

Permit No. UGW470001

## STATEMENT OF BASIS

### SIMPLOT PHOSPHATES LLC TAILINGS STORAGE FACILITY June, 2020

#### I. Description of Facility and Purpose of Permit

Simplot operates a surface mine and concentrator facility for processing ore used in the production of phosphate fertilizer, located approximately 10 miles north of Vernal, Utah. The mine and processing facilities have been in production, under previous owners, since 1958. Phosphate ore is ground into a slurry near the mine site and pumped through a pipeline to the concentrator. The slurry goes through a multi-step flotation process which includes further grinding at the concentrator to separate the phosphate mineral grains from gangue minerals. The concentrated slurry is pumped by pipeline to Rock Springs, Wyoming. Clay fines and barren mineral grains from the flotation cells are pumped to an unlined Tailings Storage Facility. Clarified water from the tailings impoundment is reclaimed for re-use in the concentrator and grinding mill by barge-mounted pumps.

The tailings storage facility was considered an existing facility under the Utah Ground Water Protection Regulations until it was modified after the Regulations were adopted by raising the dam height. The facility has been in use since 1961. First one then two tailings ponds were impounded in ephemeral drainages behind dams of mine waste rock. In 1986 both of the earlier tailings dams were covered by an earthfill dam constructed of Moenkopi Formation borrow material from within the impoundment area. Seepage from the dam is collected by drains and pumped back into the tailings impoundment. Fine clay-sized tailings are discharged in the northeast area of the impoundment; coarser tailings are deposited along the upstream face of the dam.

Currently, the crest elevation of the dam is at 6005 feet and Simplot Phosphates is in the process of raising the crest to 6015 feet. Towards the end of 2019, cold weather forced construction to be stopped and it will resume in 2020. The dam is 6600 feet in length and the impoundment has an area of 550 acres. To create a greater capacity for tailings disposal, Simplot Phosphates will eventually construct 3 additional raises of 15 feet each. This will result in a final elevation of 6060 feet. This will allow an additional 20 years of operation.

Ground water quality at the site is of highly variable quality, as explained in the Hydrogeology section below. Because of the long history of mine operation before any ground water monitoring was done, baseline ground water quality that existed before mine operations began cannot be known with certainty. Water contained in the tailings slurry has total dissolved solids (TDS) content of about 2300 mg/l, and slightly elevated levels of total

phosphorus and uranium. Concentrations of dissolved constituents in the tailings water are variable, probably due to variations in the amount of runoff from the basin that drains into the tailings impoundment. As a permit condition, tailings water is sampled annually in the third quarter of the year, when dissolved constituents will be at their highest concentration after summertime evaporation.

This Ground Water Discharge Permit requires monitoring of wells completed in aquifers and saturated zones that may be affected by subsurface discharge from the tailings impoundment, and also monitoring of surface water in Big Brush Creek, which may receive discharge from aquifers affected by the tailings impoundment. If monitoring confirms that discharge from the tailings impoundment is degrading ground or surface water quality, Simplot Phosphates will be required to take corrective action, under the provisions of UAC R317-6-6.15.

## II. Description of Hydrogeology

The mine and tailings storage facility are located on the south flank of the Uinta Arch. Sedimentary rocks of Pennsylvanian to Triassic age in the vicinity dip 8 to 10 degrees southward. The mine's water supply wells tap an aquifer contained in the Pennsylvanian Morgan Formation and Weber Quartzite which underlie the site. This aquifer is recharged where the formations are exposed at a higher elevation north of the minesite, and it is under artesian pressure in the mine's water supply wells. The basal mudstone member of the overlying Permian Park City Formation probably acts as a confining layer for this aquifer. Phosphate ore is mined from the Park City Formation. The Triassic Moenkopi Formation overlies the Park City south of the mine, and is exposed at the surface in the vicinity of the tailings storage facility. The Moenkopi consists of siltstone, fine-grained sandstone, and gypsum, and is generally a barrier to ground water flow. The aquifer in the Morgan and Weber is protected from contamination at the tailings facility site by the confining beds in the Park City and Moenkopi Formations and by its artesian pressure. The southernmost edge of the tailings impoundment comes onto contact with an escarpment formed by the Gartra Grit Member of the Triassic Chinle Formation, a medium to coarse grained sandstone, which overlies the Moenkopi. Approximately 1500 to 2000 feet east of the tailings dam is Big Brush Creek. A narrow band of alluvium, which contains a shallow unconfined alluvial aquifer, is present adjacent to the creek. This aquifer discharges to the stream.

Ground water in the Moenkopi Formation underlying the impoundment most likely exists in localized, unconnected zones of saturation. Ground water quality in the Moenkopi is poor, with TDS content ranging from 4000 to 6000 mg/l.

The alluvial aquifer near the base of the tailings dam may have been affected by seepage from the tailings impoundment or by ground water that was in contact with the Moenkopi Formation. Some monitor wells completed in this aquifer show elevated levels of TDS and

uranium; other wells have lower levels of TDS which probably indicates aquifer recharge from Big Brush Creek. Since this permit has been in effect, two alluvial aquifer monitor wells, GE-2 and GE-5, have shown alternation over time between ground water with lower and higher dissolved-solids content. Investigation indicates that this variation is natural and not due to seepage from the tailings impoundment. Additional sampling will be required in this permit version to confirm this, the next time these wells show higher dissolved-solids content, as indicated by exceedance of the former (2010) protection levels for TDS or sulfate

While ground water in the Moenkopi Formation is of poorer quality than the tailings water, the higher hydraulic head caused by the dam could cause increased ground water flow through the Moenkopi, which would result in increased dissolution of gypsum and flow into higher-quality aquifers. If any pollutants from the tailings water or the Moenkopi are discharged to the alluvial aquifer, they may eventually discharge into Big Brush Creek. It would not be possible to distinguish such an increase in dissolved solids content at any particular monitor well until water from the tailings impoundment arrived at the well.

### III. Basis for Permit Issuance

The tailings impoundment does not have a liner. While water associated with the tailings is of generally better quality than ground water in the underlying Moenkopi Formation, the impoundment may affect waters of the state by discharge into the alluvial aquifer and from there into Big Brush Creek, or by discharge into the deep Weber/Morgan aquifer. It is also possible that increased subsurface flow through the Moenkopi could discharge into better-quality ground and surface water. Simplot Phosphates is required to monitor ground and surface water which may be impacted by the tailings impoundment.

### IV. Basis for Specific Permit Conditions

#### a. Ground Water Monitoring

Because of the variable hydrogeologic conditions at the site and likely previous releases of tailings water to the ground water, a comparison of ground water quality upgradient and down-gradient of the site could not evaluate possible impacts on waters of the state. Ground water monitoring shall focus mainly on the alluvial aquifer at the base of the tailings dam, which would be some of the first ground water to be affected by discharges from the impoundment. Because this is an existing facility and the alluvial aquifer may have been affected by seepage from the dam, its original background water quality cannot be known. Existing background water quality was determined based on data from 1999 to 2009 at monitor wells in the alluvial aquifer, the Weber aquifer, the Moenkopi Formation and the Gartra Grit Member. No further degradation in water quality beyond protection levels derived

from this background data will be permitted.

Water chemistry in the tailings impoundment is similar to that of ground water that has been in contact with the Moenkopi Formation, and it has been difficult to determine if water chemistry in a particular well is due to influence from either of these two sources. In response to an increase in dissolved-solids content in well GE-2, in 2011 Simplot conducted a study of water chemistry from various sources with the goal of distinguishing leakage from the impoundment from Moenkopi ground water. Among the conclusions from this study was that water in the tailings impoundment, which is subjected to prolonged evaporation, is enriched in heavier stable isotopes of hydrogen and oxygen relative to ground water that is recharged relatively quickly from local precipitation, and protected from evaporation while it is underground. Isotopic analysis, therefore, offers a conclusive method to distinguish impoundment leakage from naturally-recharged ground water. Procedures to be followed after a monitor well is found to be out of compliance with permit protection levels have been modified to incorporate this conclusive test for impoundment leakage. As a permit condition, if protection levels are exceeded in a down-gradient monitor well for four successive sampling events, Simplot Phosphates will evaluate whether the observed ground water chemistry is due to seepage from the tailings impoundment, using all available data and isotopic analysis if necessary.

Simplot's 2011 investigation concluded that well GE-2 had not been affected by impoundment seepage, and therefore periods where the well yielded ground water with a higher dissolved-solids content were natural variation. Background mean and standard deviation were re-calculated using the entire period of record from this well, to account for this variation. New protection levels were derived from these statistics. Similar periodic variation was observed in well GE-5. Although isotopic analysis was not done for this well, the balance of major ions in its water does not resemble that in the tailings pond water. To confirm that phases of higher dissolved-solids content in these wells are not due to leakage from the tailings impoundment, as a permit condition, the next time that the protection levels from previous versions of this permit (derived from a phase of lower dissolved solids) are exceeded, Simplot will evaluate whether the water with higher dissolved solids content represents tailings impoundment leakage, using isotopic analyses if necessary. Recent sampling events show that GE-2 and GE-5 are now in compliance. However, GE-3 is just slightly out of compliance and is now on the accelerated schedule of monthly monitoring.

Ground water protection levels have been established for total phosphorus. Previously, protection levels were based on dissolved phosphorus, which requires filtering of the sample to remove particulate phosphorus. It is not known to what

extent particulate phosphorus is transported in ground water, and establishing protection levels for total phosphorus is a conservative approach to evaluate potential transport of phosphorus in ground water, which could lead to discharge of phosphorus to surface water. Monitoring for this permit has shown that dissolved and total phosphorus do not differ greatly in ground water, and only differ slightly in tailings pond water.

b. Surface Water Monitoring

To demonstrate the effectiveness of the tailings water containment, the facility must not cause surface water standards for TDS, gross alpha and beta, radium, iron and phosphorus to be exceeded in Big Brush Creek. Discharge of salts must also be kept to a minimum according to the provisions of the Colorado River Basin Salinity Forum. Because discharge from the alluvial aquifer into the stream is diffuse and not a point source, Simplot Phosphates monitors water quality upstream and downstream from the tailings dam. Changes in surface water quality between the upstream and downstream monitoring points must be evaluated considering that some of the degradation in water quality at this site is natural, from stream water coming in contact with the Moenkopi Formation. In the event that significant increases in the monitored surface water parameters are observed downstream of the Simplot Phosphates site, the data will be reviewed by DWQ to determine appropriate remedial action.

In addition, water quality in the tailings reservoir shall also be monitored annually in the third quarter of the year, when water in the tailings impoundment contains its highest annual concentration of dissolved constituents, due to summer evaporation. This will help to evaluate whether down-gradient monitor wells are affected by seepage from the impoundment.

c. Discharge Minimization Technology

The tailings dam was constructed over three alluvium-filled drainages incised into the Moenkopi Shale. The original dam was considered an “existing facility” under the ground water protection regulations, but it has been modified several times by raising the dam elevation to increase tailings storage capacity in an effort to contain seepage through the alluvium, cutoff slurry walls were installed in these drainages by Simplot Phosphates’ predecessor at the site, Chevron Resources Co. Seepage which collects behind the slurry walls is eventually returned to the tailings pond. Monitor wells down-gradient of the tailings dam, completed in the alluvial aquifer, the Moenkopi Formation and the deep Weber Quartzite and Morgan Formation, as well as monitoring surface water quality in Big Brush Creek, will indicate whether excessive

seepage from the tailings dam is affecting ground or surface water resources. Ground water elevations and water chemistry in monitor wells associated with the cutoff walls (“CO” series of wells) are evaluated to insure the cutoff walls are functioning as intended. Stability and construction of the tailings dam is regulated by the Division of Water Rights, Dam Safety section.

V. Potential Impacts to Ground Water

Potential impacts to ground water have been minimized by the use of discharge minimization technology and monitoring to insure that seepage from the tailings impoundment is not affecting ground water quality. Ground water quality varies significantly around the site, and this version of the permit incorporates use of isotopic analysis to determine whether a future observed deterioration of ground water quality at a down-gradient monitor well is due to natural changes in the source of ground water sampled by the well, or due to seepage from the tailings impoundment. If other activities at the mine site affect ground water quality, or if there are unmonitored pathways for seepage from the tailings impoundment, the geologic structure of the area will direct shallow ground water to Big Brush Creek. The creek is monitored upstream and downstream of the mine site, allowing for detection of unanticipated releases of contaminants.