUM MILL AT MEXICAN HAT, UTAH, LOCATED AN ESTIMATED 100 MILES DOWNSTREAM FROM SHIPROCK, NEW MEXICO, ON THE SAN JUAN RIVER, USES THE RIVER AS THE DOMESTIC WATER SUPPLY FOR MILL EMPLOYEES. DR. WINN STATED THAT THERE ARE NO TOWNS BETWEEN SHIPROCK, NEW MEXICO, AND MEXICAN HAT, UTAH, WHICH USE THE SAN JUAN RIVER AS THEIR SOURCE OF DOMESTIC WATER. HE STATED THAT HE DID NOT

(CONTINUED)

LI:DIWalker:lo
8/30/60
4:15 p.m.

EXHIBIT A/1

KNOW WHETHER THE RIVER WATER WAS USED FOR IRRIGATION PURPOSES BETWEEN THESE TWO LOCALITIES.

AT APPROXIMATELY 1330 ON 8/30/60, I CONTACTED FRANK HANAGARNE, SAFETY ENGINEER, KERR-MCGEE OIL INDUSTRIES, SHIPROCK, NEW MEXICO, BY TELEPHONE CONCERNING THIS INCIDENT. MR. HANAGARNE STATED THAT ON AUGUST 22, 1960, SOMETIME BETWEEN 0000 AND 0800 HOURS, A PORTION OF THE DAM ON THE TAILINGS POND CONTAINING RAFFINATE FROM THE SOLVENT EXTRACTION SECTION OF THE VANADIUM CIRCUIT BROKE, RELEASING FROM 150,000 TO 200,000 GALLONS OF LIQUOR TO THE SAN JUAN RIVER. ACCORDING TO MR. HANAGARNE, THE PH OF THE LIQUOR WAS 1.7 TO 1.8 AND CONTAINED APPROXIMATELY 0.1 GRAM PER LITER OF VANADIUM OXIDE AND A TRACE OF URANIUM OXIDE. MR. HANAGARNE STATED THAT HE HAD NO IDEA WHAT THE RA-226 CONCENTRATION WAS INASMUCH AS IT HAD NEVER BEEN DETERMINED. ACCORDING TO MR. HANAGARNE, THE NORMAL RIVER FLOW IS APPROXIMATELY 1060 CFS, BUT AT THE TIME OF THE INCIDENT WAS ONLY ABOUT 200 CFS. I ASKED MR. HANAGARNE IF MILL PERSONNEL HAD REPORTED THE INCIDENT TO THE AEC. MR. HANAGARNE REPLIED THAT THE INCIDENT HAD BEEN REPORTED ONLY TO THE NEW MEXICO STATE DEPARTMENT OF HEALTH. HE FURTHER STATED THAT THIS REPORT HAD BEEN MADE ABOUT THE 24TH OR 25TH OF AUGUST, 1960.

(CONTINUED)

AS FAR AS CAN BE ESTIMATED, THE MATERIAL RELEASED SHOULD HAVE ARRIVED AT MEXICAN HAT, UTAH, ON ABOUT AUGUST 27, 1960.

THIS OFFICE IS TAKING THE FOLLOWING ACTION RELATIVE TO THIS INCIDENT:

1. GEORGE SMITH, LICENSEE INSPECTION DIVISION, ID, WILL ARRIVE IN SHIPROCK, NEW MEXICO, TO CONDUCT AN INVESTIGATION ON AUGUST 31, 1960, AND WILL SAMPLE ANY RESIDUAL EFFLUENT WHICH REMAINS.
2. THE UTAH STATE HEALTH DEPARTMENT WILL COLLECT RIVER, POTABLE WATER, AND WATER TREATMENT PLANT SLUDGE SAMPLES AT MEXICAN HAT, UTAH.

THE ANALYSIS BRANCH, DIVISION OF HEALTH AND SAFETY, ID, WILL ANALYZE ALL SAMPLES FOR RA-226 AND TH-230 IN AN EFFORT TO DETERMINE WHETHER SIGNIFICANT QUANTITIES OF THESE MATERIALS HAVE FOUND THEIR WAY INTO THE DOMESTIC WATER SUPPLY AT MEXICAN HAT, UTAH. BASED ON KNOWN CONCENTRATIONS OF SIMILAR SOLUTIONS AT OTHER URANIUM MILLS, IT IS ESTIMATED THAT A MINIMUM OF 3000 MICROCURIES OF RA-226 WAS RELEASED.

FURTHER DEVELOPMENTS WILL BE FORWARDED TO YOU BY TWX OR PHONE.

END REF LI:DIW

LI
DIWalker:lo
8-30-60

EXHIBIT A/3

A. R. Luedecke, General Manager
THRU : W. F. Finan, Assistant General Manager
for Regulation and Safety
L. P. Low, Director
Division of Compliance

KERR-MC GEE OIL INDUSTRIES, INC., SHIPROCK, NEW MEXICO
LICENSE NO. S-137

SYMBOL: CO:NEW

We have been informed that a dam retaining the liquid effluents from subject company's uranium mill broke on August 22, 1960, and released from 150,000 to 200,000 gallons of the liquid to the San Juan River. As a result of this release, it would appear that quantities of radium-226 and thorium-230 were probably released in excess of AEC standards. On the basis of an initial estimate, the incident has been classified as a Type B as defined in 10 CFR 20 and AEC 0707.

The licensee did not advise AEC of this incident and it was not until August 30, 1960, that we were informed by the Utah State Health Department of its occurrence. A representative of the IE Inspection Division arrived at the mill on August 31, 1960, and is conducting a complete investigation. We also understand that the USPHS and the Utah and New Mexico State Health Departments may conduct investigations. Our investigation will be coordinated with these agencies. We shall inform you of any significant developments in this matter.

The Division of Licensing and Regulation, the Office of the General Counsel and the Office of Public Information have been informed of this incident. We have discussed this matter with the Office of Congressional Liaison who we understand have informed the Joint Committee staff by telephone.

A copy of the IE TWX dated August 30, 1960, is attached for your information.

Attachment:
Cpy IE TWX dtd 8/30/60

cc: S. Van Blarcom, RH, w/encl

cc: W. F. Finan, AGMRA4 w/encl
R. L. Price, L&R w/encl
W. Fenimore, FI, w/encl
T. Conner, GC, w/encl
R. Donovan, GH, w/encl
D. I. Walker, LD, w/o encl
H. Woodruff, R&R, w/encl

CO CO

WEKRIEGSMAN:gk LDLOW
8/31/60

EXHIBIT B

8605220494 1p.

USAEC, IDAHO FALLS, IDAHO

. PRIORITY

SEPTEMBER 1, 1960

USAEC, WASHINGTON D. C.

INFO COPIES TO: DR. FRANK PITTMAN, DIRECTOR, RIDO
L. D. LOW, DIRECTOR, DIVISION OF COMPLIANCE
L. E. SNYDER, IDO LIAISON OFFICER

FOR WILLIAM E. HUGHES, OFFICE OF PUBLIC INFORMATION, FROM MACK C. CORBETT, DIRECTOR, OFFICE OF INFORMATION, IDO. HEREWITH IS REVISED TEXT OF SAN JUAN RIVER CONTAMINATION ANNOUNCEMENT AS APPROVED BY YOUR OFFICE FOR RELEASE SEPTEMBER 1, TO A.M. MST:

IDAHO FALLS, IDAHO--THE ATOMIC ENERGY COMMISSION'S IDAHO OPERATIONS OFFICE LEARNED FROM STATE HEALTH OFFICIALS ON AUGUST 30 THAT RUPTURE OF A TAILINGS POND AT THE KERR-MCGEE OIL INDUSTRIES URANIUM MILL AT SHIPROCK, N. M. ON AUGUST 21 OR AUGUST 22 MAY HAVE RESULTED IN A SMALL QUANTITY OF VANADIUM RAFFINATE TAILINGS CONTAINING LOW-LEVEL RADIOACTIVITY REACHING THE SAN JUAN RIVER.

THE COMMISSION IMMEDIATELY STARTED AN INVESTIGATION INTO THE ACCIDENT UPON RECEIPT OF FIRST NOTIFICATION FROM STATE HEALTH OFFICIALS. KERR-MCGEE SAID IT NOTIFIED NEW MEXICO HEALTH OFFICIALS BUT NOT THE AEC.

A REPRESENTATIVE OF THE IDAHO OPERATIONS OFFICE DIVISION OF LICENSEE INSPECTION, WHICH INSPECTS URANIUM ORE PROCESSORS IN WESTERN STATES FOR COMPLIANCE WITH AEC HEALTH AND SAFETY REGULATIONS, FLEW TO THE SHIPROCK, N. M. MILL

(MORE)

OI:MCCorbett:jao
9:30 a. m.
9/1/60

EXHIBIT D/1

8605220246 2pp

WASHINGTON, D. C.

TUESDAY. HE HAS VERIFIED THAT CONTINUED OPERATION OF THE MILL WILL NOT INVOLVE ADDITIONAL RELEASES OF EFFLUENT INTO THE RIVER. FIVE OTHER TAILINGS PONDS HAVE SUFFICIENT CAPACITY TO CONTAIN THE PLANT'S LIQUID WASTES. THE BROKEN DAM ON THE SIXTH POND HAS ALREADY BEEN REPAIRED.

APPROXIMATELY 240,000 GALLONS ARE ESTIMATED BY MINE-OFFICIALS TO HAVE ESCAPED FROM THE RUPTURED POND AT A POINT ONE MILE DISTANT FROM THE SAN JUAN RIVER FLOW. ALTHOUGH MUCH OF THE LIQUID SEEPED INTO THE GROUND SOME OF IT MAY HAVE REACHED THE RIVER FLOW THROUGH THE OUTER EDGE OF THE RIVER'S DRY BED WHICH IS A HALF MILE FROM THE RIVER FLOW AT THIS TIME OF YEAR.

THE RESULTS OF THE AEC INVESTIGATION WILL BE AVAILABLE TO THE PUBLIC WHEN THE INVESTIGATION IS COMPLETED. END REP OLAMSC

Office Memorandum • UNITED STATES GOVERNMENT

TO : D. I. Walker, Director, Division of Licensee Inspection

DATE: Sept 7, 1960

FROM : John R. Horan, Director
Health and Safety Division

SUBJECT: CONFIRMATION OF SAN JUAN RIVER FLOW DATA

SYMBOL: HESS:GW

As the result of an inquiry on Tuesday, August 29, 1960 from the Division of Licensee Inspection, Site Survey Branch Personnel obtained the following information.

The velocity of the San Juan River at the bridge at Mexican Hat, Utah for the period August 22 through August 26, 1960, ranged between 1 ft/sec. and 1.9 ft/sec.

The distance (river course) from Shiprock, New Mexico to Mexican Hat, Utah was between 110 and 130 miles.

As the result of these flow velocities, it was estimated that it would take between 83 and 143 hours for material to travel from Shiprock to Mexican Hat.

The data was obtained from Mr. Chase and Mr. Harris, U. S. Geological Survey, Colorado River Hydrological Section, Salt Lake City, Utah. The reason for the request was not disclosed.

cc: C. Wayne Bills

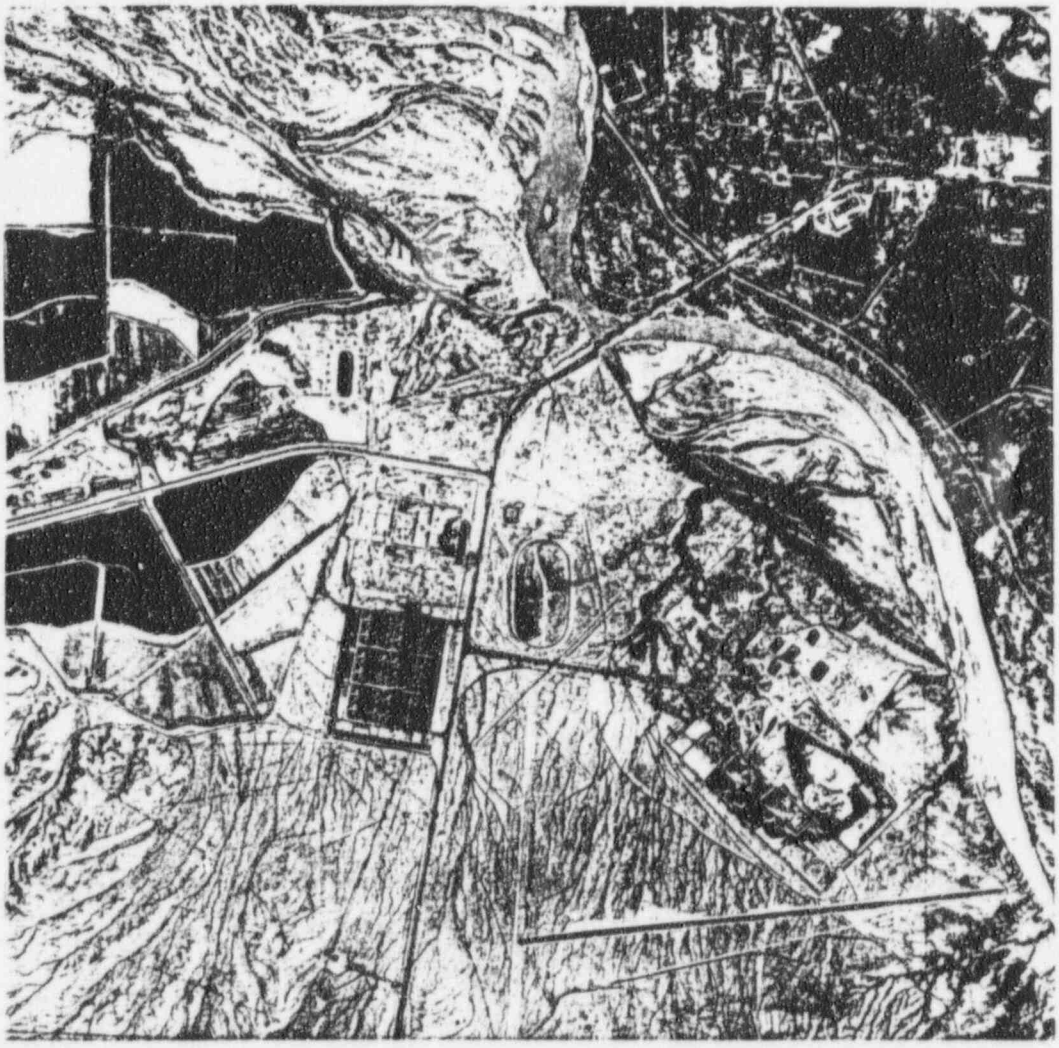
EXHIBIT B

8605220421 8pp.

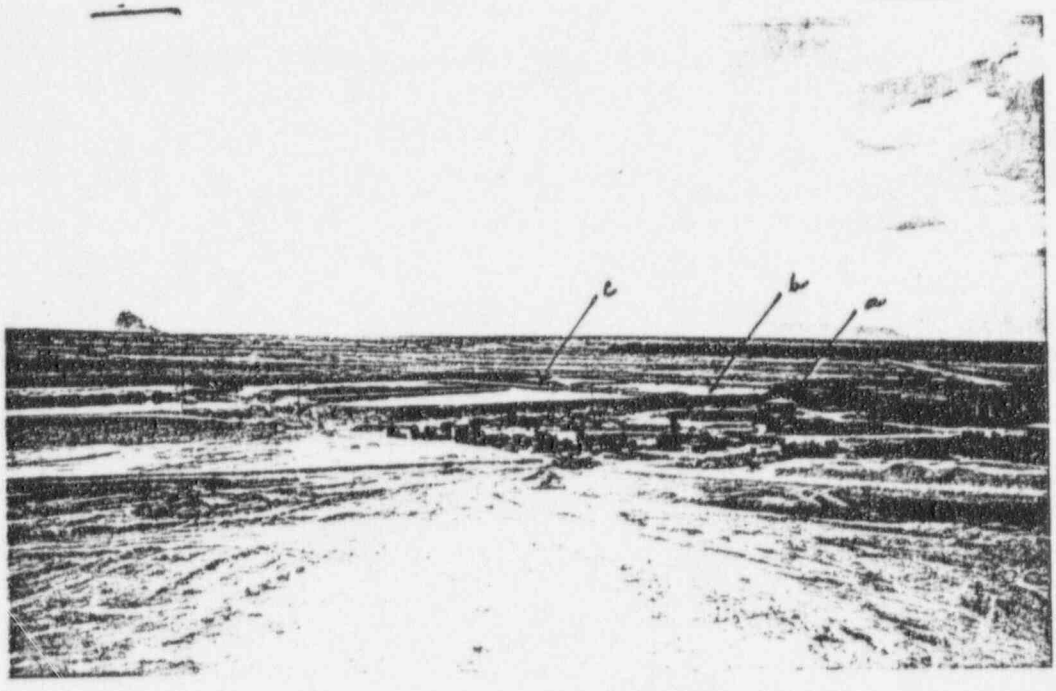
KERR-MCGEE OIL INDUSTRIES, INC.
SHIPROCK, NEW MEXICO

EXHIBIT I
PHOTOGRAPHS

August 31, September 1 and 2, 1960

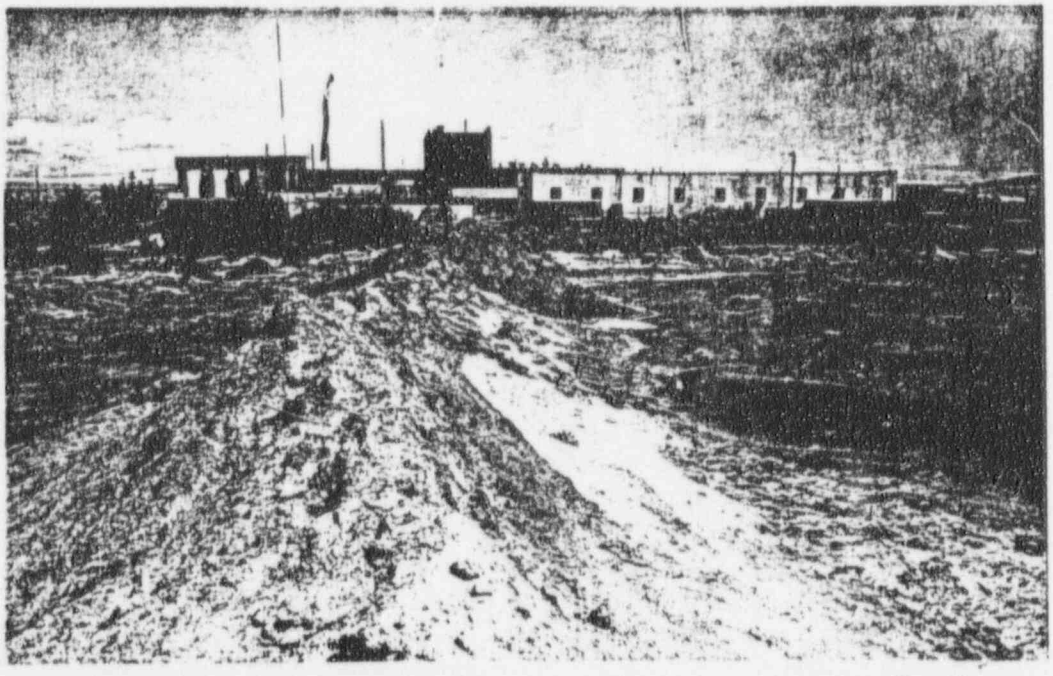


1. Aerial photograph of the mill and surrounding area. Taken in 1958. Compare with Exhibits E and F for identification.



2. Northern end of holding pond complex.
   (a) repaired area on retaining wall
   (b) pond that liquid escaped from (Pond #1)
   (c) pond that was filled simultaneously with pond that escaped (Pond #2)

3. Retaining wall of holding Pond #1 - note repaired area in upper corner of pond - note the water line marked by the arrow.

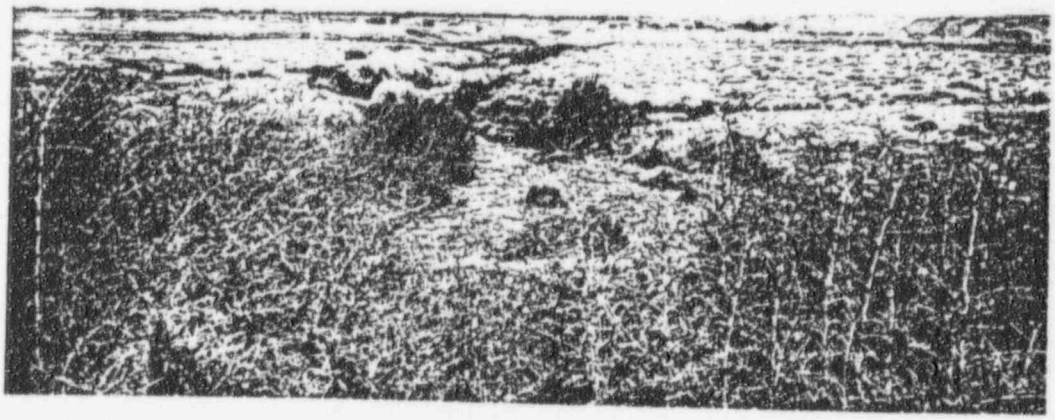


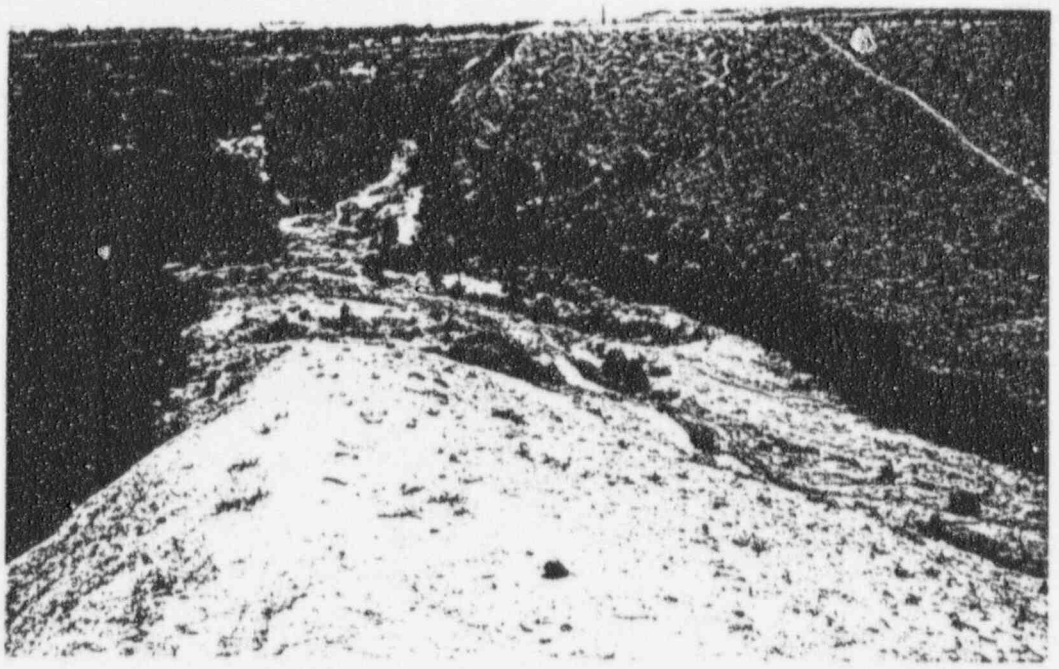
4. Photograph taken from road showing:
   (a) the eroded stream bed down which the raffinate probably flowed
   (b) the cooling water stream
   (c) the probable point of confluence of the cooling water and the raffinate
   (d) the repaired area of the holding pond retaining wall

5. The eroded area through which the raffinate probably flowed. Note the retaining wall and the size of the eroded area.

6. Culvert through which raffinate had to flow to reach river - note the height and dam like qualities of the road bed.

7. Photograph taken from the road showing the cooling water stream after it passes through the culvert.





8. Area where the cooling water stream enters the dry river bed.

9. Cooling water stream as it flows along the river bottom.

10. Area where the cooling water stream enters the San Juan River.
    (a) helium plant water collection gallery
    (b) cooling water stream

L. D. Low, Director, Division of Compliance, AEC Headquarters

October 10, 1960

Donald I. Walker, Director, Licensee Compliance Division, Idaho Operations Office

STATUS OF INSPECTION, URANIUM ORE PROCESSING MILLS

LC:RTK

In order that the quarterly submission of the subject report might more closely coincide with the submission date of the Quarterly Licensee Inspection Report, this report is being submitted approximately two months following the previous mill status report.

Insofar as this office is aware, no new development has transpired concerning the forthcoming operation of the uranium ore processing mill at Falls City, Texas.

According to our information, the status of the uranium mills under the inspectional jurisdiction of this division is as follows:

R-138, The Anaconda Company, Grants, New Mexico

6/30/60 Expiration date
No knowledge of application for renewal

5/3/60 Follow-up (1) inspection conducted
7/12/60 Report forwarded to CO
7/26/60 Report forwarded to L&R
Action not complete

R-134, Climax Uranium Company, Grand Junction, Colorado

7/31/59 Expiration date
6/24/59 & 6/8/60 Application for renewal made
Action on renewal of license still pending

6/30/60 Reinspection (1) conducted
9/23/60 Report forwarded to CO

(Continued)

A/97

R-214, Homestake- New Mexico Partners, Grants, New Mexico

2/28/59 Expiration date
2/17/59 Application for renewal made
Action on renewal of license still pending

1/27/59 Initial inspection conducted
3/12/59 Report forwarded to L&R
9/30/59 L&R requested additional information from licensee
10/15/59 Licensee replied to 9/30/59 letter
No additional correspondence known
Action not completed

R-215, Homestake-Gapin Partners, Grants, New Mexico

2/29/60 Expiration date
1/14/60 Application for renewal made
Action on renewal of license still pending

1/27/59 Initial inspection conducted
3/12/59 Report forwarded to L&R
6/11/59 L&R requested additional information from licensee
7/7/59 Licensee replied to 6/11/59 letter
No additional correspondence known
Action not completed

R-217, Kermac Nuclear Fuels Corporation, Grants, New Mexico

12/31/59 Expiration date
1/22/60 Application for renewal made
Action on renewal of license still pending

1/28/59 Initial inspection conducted
3/16/59 Report forwarded to L&R
6/4/59 L&R requested additional information
6/29/59 Licensee replied to 6/4/59 letter
No additional correspondence known
Action not completed

R-137, Kerr-McGee Oil Industries, Inc., Shiprock, New Mexico

2/29/60 Expiration date
1/25/60 Application for renewal made
Action on renewal of license still pending

(Continued)

R-157, Kerr-McGee Oil Industries, Inc., Shiprock, New Mexico (cont.)

6/13/60 Follow-up (1) inspection conducted
8/25/60 Report forwarded to CO
9/21/60 Report forwarded to L&R
Note: 8/31 - 9/2/60 Investigation conducted
10/6/60 Report mailed

R-131, Lakeview Mining Company, Lakeview, Oregon

4/30/60 Expiration date
1/14/60 Application for renewal made
Action on renewal of license still pending

5/28/59 Initial inspection conducted
7/23/59 Report forwarded to L&R
No known action taken by L&R
Action not completed

R-223, Lucky McUranium Corporation, Riverton, Wyoming

1/31/60 Expiration date
12/28/59 Application for renewal made
Action on renewal of license still pending

1/12/60 Follow-up (1) inspection conducted
3/25/60 Report forwarded to L&R
No known action taken by L&R
Action not completed

R-174, Mines Development, Inc., Edgemont, South Dakota

4/1/62 Expiration date

4/14/59 Follow-up (1) inspection conducted
7/2/59 Report forwarded to L&R
11/2/59 Order issued
5/17/60 Hearing
Hearing decision pending
Action not completed

R-216, Phillips Petroleum Company, Grants, New Mexico

12/31/59 Expiration date
10/15/59 Application for renewal made
6/24/60 L&R requested additional information concerning application

(Continued)

FARMINGTON

DAILY TIMES

Sunday Morning, August 28, 1960 — VOLUME 9 NUMBER 34 — Published Daily Except Saturday in Farmington, New Mexico — 24 PAGES — 3 SECTIONS . 15 Cents

Shiprock Probe Set . . .

Mystery Surrounds Death Of Fish Found in SJ River

Health authorities Saturday promised an investigation into the death of hundreds of fish discovered on sandbars and along the banks of the San Juan river about five miles west of Shiprock.

Dr. John Bourne, district health officer, said the probe would be started immediately. The health officer said he was not aware of the situation until informed by a reporter late Friday afternoon.

The fish evidently have been putrifying for several days. The stench surrounding the area is sickening.

What caused the deaths remained a puzzle.

One theory was offered that the fish could have suffocated from the high mud content which resulted when recent rains fell on the very low river. However, it also was learned that the dead fish condition does not exist east of Shiprock.

Cliff Wise, manager of the Kerr McGee uranium processing plant at Shiprock, said the dam in the plant's tailing pond broke several days ago. He said it was possible some of the acidic water from the pond could have filtered into the river but "so far as it is known" none of it did.

Wise said the pond is contained on the plant grounds.

The Kerr McGee plant, as well as other residents of Shiprock obtain their water from Shiprock's water system, which is treated.

Meanwhile it was reported that Navajo Helium Plant authorities had become concerned and many plant residents were buying cascade water.

The helium plant has its own water system, but even after treatment, some employes said, tests apparently had not been satisfactory.

For may persons living below Shiprock the raw river water is their only source.

FARMINGTON

DAILY TIMES

...day Evening, August 30, 1960 — Published Daily Except Saturday in Farmington, New Mexico — 8 PAGES — 10 Cents

'Finger Can't be Pointed' . . .

Contamination 'Possible' In Death of SJ River Fish

By VAL COOPER
Daily Times Staff

A U. S. Public Health Service official said today there is a "good chance" that hundreds of fish in the San Juan River died from water contamination as a result of a dam break in a tailings pond at the Kerr - McGee uranium processing plant at Shiprock.

However, Dr. R. D. Thompson, consulting chemist with the health service, emphasized that "a finger can't be pointed at anybody." He said detection work is underway, adding that it is a difficult job because the contaminated water—if it was contaminated — by this time is long gone and the fish here are nothing more than skeletons.

"All we can do is try to track it down and try to prevent it happening again," Dr. Thompson said.

The consultant and other health authorities spent some time in Shiprock Monday after their attention was called to hundreds of dead fish about five miles west of Shiprock.

Dr. Thompson said as nearly as could be determined the fish died about a week ago. He said a visit was made to the site but "the birds had done a good job" and there was nothing much more than bones left.

Others on the investigative trip included Dr. John Roberts, district health officer; Larry McElreath, district sanitarian, Rod Struve, health center chemist; and John Hamlin, USPHS sanitarian at the Shiprock Indian Hospital.

They conferred with both Navajo Helium Plant and Kerr - McGee uranium processing plant officials.

Kerr - McGee officials said a dam broke in the plant's tailing pond several days ago. Cliff Wise, manager of the plant, said it was possible, but that so far as is known no acidic water filtered into the river.

Dr. Thompson said the plant officials also had been aware for some time that there was some seepage from the plant's septic system and other areas. But, he added, radio - activity tests showed there is "nothing to worry about."

Dr. Thompson said some water from the helium plant was taken to the Health Center laboratory for analysis after helium personnel expressed concern about its purity.

The helium plant has its own water system. The point of intake from the river is about a quarter of a mile west of the Shiprock bridge, below the uranium processing plant. Dr. Thompson said if any acidic water had found its way into the river as a result of the dam break he was of the opinion it would have been thoroughly diluted by the time it reached the helium plant collection gallery. From the collection gallery the water is pumped to a treatment plant, thence through a softening process.

Dr. Thompson said he would have no hesitancy about drinking the helium plant water.

Other residents of Shiprock obtain their water from an irrigation canal which has its beginning at Hogback and goes through a treatment plant at Shiprock.

Dr. Thompson has been in Farmington this summer in connection with a physiological survey. He expects to return to his duties as professor of chemistry at Colorado State University at Fort Collins in about two weeks.

THE DENVER POST, September 2, 1966 and Sept. 16

INVESTIGATION MADE

San Juan Pollution Discounted by AEC

IDAHO FALLS, IDA., Sept. 1, — (AP) — An Atomic Energy Commission spokesman said Wednesday preliminary investigation of reported radioactive pollution of the San Juan River in New Mexico and southern Utah indicates very little, if any, waste material from the Kerr-McGee mill at Shiprock, N.M., reached the river.

He said the situation did not appear to be serious.

The Idaho operations office of the AEC here is in charge of handling quick investigations in the Western states, where many uranium processing mills are located.

The AEC spokesman gave this preliminary report:

A rupture occurred Aug. 31 or Sept. 1 at one of six tailings ponds near the Shiprock mill. It was reported to New Mexico health authorities, but the AEC was not informed until Aug. 31, when, an investigator from the Idaho office was sent to check.

MILE FROM RIVER

The ponds, where waste material from the plant was dumped, are about one mile from the San Juan River. There is no direct connection. But a dike on one pond broke, so the waste solution which contains uranium raffinate — and not uranium — spilled over.

The San Juan rises New Mexico and empties into the Colorado River in southern Utah. Downstream residents are grassed, ranchers. The acidic waste solution could hurt fish and generally contaminate the water.

It's possible some radioactivity, in the form of radium, could be in the waste solution, but if there is any radioactivity, it is at a very low level.

The investigator's preliminary study indicated that no waste solution at all reached the river.

EXHIBIT D/3

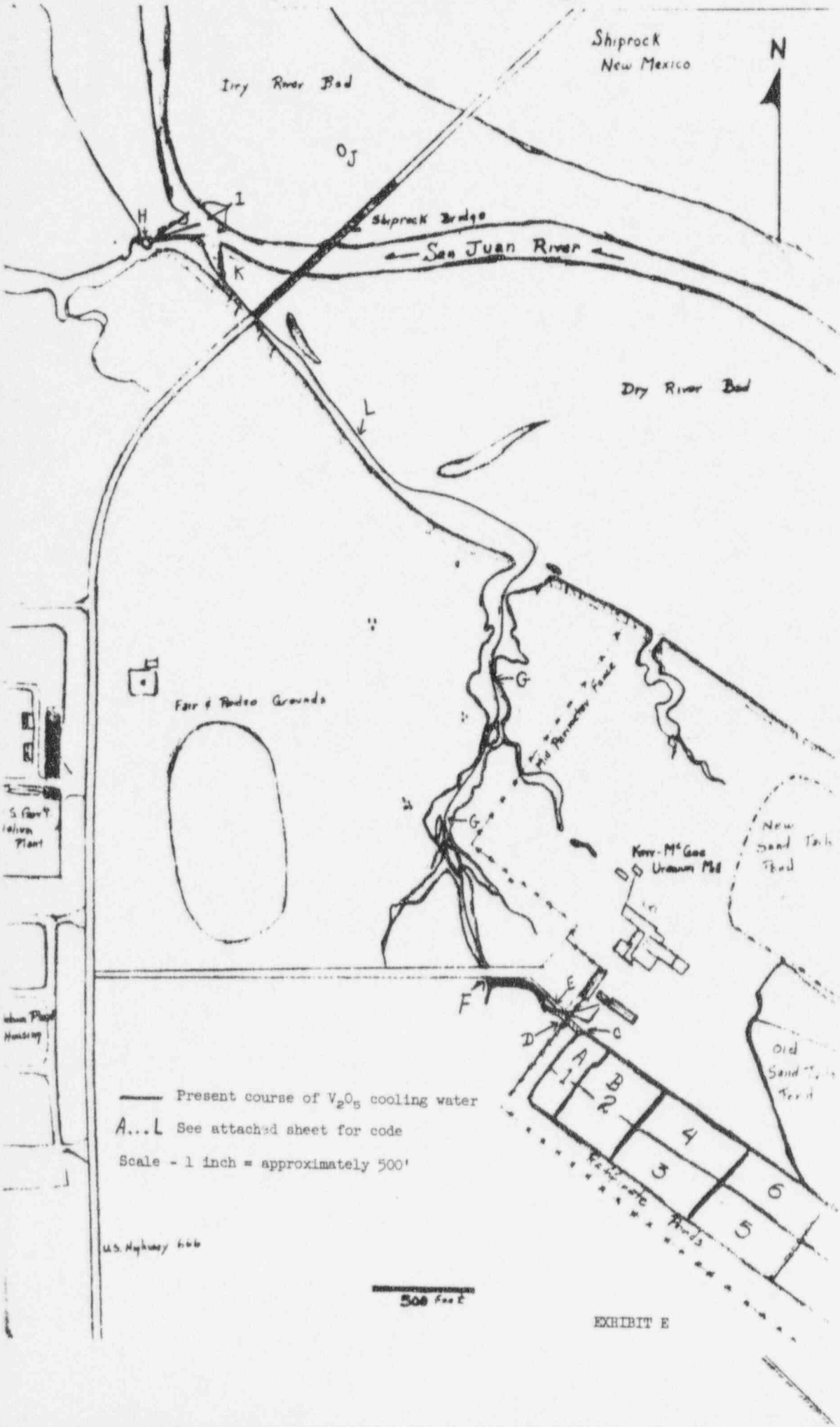

Shiprock
New Mexico
N
Iry River Bed
J
I
H
K
Shiprock Bridge
San Juan River
Dry River Bed
L
Fair & Rodeo Grounds
G
Old Perimeter Fence
New Sand Tailings Pond
Kerr-McGee Uranium Mill
F
E
D
C
A
B
1
2
3
4
5
6
Present course of V_2O_5 cooling water
A...L See attached sheet for code
Scale - 1 inch = approximately 500'
U.S. Highway 666
500 feet

EXHIBIT E

KERR-McGEE OIL INDUSTRIES, INC.
Shiprock, New Mexico

Code	Description
A	Holding pond - retaining wall broke releasing contents
B	Holding pond - filled simultaneously with Pond A
C	Approximate area on retaining wall that has been repaired
D	Eroded dry stream bed, down which the raffinate probably flowed
E	Confluence of cooling water stream and possible flood stream
F	Culvert through which the raffinate had to flow
G	Arroyo, down which the raffinate probably flowed
H	Helium plant water collection gallery
I	Approximate location of L. P. water collection pipes (approximately 3 feet under the sand)
J	Approximate location of one of the BIA wells
K	Confluence of cooling water stream and San Juan River
L	Approximate course of cooling water stream in the river bottom

EXHIBIT E/2

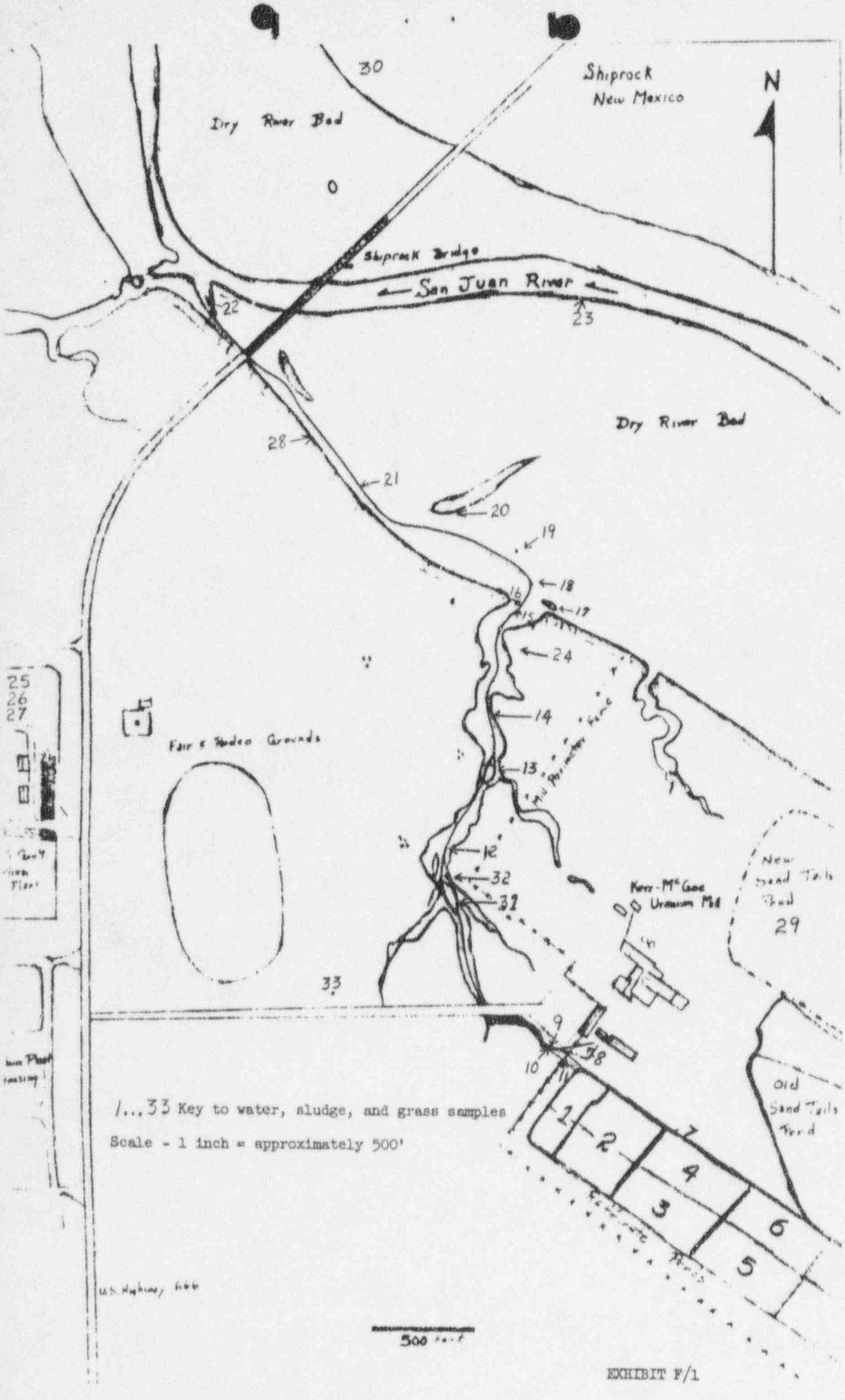

Shiprock
New Mexico
N
Dry River Bed
Shiprock Bridge
San Juan River
Dry River Bed
Fair & Rodeo Grounds
Kerr-McGee Uranium Mill
New Sand Tails Pond
Old Sand Tails Pond
U.S. Highway 666
500 feet
1...33 Key to water, sludge, and grass samples
Scale - 1 inch = approximately 500'

EXHIBIT F/1

KERR-McGEE INVESTIGATION SAMPLE RESULTS
Aug. 31, Sept. 1 and 2, 1960

EXHIBIT F/2

Location		Liquid Samples			Sludge Samples	
Code	Description	Natural Uranium $\mu c/ml \times 10^{8}$	Ra^{226} $\mu c/ml \times 10^{9}$	Th^{230} $\mu c/ml \times 10^{8}$	Ra^{226} * $\mu c/gm \times 10^{7}$	Th^{230} $\mu c/gm \times 10^{8}$
1	Holding pond #1 - pool in bottom	0.1	440 ± 4 (110)	384 ± 3.4 (78.8)		
1	Holding pond #1 - north - top 1/2 inch				365 ± 5	142 ± 8
1	Holding pond #1 - north - 2 inch depth				1598 ± 9.8	134 ± 8
1	Holding pond #1 - north - 6 inch depth				272 ± 4.4	104 ± 4
2	Holding pond #2 - north	0.27	572 ± 4 (143)	158 ± 2.1 (31.6)		
2	Holding pond #2 - south	0.26	900 ± 5 (225)	159 ± 2.2 (31.8)		
3	Holding pond #3 - top 1/2 inch				131 ± 3	118 ± 8
3	Holding pond #3 - 2 inch depth				15.8 ± 1.8	48 ± 4
3	Holding pond #3 - 4 inch depth				15.3 ± 1.5	114 ± 6
4	Holding pond #4 - east	0.09	890 ± 5 (222.25)	304 ± 3.1 (60.8)		
4	Holding pond #4 - west	0.09	920 ± 5 (230)	168 ± 2.2 (33.6)		
5	Holding pond #5 - top 1/2 inch				957 ± 7.5	82 ± 6
5	Holding pond #5 - 2 inch depth				516 ± 5.9	158 ± 10
5	Holding pond #5 - 6 inch depth				93.5 ± 3.2	122 ± 8
6	Holding pond #6 - 2 inch depth				2135 ± 10.3	1200 ± 26
6	Holding pond #6 - 2 inch depth				1254 ± 8.6	20 ± 2
6	Holding pond #6 - 6 inch depth				78.9 ± 3.8	60 ± 6
7	V_2O_5 raffinate being pumped to pond	0.08	910 ± 5 (227.5)	48 ± 1.2 (9.6)		

EXHIBIT F/3

Location		Liquid Samples			Sludge Samples	
Code	Description	Natural Uranium $\mu c/ml \times 10^{6}$	Ra^{226} $\mu c/ml \times 10^{9}$	Th^{230} $\mu c/ml \times 10^{8}$	Ra^{226} * $\mu c/gm \times 10^{7}$	Th^{230} $\mu c/gm \times 10^{8}$
8	V_2O_5 circuit cooling water - preflood channel	0.06	0.75 ± .3	3.2 ± 0.2		
9	Cooling water channel - 20' w. of fence - 40' w. of break				215 ± 4.3	23,600 ± 120
10	Flood channel - 20' w. of fence - 40' w. of break				2.6 ± 0.8	20 ± 6
11	Flood channel - 30' w. of break				56 ± 2.2	378 ± 14
12	Flood channel - 1/4 mile w. of break	0.36	< 0.8	6.7 ± 0.4	5.5 ± 1.4	252 ± 10
13	Flood channel - confluence of cooling H_2O and process H_2O	7.8 (1.1)	broken test tube	1,060 ± 6 (212)		
14	Flood channel - 3/4 way from break to river bottom	0.86	6.8 ± .5 (1.7)	25 ± 0.8 (5)	28 ± 1.7	66 ± 8
15	Flood channel at entrance to river bottom, upstream				268 ± 4.2	174 ± 8
16	Flood channel at entrance to river bottom, downstream				27 ± 1.5	48 ± 4
17	Stagnant pool - upstream side of flood channel	0.63	broken test tube	85 ± 1.6 (17)		
18	Flood channel - where it makes west turn - in river bottom	0.48	22.3 ± 0.7 (5.56)	14 ± 0.6 (2.8)	54.1 ± 2.7	23,140 ± 120
19	Small puddle adjacent to flood channel in river bottom				38 ± 1.6	72 ± 4
20	Large semi-stagnant pool in river bottom	1.09	33 ± 0.8 (8.25)	16 ± 0.7 (3.2)	24 ± 1.4	50 ± 4
21 **	Flood channel - midway between bridge and mouth	0.06	0.24 ± 0.2	4.9 ± 0.3		
22	Confluence of flood channel and San Juan - near H. P. gallery	0.22	6.6 ± 0.5 (1.65)	11.6 ± 0.5 (2.8)	< 1.3	2,180 ± 38
23	River, directly opposite flood channel - Control	0.009	0.2 ± 0.3	1 ± 0.1	< 0.99	168 ± 10
24	Bank of flood channel arroyo - Control				< 1.1	182 ± 8

EXHIBIT F/4

Code	Location Description	Liquid Samples Natural Uranium µc/ml x 10^{6}	Liquid Samples Ra^{226} µc/ml x 10^{9}	Liquid Samples Th^{230} µc/ml x 10^{8}	Sludge Samples Ra^{226} µc/gm x 10^{7} *	Sludge Samples Th^{230} µc/gm x 10^{8}
25	Helium plant raw water - before zeolite treatment	0.02	< 0.2	0.6 ± 0.1		
26	Helium plant potable water - after zeolite treatment	0.02	< 0.2	< 0.5		
26	Helium plant potable water - after zeolite treatment	0.02	< 0.2	< 0.5		
27	Helium plant zeolite - in service 47,900 gallons				0.4 ± 0.26	2 ± 2
27	Helium plant zeolite - regenerated				0.52 ± 0.25	0 ± 2
28	Seepage on south wall of river bank	0.03	< 0.4	0.6 ± 0.1		
29	Sand tails pond - grab sample	16.4 (2.3)	195 ± 5 (48.75)	12,800 ± 20 (2,560)		
30	BIA water treatment plant - activated charcoal after backwash				4.6 ± 0.8	36 ± 6
					Grass Samples	
31	Grass sample - 100 yds from break in flood channel				94 ± 1.1	10 ± 1
32	Grass sample - 120 yds from break in flood channel				63 ± 1.1	39 ± 3
33	Grass sample - Control				11.1 ± 0.4	13 ± 1

* Note: Concentration given in µc/gm x 10^{-7} not in µc/gm x 10^{-8} as reported to Mr. Low.

** Sample taken by Blaeske of the USPHS.

( ) Number in parentheses indicate number of times MPC for unrestricted area - MPC for Th^{230} is considered as the one for natural thorium.

(Copy of a copy)

Mr. Albert Plata, San Eng.
Window Rock Field Office

30 August 1960

J. F. Blaneka, Sanitarian
Shiprock, N. M.

Confirming Telephone Conversation re: Industrial Waste Discharge

This office requests that you visit this office as soon as possible to assist in an industrial waste contamination problem.

On Monday night, 29 August at midnight on of the Kerr Mac dikes on an acid liquor pond gave way and dumped between 150,000 to 200,000 gallons of liquor into the San Juan above both the Helium plant and Central Water supply intakes. It is estimated that the pH at discharge was 1.7 to 2.0 but due to the alkalinity of the soil and the distance traveled to the river the available H ion content was probably negligable. The SO_4 and total solids content raised appreciably but are now on the decline. The water processing system of the Helium plant eliminated most of this on the domestic side though the pH varied from 7.5 - 7.4.

The most fortunate part of the incident is that the Central Supply System was drawing water from the irrigation canals which originate a safe distance east of the confluence. Had this not been true the results could have been tragic since there is no further treatment than filtration and chlorination.

The fact that no one at Kerr Mac bothered to inform the water plant has been disturbed with the plant and I feel sure that this error will not occur again.

Large quantities of fish were killed at points below Shiprock. I strongly suspect the presence of, in addition to high SO_4, organo phosphors and possibly radium. I therefore request that you make immediate arrangements for emergency testing for these compounds and that monitoring equipment be provided also that we can use along the wash. I had asked Mr. Norfitt to attempt a similar arrangement in Dec. 1959 so possibly some ground work has been laid.

Finally I should like you to be considering an engineering proposal for retaining dikes around the settling ponds similiar to those used in the petroleum industry.

EXHIBIT G/1

I need not remind you that the situation has been made even more delicate by a Farmington News release bannered "The Mystery of The Dying Fish".

It is important that we gather all possible information at the earliest possible moment. I have reassured the local population as much as possible but am concerned about future releases. In order to combat any misinformation I must have facts which my limited facilities at this post cannot provide.

As an added precaution, and until such time as we know, BIA water plant has been instructed to remain on the ditch even should it mean water rationing. Irrigation is being contacted to sustain the flow

EXHIBIT G/2

ID 104
(R 1-55)

U. S. ATOMIC ENERGY COMMISSION
IDAHO OPERATIONS OFFICE
HEALTH AND SAFETY BRANCH

ROUTINE__ SPECIAL __ **IDO H & S SAMPLE RECORD SHEET**

Serial No. [illegible]

Sample from: Kerr McGee - Shiprock, N.M.
Collected by: [illegible]
Date submitted: 10/12/60

Samples Received:
Analysis Completed:
Analyzed by: HWC

Method: End Window__ ; Prop. counter__ ; Spectrophotometric__ ; Fluorometric__ ; Polarographic__ .

Sample No.	Date	Hour	Sample Description	Anal. for	Quant. used, ml.	U^{+6} or K^+ Trans.	Count time, min.	Total Count.	Gross Count, c/m.	Bkgd., c/m.	Net count, c/m.	K^{40} corr. / pH	Foreign activity Th^{230} μc/ml $\times 10^{-8}$	Foreign activity Ra^{226} μc/ml $\times 10^{-9}$
[redacted]			liquid #1	pH						1		6.9		
				U nat										
				Ra^{226}	250	10-17	30	713		14	699			
						10-24	30	1934		15	1919			31.6 ± 1.1
				Th^{230}	100		30	177	59±0.5	28	50±0.3		50 ± 0.3	
			liquid #2	pH								3.2		
[redacted]				U nat										
				Ra^{226}	250	10-17	30	997		14	984			
						10-24	30	1463		15	1448			18.7 ± 0.9
				Th^{230}	100		30	116	39± 0.3	28	30±0.1		30 ± 0.1	

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ID COMPLIANCE

A/98

Notified: ____ Time: ____ Resampling recommended: Yes____ No____

Approved: CWSlay by E. Edwards
Chief, Analysis Section

ID-104
(R-1-55)

U. S. ATOMIC ENERGY COMMISSION
IDAHO OPERATIONS OFFICE
HEALTH AND SAFETY BRANCH

Serial No. 18833

ROUTINE ___ SPECIAL ___

IDO H & S SAMPLE RECORD SHEET

Sample from: Kerr-McGee [illegible]
Collected by: J.H.S. : Card
Date submitted: 10/12/60

Samples Received: ___
Analysis Completed: ___

Analyzed by: HWC

Method: End Window ___ ; Prop. counter ___ ; Spectrophotometric ___ ; Fluorometric ___ ; Polarographic ___ .

Sample No.	Date	Hour	Sample Description	Anal. for	Quant. used, ml.	U^{+6} or K^{+} Trans.	Count time, min.	Total Count.	Gross Count, c/m.	Bkgd., c/m.	Net count, c/m.	K^{40} conc. c/m. (pH)	Foreign activity Th^{230} c/m. (μc/ml $\times 10^{8}$)	Foreign activity Ra^{226} d/m (μc/ml $\times 10^{9}$)
[redacted]			Liquid #3	pH								3.9		
				U^{nat}										
				Ra^{226}	750	1125 10-17	30	904		14	890			
						10-24 1100	30	1491		15	1476			19.2 ± 1.0
				Th^{230}	100		30	133	4.4 ± 0.3	.8	3.5 ± 0.1		3.5 ± 0.1	
			Liquid #4	pH								7.2		
[redacted]				U^{nat}										
				Ra^{226}	750	1215 10-10	30	27		14	13			
						10-24 1230	30	20		15	5			<.16
				Th^{230}	100		30	54	1.8 ± 0.2	.8	0.8 ± 0.1		0.8 ± 0.1	

Notified: ___ Time: ___ Resampling recommended: Yes ___ No ___

Approved: CWS by E. Eberle
Chief, Analysis Section

ID-104
(R-1-55)

U. S. ATOMIC ENERGY COMMISSION
IDAHO OPERATIONS OFFICE
HEALTH AND SAFETY BRANCH

Serial No. 18[illegible]

ROUTINE ___ SPECIAL ___

IDO H & S SAMPLE RECORD SHEET

Sample from: Kerr McGee - Shiprock, N.M.

Collected by: JHS, CG?

Date submitted: 10/12/60

Samples Received: ______

Analysis Completed: ______

Analyzed by: HWC

Method: End Window ___; Prop. counter ___; Spectrophotometric ___; Fluorometric ___; Polarographic ___.

Sample [redacted]	Date	Hour	Sample Description	Anal. for	Quant. used, ml.	U^{+6} or K^{+} Trans.	Count time, min.	Total Count.	Gross Count, c/m.	Bkgd., c/m.	Net count, c/m.	pH (corr. c/m.)	Foreign activity: Th^{230} μc/ml ×10^{-8}	Foreign activity: Ra^{226} μc/ml ×10^{-9}
			Liquid #5	pH								7.4		
				U nat										
				Ra^{226}	750	10-17 1245	30	32		14	18			
						10-24 1245	30	30		15	15			<0.22
				Th^{230}	/100		30	57	1.9±0.3	28	0.4±0.1		0.4±0.1	
[redacted]			Liquid #6	pH								7.7		
				U nat										
				Ra^{226}	750	[illegible] 1245	30	19		14	5			
						10-24 1245	30	19		15	4			<0.12
				Th^{230}	/100		30	24	0.8±0.2	28	0.0±0.0		<0.5	

Notified: ______ Time: ______ Resampling recommended: Yes ___ No ___

Approved: CWS by [signature]
Chief, Analysis Section

ID-104
(R-3-55)

U. S. ATOMIC ENERGY COMMISSION
IDAHO OPERATIONS OFFICE
HEALTH AND SAFETY BRANCH

Serial No. 18235

ROUTINE ___ SPECIAL ___

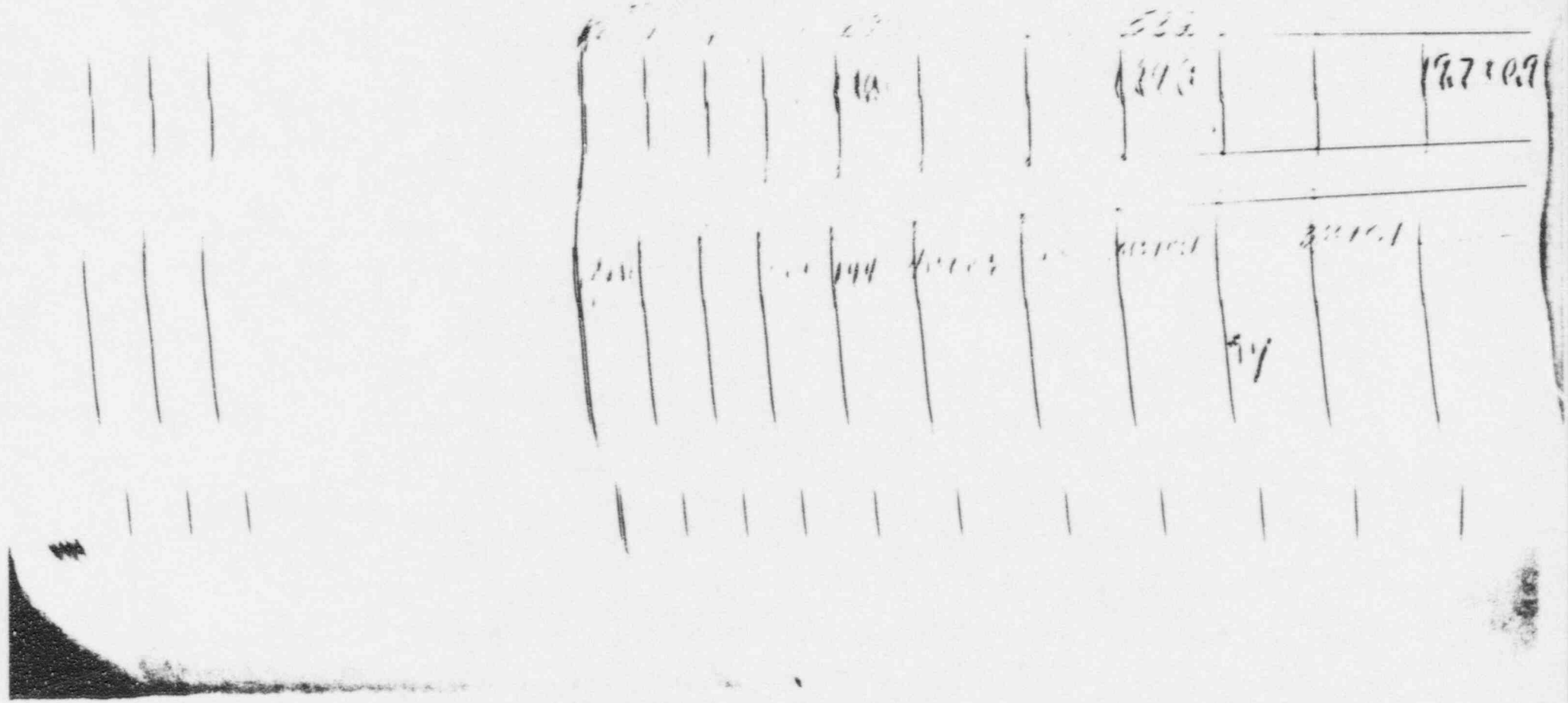
IDO H & S SAMPLE RECORD SHEET

Sample from: Kerr McGee Shyrock, Wy.
Collected by: CAZ + JHS
Date submitted: 6/12/56

Samples Received:
Analysis Completed:
Method: End Window ___ ; Prop. counter ___ ; Spectrophotometric ___ ; Fluorometric ___ ; Polarographic ___ .

Analyzed by: DWC

Sample No.	Date	Hour	Sample Description	Anal. for	Quant. used, ml.	U +6 or K+ Trans.	Count time, min.	Total Count.	Gross Count, c/m.	Bkgd., c/m.	Net count, c/m.	K40 c/m.	Foreign activity	
			Figure # 6	U								3.8	230 c/m	Ra 226 d/m x 10^9
				U mat										



ID 104
(R 1-55)

U. S. ATOMIC ENERGY COMMISSION
IDAHO OPERATIONS OFFICE
HEALTH AND SAFETY BRANCH

ROUTINE___ SPECIAL ___

IDO H & S SAMPLE RECORD SHEET

Serial No. [illegible]

Sample from: Kerr - McGee, Shiprock, N.M.

Collected by: [illegible] : GHS

Date submitted: 10/12/60

Samples Received:

Analysis Completed:

Analyzed by: HWC

Method: End Window___ ; Prop. counter___ ; Spectrophotometric___ ; Fluorometric___ ; Polarographic___ .

Sample No.	Date	Hour	Sample Description	Anal. for	Quant. used, ml.	U^{+6} or K^{+} Trans.	Count time, min.	Total Count.	Gross Count, c/m.	Bkgd., c/m.	Net count, c/m.	K^{40} pH	Foreign activity Th^{230} μμc/ml $\times 10^{-8}$	Foreign activity Ra^{226} μc/ml $\times 10^{9}$
[redacted]			Liquid #10	pH								6.5		
				U nat										
				Ra^{226}	250	[illegible]	30	46		14	32			
						[illegible]	30	50		15	35			0.3±0.2
				Th^{230}/100			30	37	[illegible]	28	[illegible]		[illegible]	
[redacted]			Liquid #11	pH								6.7		
				U nat										
				Ra^{226}	250	[illegible]	30	454		14	440			
						[illegible]	30	[illegible]		15	714			9.2±0.7
				Th^{230}/100			30	220	[illegible]	28	[illegible]		[illegible]	

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ID COMPLIANCE

Notified: ______ Time: ______ Resampling recommended: Yes ____ No ____

Approved: [signature]
Chief, Analysis Section

ID 184
(R 1-55)

U. S. ATOMIC ENERGY COMMISSION
IDAHO OPERATIONS OFFICE
HEALTH AND SAFETY BRANCH

Serial No. 16037

ROUTINE ___ SPECIAL ___

IDO H & S SAMPLE RECORD SHEET

Sample from: Kerr McGee, Shiprock, N. Mex.
Collected by: CAT & GHS
Date submitted: 4/12/60

Samples Received: ___
Analysis Completed: ___
Method: End Window ___ ; Prop. counter ___ ; Spectrophotometric ___ ; Fluorometric ___ ; Polarographic ___ .

Analyzed by: AWC

Sample No.	Date	Hour	Sample Description	Anal. for	Quant. used, ml.	U +6 or K+ Trans.	Count time, min.	Total Count.	Gross Count, c/m.	Bkgd., c/m.	Net count, c/m.	K40 c/m.	Foreign activity Ra226 c/m.	Ra d/m
			Figure # 12	pH								7.5		
				U mg										x109
				Ra^{226}	750	10-17 1050	30	94		14	80			2.0 ± 0.3
							30	160		15	145			2.0 ± 0.3
				Th^{230}			30	25	[illegible]	16	0.01		< 0.5	
			Figure # 13	pH								6.8		
				U mg										
				Ra^{226}	750	10-17 1050	30	74		20	54			
							30	104		22	96			1.3 ± 0.3
				Th^{230}				91	24 ± 3	16	15 ± 1		1.5 ± 0.1	

RECEIVED
NOV 1 1960
ID COMPLIANCE

Notified: ___ Time: ___ Resampling recommended: Yes ___ No ___

Approved: CWS by EHK
Chief, Analysis Section

ID-104
(R.1-55)

U. S. ATOMIC ENERGY COMMISSION
IDAHO OPERATIONS OFFICE
HEALTH AND SAFETY BRANCH
IDO H & S SAMPLE RECORD SHEET

Serial No. 1[illegible]

ROUTINE ___ SPECIAL ___

Sample from: Kerr-McGee, Ambrosia Lake, N.M.
Collected by: CRH & GHP
Date submitted: 10/12/60

Samples Received: ______
Analysis Completed: ______
Analyzed by: [illegible]

Method: End Window ___ ; Prop. counter ___ ; Spectrophotometric ___ ; Fluorometric ___ ; Polarographic ___ .

Sample No.	Date	Hour	Sample Description	Anal. for	Quant. used, ml.	U+6 or K+ Trans.	Count time, min.	Total Count.	Gross Count, c/m.	Bkgd., c/m.	Net count, c/m.	K40 c/m. (pH)	Foreign activity Th230 c/m	Ra226 d/m
[redacted]			Liquid # 14	pH								7.3	[illegible]	[illegible] ×10⁹
				U nat									[illegible]	
				Ra226	750	10-19 1050	30	92		5	87			
						[illegible]	30	449		5	444			84±0.5
				Th230	[illegible]		30	175	[illegible]	21	[illegible]		491[illegible]	
[redacted]			Liquid # 15	pH								7.6		
				U nat										
				Ra226	750	10-11 1125	30	49		20	29			
						[illegible]		54		[illegible]	26			<0.32
				Th230	[illegible]		30	55	[illegible]	26	[illegible]		[illegible]	

RECEIVED
NOV 1 1960
ID COMPLIANCE

Notified: ______ Time: ______ Resampling recommended: Yes ___ No ___

Approved: [illegible signature]
Chief, Analysis Section

ID-104
(R-1 55)

U. S. ATOMIC ENERGY COMMISSION
IDAHO OPERATIONS OFFICE
HEALTH AND SAFETY BRANCH
IDO H & S SAMPLE RECORD SHEET

Serial No. 10229

ROUTINE ___ SPECIAL ___

Sample from: Kerr-McGee

Collected by: CAH & JHS

Date submitted: 10/12/60

Samples Received: ___

Analysis Completed: ___

Analyzed by: HWC

Method: End Window ___ ; Prop. counter ___ ; Spectrophotometric ___ ; Fluorometric ___ ; Polarographic ___ .

Sample No.	Date	Hour	Sample Description	Anal. for	Quant. used, ml.	U +6 or K+ Trans.	Count time, min.	Total Count.	Gross Count, c/m.	Bkgd., c/m.	Net count, c/m.	K40 corr. c/m.	Th Foreign activity µc/ml	Ra 226 d/m. pc/l.
			Liquid #16	pH								7.3		
				U nat										
				Ra^{226}	750	70-77 1125	30	56		5	51			
								224		5	219			4 ± 0.4
				Th^{230}				129	134±0.2	26	108±1			
			Liquid #17	pH								7.2		
				U nat										
				Ra^{226}	750	70-77 1230	30	267		20	247			
								317		17	320			3.4 ± 0.5
				Th^{230}			30	257	3.6±0.5	26	227±3		111±3	

RECEIVED
NOV 1 1960
ID COMPLIANCE

Notified: ___ Time: ___ Resampling recommended: Yes ___ No ___

Approved: CWS by [illegible]
Chief, Analysis Section

ID-104
(R-1-55)

U. S. ATOMIC ENERGY COMMISSION
IDAHO OPERATIONS OFFICE
HEALTH AND SAFETY BRANCH

Serial No. 1881-1

ROUTINE ___ SPECIAL ___

IDO H & S SAMPLE RECORD SHEET

Sample from: Kerr McGee, Reynolds, Ft

Collected by: CCH - GHF

Date submitted: 10/12/60

Samples Received: ___

Analysis Completed: ___

Analyzed by: dwc

Method: End Window ___ ; Prop. counter ___ ; Spectrophotometric ___ ; Fluorometric ___ ; Polarographic ___ .

Sample No.	Date	Hour	Sample Description	Anal. for	Quant. used, ml.	U +6 or K+ Trans.	Count time, min.	Total Count.	Gross Count, c/m.	Bkgd., c/m.	Net count, c/m.	K^{40} corr. c/m.	Foreign activity Th^{230} c/m.	Foreign activity Ra^{226} d/m
			Legend # 16	H								7.4		
				$\frac{1}{2}$ mat										
			5	Ra^{226}	750	20-4 1220	30	65		5	60			
						20-4		254		5	249			4.5 ± 0.4
				Th^{230}				164	56 ± 3	26	47 ± 3		47 ± 3	
			Legend # 19	H								7.8		
				$\frac{1}{2}$ mat										
			"	Ra^{226}	750	20-4 1220	30	42		20	22			
								42		22	20			< 0.26
				Th^{230}			20	34	11 ± 2	26	8 ± 3		605	

RECEIVED
NOV 1 1960
ID COMPLIANCE

Notified: ___ Time: ___ Resampling recommended: Yes ___ No ___

Approved: C. W. Lyon
Chief, Analysis Section

ID-104
(R-1-55)

U. S. ATOMIC ENERGY COMMISSION
IDAHO OPERATIONS OFFICE
HEALTH AND SAFETY BRANCH
IDO H & S SAMPLE RECORD SHEET

ROUTINE ___ SPECIAL ___

Serial No. 18861

Sample from: Kerr McGee, Shiprock, N.M.

Collected by: JHS · CGH

Date submitted: 10/12/66

Samples Received: ______

Analysis Completed: ______

Analyzed by: HWC

Method: End Window ___ ; Prop. counter ___ ; Spectrophotometric ___ ; Fluorometric ___ ; Polarographic ___ .

Sample No.	Date	Hour	Sample Description	Anal. for	Quant. used, ml.	U^{+6} or K^{+} Trans.	Count time, min.	Total Count.	Gross Count, c/m.	Bkgd., c/m.	Net count, c/m.	K^{40} c/m. (pH)	Foreign activity Th^{230} d/m.	Foreign activity Ra^{226} d/m.
[redacted]			Liquid #20	pH								7.6	µc/ml x10⁻⁸	µc/ml x10⁻⁹
				U_{nat}										
			5	Ra^{226}	750	10-19 1300	30	13		5	8			
						[illegible]	[illegible]	56		5	51			1.0 ± 0.1
				Th^{230}	[illegible]		30	34	1.1 ± 0.2	26	[illegible]		<0.5	
[redacted]			Liquid #21	pH								7.4		
				U_{nat}										
			4	Ra^{226}	750	10-19 1300	30	290		20	270			
						10-20 1043	30	530		28	502			7.0 ± 0.[illegible]
				Th^{230}	[illegible]		30	203	6.8 ± 0.[illegible]	26	5.9 ± 0.3		5.9 ± 0.3	

RECEIVED
NOV 1 196[illegible]
ID COMPLIANCE

Notified: ______ Time: ______ Resampling recommended: Yes ___ No ___

Approved: CWS by E.R. Edwards
Chief, Analysis Section

ID-104 (R-1-55)

U. S. ATOMIC ENERGY COMMISSION
IDAHO OPERATIONS OFFICE
HEALTH AND SAFETY BRANCH

Serial No. 18842

ROUTINE ___ SPECIAL ___

IDO H & S SAMPLE RECORD SHEET

Sample from: Kerr-McGee, Shiprock, N.M.

Collected by: CWH & JHS

Date submitted: 10/12/60

Samples Received: ______

Analysis Completed: ______

Analyzed by: AWC

Method: End Window ___ ; Prop. counter ___ ; Spectrophotometric ___ ; Fluorometric ___ ; Polarographic ___ .

Sample [redacted]	Date	Hour	Sample Description	Anal. for	Quant. used, ml.	U^{+6} or K^{+} Trans.	Count time, min.	Total Count.	Gross Count, c/m.	Bkgd., c/m.	Net count, c/m.	K^{40} corr. c/m. pH	Foreign activity c/m. Th^{230} µc/ml x10^8	Foreign activity c/m. Ra^{226} µc/ml x10^9
			Liquid # 22	pH								7.5		
				U nat										
			5	Ra^{226}	750	10-19 1330	30	49		5	44			
						10-26 1042	30	143		5	138			2.3 ± 0.[illegible]
				Th^{230}	100		30	41	1.4 ± 0.2	26	0.5 ± 0.[illegible]		0.5 ± 0.[illegible]	
[redacted]			Liquid # 23	pH								7.7		
				U nat										
			11	Ra^{226}	750	10-19 1410	30	406		20	386			
						10-26 1112	30	975		28	947			15 ± 0.8
				Th^{230}	100		30	33	1.1 ± 0.2	26	0.2 ± 0.0		<0.5	

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NOV 1 1960
ID COMPLIANCE

Notified: ______ Time: ______ Resampling recommended: Yes ___ No ___

Approved: CWS by E. Blomeke
Chief, Analysis Section

ID-[illegible]
(R-1-55)

U. S. ATOMIC ENERGY COMMISSION
IDAHO OPERATIONS OFFICE
HEALTH AND SAFETY BRANCH
IDO H & S SAMPLE RECORD SHEET

Serial No. 18343

ROUTINE ___ SPECIAL ___

Sample from: Kerr-McGee, Shiprock, N.M.
Collected by: C.A.H. & J.H.S.
Date submitted: 4/12/60

Samples Received: ___
Analysis Completed: ___
Method: End Window ___ ; Prop. counter ___ ; Spectrophotometric ___ ; Fluorometric ___ ; Polarographic ___ .

Analyzed by: HWC

Sample No.	Date	Hour	Sample Description	Anal. for	Quant. used, ml.	U +6 or K+ Trans.	Count time, min.	Total Count.	Gross Count, c/m.	Bkgd., c/m.	Net count, c/m.	K40 conc. pCi/m.	Foreign activity Th230 c/m.	Foreign activity Ra226 c/m.
			Sample #25	pH								7.9		
				U nat										
				R_a^{226}	750	10-19 1410	30	20		5	15			
						10-26 1410	30	87		5	82			1.6±0.3
				Th^{230}	100		30	27	0.4±0.2	26	0±0.0		<0.5	
			Sample #28	pH								8.0		
				U nat										
				R_a^{226}	750	10-19 1440	30	48		20	28			
						10-26 1455	30	47		28	19			<0.27
				Th^{230}	100		30	35	1.2±0.2	26	0±0.0		<0.5	

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NOV 1 1960
ID COMPLIANCE

Notified: ___ Time: ___ Resampling recommended: Yes ___ No ___

Approved: C.A.S. by E.K.B.
Chief, Analysis Section

ID-104
(R-1-55)

U. S. ATOMIC ENERGY COMMISSION
IDAHO OPERATIONS OFFICE
HEALTH AND SAFETY BRANCH

Serial No. 18844

ROUTINE ___ SPECIAL ___

IDO H & S SAMPLE RECORD SHEET

Sample from: Kerr-McGee, Shiprock, N. M.
Collected by: JAS & CGH
Date submitted: 10/12/60

Samples Received: ___
Analysis Completed: ___

Analyzed by: HWC

Method: End Window ___ ; Prop. counter ___ ; Spectrophotometric ___ ; Fluorometric ___ ; Polarographic ___ .

Sample No.	Date	Hour	Sample Description	Anal. for	Quant. used, ml.	U^{+6} or K^{+} Trans.	Count time, min.	Total Count.	Gross Count, c/m.	Bkgd., c/m.	Net count, c/m.	K^{40} c/m. (pH)	Foreign activity Th^{230} c/m.	Foreign activity Ra^{226} d/m.
[redacted]			Liquid # 30	pH								11.2	Th recovered x10⁸	recovered x10⁹
				Ra^{226}	750	10-19 1440	30	105		5	100			
						10-26 1155	30	439		5	434			8 ± 0.5
				Th^{230}	100		30	31	1.0 ± 0.2	.26	0.7 ± 0.0		< 0.5	
[redacted]			Liquid # 31	pH								8.3		
				Ra^{226}	750	10-19 1545	30	64		20	44			
						10-26 1228	30	76		28	48			0.43 ± 0.2
				Th^{230}	100		30	41	1.4 ± 0.2	.26	0.5 ± 0.0		0.5 ± 0.0	

REC[illegible]
NOV 1 1960
ID COMPLIANCE

Notified: ___ Time: ___ Resampling recommended: Yes ___ No ___

Approved: CWS by [illegible]
Chief, Analysis Section

ID-104
(R-1-55)

U. S. ATOMIC ENERGY COMMISSION
IDAHO OPERATIONS OFFICE
HEALTH AND SAFETY BRANCH

ROUTINE ___ SPECIAL ___

IDO H & S SAMPLE RECORD SHEET

Serial No. 18845

Sample from: [illegible]

Collected by: [illegible]

Date submitted: [illegible]

Samples Received: ______

Analysis Completed: ______

Analyzed by: ______

Method: End Window ___; Prop. counter ___; Spectrophotometric ___; Fluorometric ___; Polarographic ___.

Sample No.	Date	Hour	Sample Description	Anal. for	Quant. used, ml.	U^{+6} or K^{+} Trans.	Count time, min.	Total Count.	Gross Count, c/m.	Bkgd., c/m.	Net count, c/m.	K^{40} count c/m. (pH)	Foreign activity Th^{230} c/m. (µc/ml $\times 10^{8}$)	Ra^{226} (µc/ml $\times 10^{9}$)
[redacted]			[illegible] #58	pH								8.4		
				U										
			5	Ra^{226}	750	10-14 1515	30	9		5	4			
						10-26 1328	30	10		5	5			<0.13
				Th^{230}	100		30	41	1.4±0.2	26	0.5±0.0		0.5±0.0	
[redacted]			[illegible] #33	pH								7.6		
				U										
			5	Ra^{226}		10-19 1555	30	8		5	3			
						10-26 1301	30	13		5	8			0.13±0.07
				Th^{230}	100		30	37	1.2±0.2	26	0.3±0.0		<0.5	

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Notified: ______ Time: ______ Resampling recommended: Yes ___ No ___ Approved: [illegible]

ID-130
(8 - 59)

U. S. ATOMIC ENERGY COMMISSION
IDAHO OPERATIONS OFFICE
HEALTH AND SAFETY DIVISION
SAMPLE RECORD

Serial No. 16995

Sample from: Kerr McGee

Address

Collected by:

Date: 10-24-60

Analyzed by:

Date:

Sample No.	Hour	Sample Description	Sampling Rate L/M	Sampling Time Min.	Sampling Total Liters	Anal. No.	Quantity Used, ml.	Fluor. Read., sc. div.	Uranium present Total μμ curies	Uranium present μc/ml x 10^{8}
1		Liquid Samples				1	.1	540.		550.
2		"				2		4.1		3.8
3		"				3		4.1		3.8
4		"				4		3.8		3.5
5		"				5		1.9		1.5
6		"				6		1.2		.8
8		"				7		3.5		3.2
9		"				8		25.		25.
10		"				9		26.		26.
11		"				10		53.		54.
12		"				11		6.9		6.6x
13		"				12		22.		22.
14		"				13		34.		34.
15		"				14		37.		37.
16		"				15		66.		66.
17		"				16		3.1		2.8

RECEIVED
NOV 1 1960
ID COMPLIANCE

Standard 33 sc. div. per .005 μg. Blank .4 sc. div.; Sensitivity 1.5×10^{-3} microgram/sc. div.

CWS by E R Ebersole Chief, Analysis Branch
APPROVED

ID-130
(8 - 59)

U. S. ATOMIC ENERGY COMMISSION
IDAHO OPERATIONS OFFICE
HEALTH AND SAFETY DIVISION
SAMPLE RECORD

Serial No. 18996

Sample from: Kerr McGee

Address

Collected by:

Date: 10-24-60

Analyzed by: JAS

Date: 10-24-60

Sample No.	Hour	Sample Description	Sampling: Rate L/M	Sampling: Time Min.	Sampling: Total Liters	Anal. No.	Quantity Used, ml.	Fluor. Read., sc. div.	Uranium present: Total µµ curies	Uranium present: µc/ml x 10⁸
~~18~~		Liquid Samples				17	.1	40.		40
19		"				18		1.1		.7
20		"				19		73.		73.
21		"				20		24.		24.
22		"				21		36.		36.
23		"				22		31.		31.
25		"				23		160.		160.
28		"				24		1.1		.7
~~30~~		"				25		21.		21.
31		"				26		1.3		.9
32		"				27		1.7		1.3
33		"				28		2.4		2.

RECEIVED
NOV 1 1960
ID COMPLIANCE

Standard 33 sc. div. per 0.05 µg; Blank .4 sc. div.; Sensitivity 1.5×10^{-3} microgram/sc. div.

AWS by EKE

APPROVED

Chief, Analysis Branch