

URANIUM REDUCTION COMPANY

INTER-OFFICE CORRESPONDENCE

To B. B. Winn A10-TRD 25
From T. R. Downard **Date** 5/18/59
Enclosure 3

Subject Airborne dust sampling survey. Refer to A-10-TRD 20

Purpose: To determine the uranium concentration in airborne dust in various mill work locations and the surrounding area.

Procedure: This survey consists of two phases:
 (1) A survey of the area immediately surrounding the mill control area and the city of Moab.
 (2) Various work locations within the mill control area.

Phase #1. In order to determine the uranium concentration in airborne dust in zones outside the control area, a portable sampling apparatus was assembled. This apparatus consisted of a Staplex Hi Volume air sampler powered by a Homelite 110/220 V. portable light plant. This apparatus was loaded into one of the URC trucks, the sampler being mounted on top of the truck cab. The samples taken were collected while the truck patrolled the various sampling areas in order to collect as representative sample as possible. Equipment was also included for measurement of wet and dry bulb temperatures and relative humidity. The SBX-11B scintillator was used to measure the external radiation level in these sampling areas. The general weather conditions are also given.

Table # 1: Sample taken along highway and north fence area outside scalehouse.

Date:	4-16-59
Time:	9:10 A.M.
Wet bulb temp.	43° F.
Dry bulb temp.	59° F.
Relative Humidity	21%
Wind: Easterly at 3-5 MPH	variable
External Radiation	.14 mrem/hr
U Concentration	.08 x 10 ⁻¹¹ µc/ml

Table # 2: Sample taken along road by tailings pond.

Date:	4-16-59
Time:	9:35 A.M.
Wet bulb temp.	42° F.
Dry bulb temp.	57° F.
Relative Humidity	21%
Wind: Easterly at 3-5 MPH	variable and shifting
External Radiation	.22 mrem/hr
U Concentration	.05 x 10 ⁻¹¹ µc/ml

Table # 3: Sample taken in western section of City of Moab.

Date: 4-16-59
 Time: 9:58 A.M.
 Wet bulb temp. 44° F.
 Dry bulb temp. 62° F.
 Relative Humidity 17%
 Wind: nil
 External Radiation .020 mrem/hr
 U Concentration $.04 \times 10^{-11}$ $\mu\text{c/ml}$

Table # 4: Sample taken in eastern section of City of Moab.

Date: 4-16-59
 Time: 10:37 A.M.
 Wet bulb temp. 43° F.
 Dry bulb temp. 63° F.
 Relative Humidity 11%
 Wind: westerly at 5-10 MPH variable and gusty
 External Radiation .022 mrem/hr
 U Concentration $.06 \times 10^{-11}$ $\mu\text{c/ml}$

The weather conditions observed are considered to be normal for this time of year.

Phase #2: A very thorough air sampling survey was made of working locations within the mill. This survey was made by means of an automatic continuous air sampler made temporarily available to us by the Utah Public Health Department. This sampler was pre-set to take samples of 1 hour duration, and was operated continuously in the sampling zones. Therefore, we obtained 24 samples, each of 1 hour duration, for each day of sampler operation. In some zones, such as the crushing department, the mill was not in operation during the entire sampling period. In these cases, the samples taken during the shut-down periods were not used. The samples taken during operation for each particular location were combined to obtain a weighted average for each location. Therefore, the average concentration given for each location indicates the concentration found during mill operation.

The results of this survey are listed in the following table:

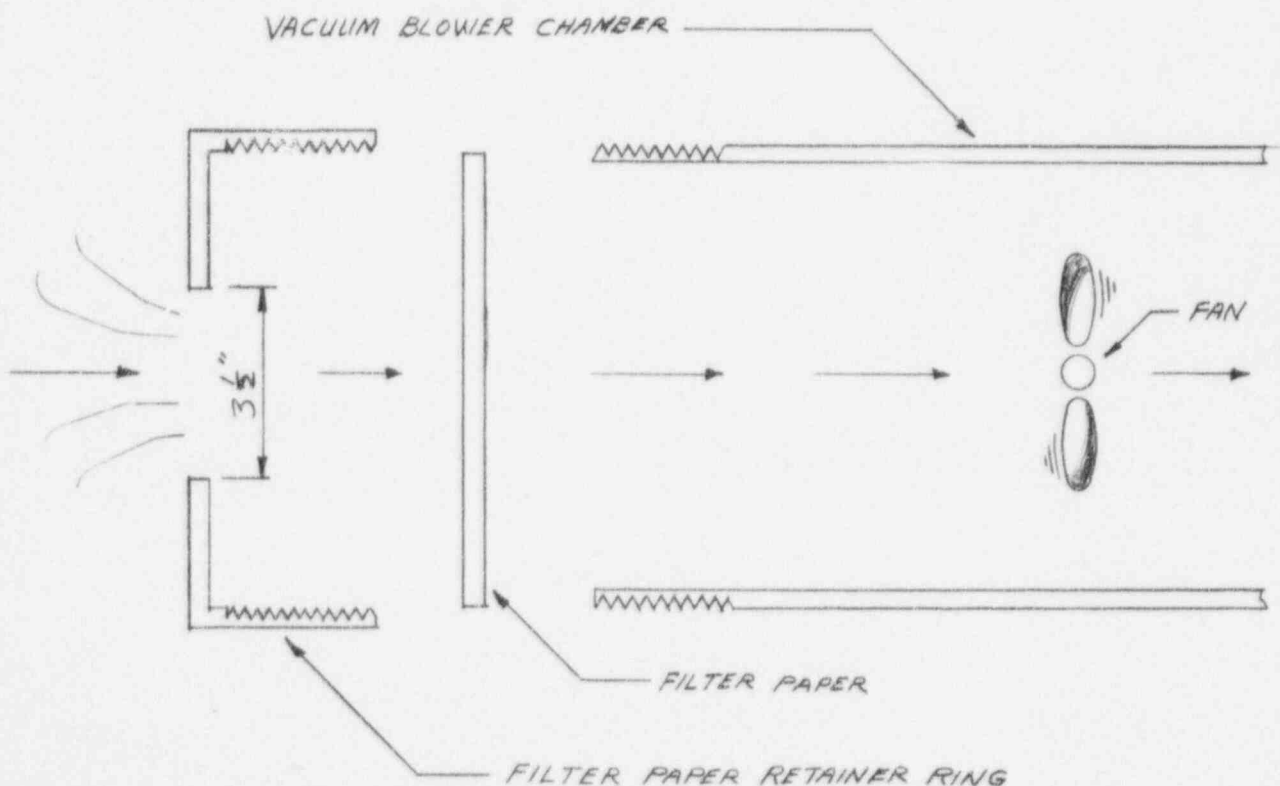
Work Location	Number of 1 hour samples	Assay results mg U_3O_8	U Concentration $\times 10^{-11}$ $\mu\text{c/ml}$
Precipitation	24	.040	0.41
#1 Hearth level	24	1.0	10.35
#5 Hearth level	48	1.09	5.63
Packaging area	24	.67	6.90
"A" RIP	24	.042	0.43
"B" RIP	23	.040	0.43
Boiler room	24	.028	0.29
Cone Crusher	27	.090	0.83
Jaw Crusher	18	.045	0.46
Sample tower-			
Ground floor	16	.063	0.98
#1 roll crusher	18	.085	1.17
Fine ore bins	28	.075	0.66
Ball Mill	48	.053	0.27

Discussion: This sampling period began on 4-16-59 and was concluded on 5-5-59. In comparing the results obtained in this survey with results obtained in report A10-TRD 20, it is noted that the general comparison is fairly close, except in the crushing and sampling areas. In all cases, the more recent survey is concluded to be the more accurate due to the longer sampling period and the larger number of samples obtained in each location.

It is felt that the large difference in results obtained in the crushing and sampling area is due to a feature of construction of the automatic air sampler. Refer to Sketches A and B.

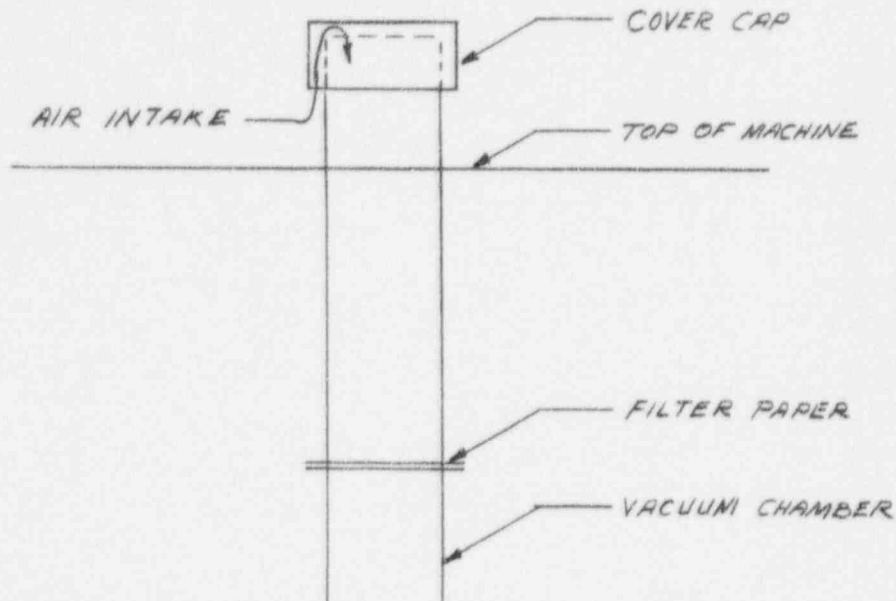
Sketch A shows the details of the sampling head of the Staplex Hi Volume air sampler. The sampled air is drawn through a 3 1/2" I. D. retainer ring which holds the filter paper in place, and then through the filter paper.

S K E T C H A
Staplex Hi Volume Sampler.



The sampled air is drawn in at a rate of 10 CFM. Since the filter paper is directly exposed, and since the sampling rate is fairly high, it is believed that these samples include larger particles of dust which would normally settle out but which are sucked into the filter paper by the high volume air stream.

S K E T C H B
Automatic Air Sampler.



The sampling head on the automatic sampler is designed to function in the same manner as the human nostril. The hair in the nostril and the up-draft intake of inhaled air tend to filter out the larger particles of dust in the air inhaled. The sampling head on the automatic air sampler approximates this action. The air intake tube is equipped with a covering cap which protects the filter paper from direct exposure to settling dust, and also directs the intake air in an upward direction.

The sampling rate of the automatic air sampler is 4 liters per minute. This is a much slower intake rate than that of the Staplex air sampler and is considered to be slow enough to prevent collection of large dust particles.

With all the factors taken into consideration, it is considered that this survey is of much greater accuracy than preceeding surveys.

It is to be noted that the sampler used in the mill survey was positioned on a portable platform which placed the sampling head at nose height in the work locations.

Calculations: The assay results of the submitted air samples are given by the analytical laboratory in terms of mg U_3O_8 contained in the entire sample. In order to obtain a weighted average for the sample location, the total grams U_3O_8 are divided by the number of liters of air sampled during the sampling period, the resultant figure being the mg U_3O_8 /liter concentration average. For greater ease of calculation, this number is converted to gms. $\times 10^{-6}$ U_3O_8 /liter. The number of gms. U_3O_8 /liter is multiplied by 0.595×10^{-3} , the resultant being in terms of $\mu\text{c/ml}$. Exponential powers of 10 are observed to give a final result in terms of a resultant number times 10^{-11} $\mu\text{c/ml}$.

Example: The analytical assay of the precipitation sample showed a total U_3O_8 content of .040 mg. This is divided by the sample volume, 5760 liters, and the resultant is 6.94×10^{-9} gms U_3O_8 /liter. This figure is then multiplied by a conversion factor of $.595 \times 10^{-3}$, and the resultant is 4.13×10^{-12} $\mu\text{c/ml}$, or a final concentration figure of $.41 \times 10^{-11}$ $\mu\text{c/ml}$.

FLUORIMETRIC ANALYSIS OF U_3O_8 IN AIR SAMPLES

Place the filter papers in a 100 ml beaker, add 10 ml 1:1 H_2SO_4 , 10 ml HNO_3 , 2 ml HF and heat to sulfuric acid reflux, cool, add 5 ml $MClO_4$ and again heat to sulfuric acid reflux. Cool, add 10 ml H_2O and boil until soluble salts are in solution. Cool, transfer to a 25 ml graduate, add 3 ml 1:1 HNO_3 and fill to volume with distilled water.

Pipette a 2 ml sample into a 40 ml vial, add 15 ml saturated $Al(NO_3)_3$ solution, 10 ml Ethyl Acetate, cap the vial and shake on Eberbach shaker for 2 minutes.

Allow the aqueous and Ethyl Acetate phases to separate and pipette 0.2 ml of the Ethyl Acetate phase onto each of three 0.4 gram NaF flux pellets, previously prepared and placed on clean, dry platinum dishes. Four standard pellets are prepared by pipetting 0.1 ml of 1μ gm U_3O_8 /ml solution on each pellet.

Place pellets under heat lamp for 10 minutes to volatilize Ethyl Acetate, then fuse pellets at $900^\circ C$. for three minutes, cool for 15 minutes and read pellets in Jarrell Ash Fluorimeter.

$$\frac{1 \times 10^{-7} \text{ gm } U_3O_8 \times \left[\frac{\text{Sample Reading} - \text{Blank}}{\text{Standard Reading} - \text{Blank}} \right] \times 625}{\text{Volume of air in Liters}} = \text{gms } U_3O_8/\text{liter of air}$$

$$(\text{gm } U_3O_8/\text{Liter Air}) \left[\frac{5.95 \times 10^{-4} \mu \text{ Curie/ml}}{\text{gm } U_3O_8/\text{Liter}} \right] = \mu \text{ Curie/ml air}$$

For example in the case where 200 liters of air is taken and readings are as follows: Standard, 72.0; Sample, 10.0; Blank, 2.0.

$$\left[\frac{(1 \times 10^{-7} \text{ gm } U_3O_8) \times \frac{8}{70} \times 625}{200 \text{ liters}} \right] \times \left[\frac{5.95 \times 10^{-4} \mu \text{ c/ml}}{\text{gm } U_3O_8/\text{Liter}} \right] = 1.85 \times 10^{-11} \mu \text{ c/ml}$$