I. Facility Description

Simplot Phosphates LLC 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. This is an existing facility which has 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 is ground further at the concentrator in closed circuit with hydrocyclone classifiers. Coarse materials from the classifiers are processed in flotation cells to remove the phosphate mineral grains, which are pumped in a slurry pipeline to Rock Springs, Wyoming. Clay fines from the classifiers and barren mineral grains from the flotation cells are pumped to the Tailings Storage Facility. Clarified water from the tailings impoundment is reclaimed for re-use in the grinding mill by a barge-mounted pump. The tailings impoundment is located mainly over the outcrop of the Moenkopi Formation, a predominantly marine and tidal flat mudstone with very low permeability. Therefore, a liner was not required for the tailings impoundment.

The tailings storage facility has been expanded twice since its first use in 1961. Initially, 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, while coarser tailings are deposited along the upstream face of the dam.

Currently, the crest elevation of the dam is at 5,985 feet. The dam is 5,600 feet in length and the impoundment has an area of 326 acres. To create a greater capacity for tailings disposal, Simplot Phosphates will eventually construct 6 additional raises of 15 feet each. This will result in a final elevation of 6,060 feet after about 40 years of operation.

Water contained in the tailings slurry has total dissolved solids (TDS) content of about 2,000 mg/l, and elevated levels of gross alpha, uranium, manganese, chromium and thallium.
II. 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 mine site, 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 early 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 mudstone, siltstone, fine-grained sandstone, and gypsum, and is generally a barrier to ground water flow. The aquifer in the Morgan Formation and Weber Quartzite 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, or upward vertical hydraulic gradient. The southernmost edge of the tailings impoundment comes into 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 1,500 to 2,000 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 alluvial aquifer discharges to Big Brush Creek.

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 4,000 to 6,000 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 monitoring wells completed in this aquifer show elevated levels of TDS, gross alpha and uranium; other wells have lower levels of TDS which probably indicates aquifer recharge from Big Brush Creek.

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 pore water or the Moenkopi Formation are discharged to the alluvial aquifer, they may eventually discharge into Big Brush Creek.

III. Basis for Permit Issuance

The tailings impoundment is located mainly over the outcrop of the Moenkopi Formation, a predominantly marine and tidal flat mudstone with very low permeability. Therefore, a liner was not required for the tailings impoundment. 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 increased subsurface flow through the Moenkopi and 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.

a. **Ground Water Quality Monitoring**

Because of the hydrogeologic conditions at the site and previous releases of tailings water to the ground water, a comparison of ground water quality upgradient and downgradient of the site could not be used to 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 the first ground water to be affected by discharges from the impoundment. Because this is an existing facility and the alluvial aquifer has already 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 monitoring wells in the alluvial aquifer, the Weber Quartzite aquifer, the Moenkopi Formation, and the Gartra Grit Member. No further degradation in water quality due to excessive subsurface release of water from the tailings impoundment will be permitted.

For this permit term, background ground water quality in the monitoring wells, and protection levels derived from it, has been re-calculated using monitoring data collected from 1999 to 2009. One well located in the alluvial aquifer, GE-2, has shown an increase in dissolved solids content since 2001, and the well exceeded protection levels (based on data from 1999-2000) for TDS and uranium several times in 2008-09. Evaluation of whether this represents leakage from the tailings impoundment is complicated by the fact that tailings reservoir water has very similar chemistry to ground water that has been in contact with the Moenkopi Formation. As a compliance schedule item, Simplot Phosphates will be required to investigate whether it is possible to distinguish tailings impoundment water from other natural waters at the site by its chemistry, and whether the observed changes in ground water chemistry at well GE-2 represent leakage from the tailings impoundment. Protection levels for well GE-2 in this version of the permit are based on data from 1999-2000; if Simplot Phosphates can demonstrate that the observed changes in ground water chemistry in this well are due to migration of ground water from natural sources, the statistical means and protection levels for GE-2 will be revised to incorporate all previous monitoring data from this well.

Monitoring of water chemistry in the tailings impoundment shows that it has elevated TDS and sulfate content compared to some downgradient wells. To better evaluate whether any future changes in water chemistry that may be observed in these wells is due to leakage from the impoundment, protection levels
for sulfate will be established at these wells, based on monitoring data from 1999-2009. Downgradient wells with sulfate content significantly lower than the tailings water are WW-E, CO-6, GE-5 and GR-1. Protection levels for sulfate will be established for well GE-2 based on data from 1999-2000. In addition, one analysis of tailings water shows elevated levels of nitrate, ammonia and fluoride compared to natural ground water at the site. These parameters will be monitored in the wells and in the tailings water to evaluate their usefulness for distinguishing tailings water from unaffected ground water.

Ground water protection levels have previously been established for total phosphorus, on request of SF Phosphates, Simplot’s predecessor at the site, for ease in sampling. Transport of phosphorus in particulate form is generally not a problem in ground water, which is naturally filtered through the aquifer matrix. At Simplot Phosphate’s request, protection levels will be established based on dissolved phosphorus, which requires sample filtering in the field. Preliminary protection levels for this parameter are contained in this permit version, once adequate background data for dissolved phosphorus has been collected through regular compliance monitoring, protection levels in the permit will be revised. The permit will continue to require collection of samples for both total and dissolved phosphorus, to evaluate whether transport of particulate phosphorus in ground water is occurring at this site.

b. Surface Water Quality 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, SF Phosphates shall monitor water quality upstream and downstream from the tailings dam. During this permit term, data from this monitoring will be used primarily to determine baseline conditions before significant expansion of the tailings facility. It is possible that some of the degradation in water quality at this site is natural, from stream water coming in contact with the Moenkopi Formation, or that surface water standards may be exceeded due to contaminant sources upstream of the tailings facility. In the event that monitoring reveals changes from the baseline conditions, natural and/or upstream sources of contamination will be evaluated by Simplot Phosphates and DWQ. These potential sources of contamination will be taken into account by DWQ before assessing compliance with surface water standards or the Colorado River Basin Salinity Forum. In addition, water quality in the tailings reservoir shall also be monitored annually.

c. Discharge Minimization Technology

The tailings dam was constructed over three alluvium-filled drainages incised into
mudstone of the Moenkopi Formation. 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 Company. Seepage which collects behind the slurry walls is eventually returned to the tailings pond. Monitoring wells downgradient 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.