

Appendix C

University of Arizona Letter

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December 17, 2009

Memo to: Jody Waugh

Regarding: Uranium in Former Evaporation Pond Area at Monument Valley

We analyzed the stained surface soils in the former evaporation pond area and extended field west in the subpile soil area for a suite of heavy metals to determine if potential toxic substances were associated with the chemical stains observed in some areas of the site. This was part of Task 6, Mn Toxicity Field Study. Our original concern was that Mn was present in different oxidation states at some places on the site and might represent a hazard in blowing dust. However, we reported previously that although Mn nodules were present in the soil, the soil levels were within background levels found in other soils and did not present an apparent risk. Mn can account for the red and blue hues present in some stained areas. However, David Moore also noted that a spot in the former evaporation ponds had a yellow stain. Dr. Janick Artiola, head of ERL's Water Quality Center Laboratory, thought this could be due to uranium. Consequently, we analyzed stained soils for a suite of metals, including calcium, vanadium, manganese, iron, strontium and uranium. A summary of results is in Table I (below), and complete results are in an attached Excel spread sheet.

Following Table 1 are field notes from David Moore on the location and appearance of the samples, and photographs showing the different hues of the stained soils. Note that uranium levels are elevated in the yellow stained area from the evaporation pond relative to levels in the extended field west (the former pile area).

Ed Glenn

Table 1. Heavy metal analyses of surface soils at Monument Valley, 2009. Samples were collected in stained areas in the former evaporation ponds (EP), and the extended field west (EPW), by scraping samples from soils exhibiting yellow (Y), green (G) or red (R) colors. Samples were analyzed by ERL's Water Quality Center Laboratory.

Summary by Analyte			
ALEC		WQCL	Sample
Log number	Sample ID	Sample ID	concentration
Analyte			ug/g
			Ca40
WQCL 1537	EP Y	09044-1	27949 ug/g
WQCL 1538	EP YG	09044-2	21067 ug/g
WQCL 1539	EFW R	09044-3	31117 ug/g
WQCL 1540	EFW G	09044-4	31585 ug/g
WQCL 1541	EFW G	09044-4 dup	33593 ug/g
WQCL 1542		QC807 Mont	21062 ug/g
WQCL 1543		QQC808 Marine	2262 ug/g
Analyte			V51
WQCL 1537	EP Y	09044-1	2672 ug/g
WQCL 1538	EP YG	09044-2	1352 ug/g
WQCL 1539	EFW R	09044-3	895 ug/g
WQCL 1540	EFW G	09044-4	884 ug/g
WQCL 1541	EFW G	09044-4 dup	928 ug/g
WQCL 1542		QC807 Mont	26 ug/g
WQCL 1543		QQC808 Marine	261 ug/g
Analyte			Mn55
WQCL 1537	EP Y	09044-1	134 ug/g
WQCL 1538	EP YG	09044-2	96 ug/g
WQCL 1539	EFW R	09044-3	148 ug/g
WQCL 1540	EFW G	09044-4	174 ug/g
WQCL 1541	EFW G	09044-4 dup	177 ug/g
WQCL 1542		QC807 Mont	567 ug/g
WQCL 1543		QQC808 Marine	1807 ug/g
Analyte			Fe56
WQCL 1537	EP Y	09044-1	4301 ug/g
WQCL 1538	EP YG	09044-2	4242 ug/g
WQCL 1539	EFW R	09044-3	54741 ug/g
WQCL 1540	EFW G	09044-4	2395 ug/g
WQCL 1541	EFW G	09044-4 dup	2161 ug/g
WQCL 1542		QC807 Mont	13970 ug/g
WQCL 1543		QQC808 Marine	57474 ug/g

Table 1 (continued).

Analyte			Sr88
WQCL 1537	EP Y	09044-1	107 ug/g
WQCL 1538	EP YG	09044-2	71 ug/g
WQCL 1539	EFW R	09044-3	134 ug/g
WQCL 1540	EFW G	09044-4	130 ug/g
WQCL 1541	EFW G	09044-4 dup	136 ug/g
WQCL 1542		QC807 Mont	50 ug/g
WQCL 1543		QQC808 Marine	61 ug/g
Analyte			U238
WQCL 1537	EP Y	09044-1	442 ug/g
WQCL 1538	EP YG	09044-2	303 ug/g
WQCL 1539	EFW R	09044-3	2.31 ug/g
WQCL 1540	EFW G	09044-4	1.35 ug/g
WQCL 1541	EFW G	09044-4 dup	1.36 ug/g
WQCL 1542		QC807 Mont	0.88 ug/g
WQCL 1543		QQC808 Marine	6.35 ug/g

 David Moore's Field Notes and Photos:

Ben Stanley and I collected stained soil samples on 8-12-09.

In the Evaporation Pond, a solenoid had failed and there was no irrigation water for the week preceding this site visit. That combined with rain which preceded the visit resulted in the prominent red/green stained soil noted in the July trip fading away. While red/green had been common throughout the Evaporation Pond, it was not available for collection there. The yellow and yellow/green stained areas were still there as can be seen in the following photos. There was just one yellow stained area in the Evaporation pond, located in the northwest portion of the field.

We collected red and green stained soil from the Extended Field West. We found one fairly good sample as can be seen in the photo but most of the stained soil was faded there too, compared to July when it was much more common and darker.

Samples:

EP Y Evaporation Pond – Yellow 1st and 2nd photos
 Collected from Evaporation Pond between rows 14 & 15 N to S, 14 paces in W to E.
 Stained area for yellow and yellow/green samples was approximately 4' (W/E) by 7' (N/S).

EP YG Evaporation Pond – Yellow/Green Area in 1st photo; stain not visible

Collected from Evaporation Pond between rows 12 & 13 N to S, 12 paces in W to E

EFW R Extended Field West – Red 3rd photo

EFW G Extended Field West – Green 3rd photo

Both red and green collected from Extended Field West Row 14 W to E, at plant 9 S to N. Stained area was approximately 4' x 4'.

David Moore



Yellow sample taken from foreground, tape measure area. Yellow green taken from near Ben Stanley.



Close-up of yellow stain in former evaporation pond area.



Stained soil yellow/green (July 09)





Red and green sampled here.