Docket WM-33
PDR

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Mr. Dan Gillen
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U. S. Nuclear Regulatory Commission
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Dear Mr. Gillen:

This report constitutes my evaluation of the environmental impacts on ground water produced by seepage from the existing tailings pond at the Dawn mill near Ford, Washington. The document entitled "Environmental Impact Statement, Dawn Mining Company Tailings Disposal Facility Expansion Project" dated July 30, 1979 does not address this issue. That document states in Item 3 of Section 2.1.3 on page 3 "the potential impacts discussed are those related to the present proposal only, proposal for a new tailings disposal facility . Past and present impacts related to the ongoing operations, actual or potential, are discussed only in so far as they are affected by the present proposal." The aforementioned document addresses the seepage from the present tailings disposal facility only to the extent that its existence is acknowledged. The document does, however, present structural, geologic, and hydrogeologic data that are useful in the delineation of the impacts of seepage from the existing pond on ground water.

This report is based also on a document dated May 2, 1980, prepared by Envirologic Systems Inc. That report is entitled "Geohydrological and Geochemical Evaluation of Existing and Potential Contaminant Transport from Dawn Mining Company Tailings Pond, Ford, Washington". This document post-dates the aforementioned Environmental Impact Statement. However, it contains the most pertinent information relative to the impact of seepage from the existing tailings pond on ground water.

Section 3.1.3.4 of the aforementioned impact statement presents the data the company had assembled on seepage prior to July 30, 1979. Table 3.3 of this report presents the results of analyses performed on samples from five monitoring wells located around the existing tailings pond. The horizons that the wells are sampling is not made clear in the report. But as the report points out, some dissolved constituents display concentrations greater than background. The impact statement also presents data on the concentrations of these dissolved constituents in seepage zones located along Chamokane Creek. These data are presented in Table 3.4. A comparison of the data in Table 3.3 (Monitor well analyses) and Table 3.4 (Seepage analyses) indicates that the wells are not open to the seepage plume. This conclusion is based on the fact that the concentrations of dissolved sulfate in the seepage emergence waters is two orders of magnitude greater than the concentrations of dissolved sulfate in the samples collected from the monitoring wells. Total dissolved solids, uranium, nitrate, and manganese concentrations are one to two orders of magnitude higher in the

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waters of the seepage emergence zone than in the samples collected from the well waters. The aforementioned impact statement hypothesizes (Figure 3.9b) that the seepage plume is confined to a gravel filled buried valley in the glacial lake clay that occupies the bottom of the buried valley and on which Chamokane Creek flows. The aforementioned impact statement summarizes the impact of the seepage emergence zones in the following way. "From analytical work to date it is apparent that the emerging seepage solutions are relatively innoxious exceeding the EPA maximum permissible concentrations for drinking water only in nitrate, which is present in the seeps at level about three and one-half times the maximum permissible concentrations specified (in Drinking Water Standards). Observed nitrate concentrations are well within the limits specified for livestock utilization. Sulfate, manganese, and total dissolved solids occur in excess of the EPA recommended limit for drinking water, but none of the parameters are considered toxic; rather recommended limits have been set due to taste and laxative properties. All parameters show immediate dilution to near background levels upon mixing with creek waters. Observed concentrations of toxicants in the receiving stream are sufficiently low that they will not interfer with beneficial downstream water use. No pollutent concentrations have been observed in the receiving stream that are expected to affect biological community diversivity, productivity, or stability. Further, no effects on the rates of eutrophication or inorganic-organic sedimentation should be expected."

It should be pointed out that no studies were conducted on which the conclusions regarding biological community diversity, productivity or stability can be based. It should be pointed out also that the above quotes regarding concentrations of dissolved solids do not reflect the variations in water quality resulting from the seasonal changes in the ground water flow system that cause the water table to vary from 12 to 15 feet in elevation at the site. It should be noted also that at the time of the preparation of the aforementioned impact statement, the extent of ground water contamination was hypothetical. This observation is based on the fact that the five monitoring wells for which water quality data are presented in Table 3.3, clearly are not open to the same horizon that is producing the seepage at the emergence zones.

The aforementioned May 2, 1980, document prepared for Dawn Mining Company by Envirologic Systems Inc. ~~sheds considerable additional light on~~ highlights the extent of the impacts of seepage from existing tailings pond on ground water. That report notes that "within the unconsolidated section (in the buried valley fill) significant ground water flows have been noted in essentially three zones. The upper most zone occurs within and at the base of the highly permeable gravel/sand section usually composing the upper most 100 feet of the valley fill. This unit is floored on a dense, silty, blue-gray clay which serves as a base for vertical infiltration. The clay surface dips slightly westward inducing ground water migration in that direction." The report indicates that the upper sand and gravel unit is permeable as might be expected. However, the report notes also that the blue-gray clay unit "locally contains thin stringers of water bearing sand under slight artesian pressures. Water production of up to ten gallons per minute were recorded from this horizon and Dawn monitoring wells during air drilling, prior to their being backfilled and perforated above the clay layer." No information is given in the report relative to the continuity of the confined sand lenses. Therefore, it is not possible to determine whether they constitute preferential pathways along which seepage can migrate.

The Envirologic Systems' report continues with the statement "to the south of the present mill tailings ponds, the clay laps against a deeply weathered basalt rim, completely buried by later glacial fluvial deposits. One well encountered a sand/gravel layer beneath the lip of the clay which yielded up to 70 gallons per minute during drilling. Elsewhere similar material was encountered at elevations above the surface of the clay unit and no water flow was observed. Where confined beneath the clay, this horizon should be considered as a significant potential aquifer. It appears that this material has its discharge in the Chamokane Creek at two monitored springs southwest of the Dawn ponds." Presumably these springs have not displayed discharge of seepage type waters.

The Envirologic Systems' report considers that "since the major blue-gray clay unit acts as a base for downward infiltration of solutions in the project area, the upper most aquifer level discussed is of the greatest relevance to the present proposal. The nest of monitor wells established by Dawn Mining Company around the periphery of the tailings disposal area (referred to in the aforementioned impact statement) has been modified to sample this zone (the upper sand and gravel aquifer zone)." It should be noted that this monitor well design leaves open the question of whether or not seepage has entered any of the aforementioned artesian sand lenses in the clay underlying the upper sand and gravel aquifer.

The Envirologic Systems' report suggests that the aforementioned buried valley on the surface of the clay underlying the sand and gravel aquifer tends to concentrate and localize the seepage density plume, thereby preventing its spread. The well water quality data presented in Table 2 of the Envirologic Systems' report indicate that only well DW9 reflects high concentrations of total dissolved solids and sulfate that are characteristic of seepage from the pond. All other wells surrounding the tailings pond reflect total dissolved solids concentrations and sulfate concentrations that are either at or very similar to background concentrations as reflected by the data in Table 3.2 of the aforementioned Environmental Impact Statement dated July 30, 1979.

Given that the aforementioned clay layer does in fact constitute a low permeability "floor" at the bottom of the sand and gravel aquifer and that none of the artesian sand lenses discussed in the Envirologic Systems' report are hydraulically connected to the upper sand and gravel aquifer beneath the tailings pond, then the sealing of the monitor wells at the bottom of the sand and gravel aquifer can be justified. If this justification is accepted, then the delineation of the contaminated plume presented in Figure 3 of the Envirologic Systems' report can be accepted as representative of the portion of the ground water flow system that has been contaminated by seepage. This plume extends essentially from the tailings pond due west to the zone of seepage emergence along Chamokane Creek - shown on Figure 3.

The Envirologic Systems' report devotes considerable effort to a presentation of the mechanisms by which saturated and unsaturated porous media remove dissolved constituents from solution. Major emphasis is placed on cations with radium, uranium, thorium, iron, and manganese receiving major emphasis. This emphasis is a consequence of the fact that the authors believe that co-precipitation of radi nuclides with iron and manganese as oxyhydroxides is the major removal mechanism at the Dawn site. I would not disagree with the report's explanations for the removal of radionuclides between the Dawn tailings pond and Chamokane Creek. Uranium may be a possible exception. It has been observed to remain in solution for distances for greater than one-half mile (the distance between the Dawn mill tailings pond and Chamokane Creek) at other sites. On the basis of the data presented in Table 2 of the Envirologic Systems' report, uranium apparently already has reached well 9, located approximately 300 feet west of the pond. This observation is based on the fact that the uranium concentration in well DW9 is one to two orders of magnitude greater than in any of the other wells on the site. The concentration of uranium in DW9 is one order of magnitude greater than the average concentration presented for natural springs in the area in Table 3.2 of the aforementioned impact statement. The concentration of uranium in well DW9 is intermediate between background concentrations as interpreted from the data in Table 3.2 of the impact statement and concentrations in seepage emergence zones as interpreted through Table 3.4 of the impact statement. More specifically, the average concentration of uranium in springs not affected by the tailings pond is .004 parts per million; the average concentration in the seepage emergence zones is .06 parts per million. The concentration reported for monitor well 9 (Table 2 in the Envirologic Systems' report) is .015 parts per million.

Some discrepancies exist among the dissolved ions not in the radionuclide family. These discrepancies make difficult the interpretation of the data presented in Table 2 of the Envirologic Systems' report in combination with the data in Table 3.4 of the aforementioned impact statement. If the interpretation and rationale for species removal presented by Envirologic Systems is correct, then one would expect the concentrations of most ions other than calcium, magnesium, iron and manganese to be lower in the seepage emergence zones on Chamokane Creek than in well 9. This observation is important because if the concentrations of dissolved constituents other than calcium, magnesium, iron, and manganese are greater in the seepage emergence zone than in well 9 then an additional flow path other than the exclusive one proposed in the Envirologic Systems' report could be opperative. A comparison of the two tables reveals that total dissolved solids in the seepage emergence zone exceeds total dissolved solids in monitor well 9 at one seepage emergence point (SP7-1). A comparison of sulfate concentrations in the two tables reveals that sulfate concentration at two of the seepage emergence points (SP7 and SP10) exceed sulfate concentration in monitor well DW9. A comparison of nitrate concentration between monitor well DW9 and the seepage emergence zone reveals that nitrate concentration is one to three orders of magnitude greater in the seepage emergence zone than in monitor well 9. In the case of nitrate, however, it should be noted that Table 3 of the Envirologic Systems' report suggests a similar relationship between nitrate concentration in the tailings pond water and nitrate concentration in a small seep at the toe of the embankment immediately outside the pond. The concentration of nitrate at this seepage point (TP-2) is an order of magnitude greater than the concentration of nitrate in tailings pond water. A similar relationship exists for NH_3. If these data are correct, they suggest that nitrate and NH_3 are being added to the ground water flow system between the tailings pond and the seepage emergence zones. The sulfate, uranium, and total dissolved solids comparisons between the seepage emergence zones and monitor well DW9 suggest that monitor well 9 is not located on the path of highest concentration of dissolved solids in the plume. However, the absence of additional data points between monitor well 9 and the seepage emergence zones on Chamokane Creek make it impossible to locate the flow paths that are producing the higher concentrations of sulfate, total dissolved solids, and uranium in several of the sampling points within the seepage emergence zone.

These non radioactive elements will remain in the portion of the ground water flow system occupied by the seepage plume until they are discharged into Chamokane Creek after cessation of the utilization of the existing tailings pond. The major impact on ground water will be elevated levels of sulfate, total dissolved solids, nitrate, NH_3, and uranium as reflected by the data in Table 3.4 of the aforementioned impact statement and in Table 2 (monitor well DW-9) in the Envirologic Systems' report. The expected concentrations of these ions in the ground water flow system are more closely reflected by the concentrations in the seepage emergence zone as presented in Table 3.4 of the aforementioned impact statement than by the concentrations in monitor well DW-9 as presented in Table 2 of the Envirologic Systems' report. This ascertain is based on the fact that, as pointed out correctly by the Envirologic Systems' report, concentrations of these ions should be higher upgradient along a flow line than at the discharging end of the flow line.

During the period of drainage of the contaminated mound beneath the existing tailings pond, the major impact on ground water will be that a body of contaminated ground water will occupy a portion of the system between the tailings pond and Chamokane Creek. The specific contaminants and an indication of their expected concentrations is presented in Table 3.4 of the aforementioned impact statement. Concentrations of total dissolved solids, sulfate, and uranium should be greater in the ground wate. flow system than the concentrations presented in Table 3.4. The concentrations of nitrate and NH_3 are more difficult to interpret. However, the data presented in Table 3 of the Envirologic Systems' report in combination with Table 3.4 of the aforementioned impact statement suggest that concentrations of these constituents in the ground water flow system will vary significantly from location to location within the plume.

The impact of the seepage discharge into Chamokane Creek will consist of the deposition of calcium-sulfate at the emergence zones as well as the addition of dissolved solids reflected in Table 3.4 of the aforementioned impact statement to the waters of Chamokane Creek. The precipitation of gypsum at the seepage emergence zone will create white deposits at the points of emergence. These subsequently will be removed by high water levels of the creek during flood stage and added to the water as an increase in the suspended solids load. The dissolved solids added to the waters of Chamokane Creek will impact the creek as a direct function of the flow rate. Complete mixing of the creek water with discharging seepage can be anticipated within a few hundred feet of the down-gradient end of the seepage emergence zone. Consequently dilution can be expected to be a linear function of stream discharge beyond the point of complete mixing.

If it is deemed undesirable to allow the contaminated seepage plume to remain in place and continue to discharge into Chamokane Creek until the ground water mound has dissipated, then a pump back system can be installed to recover the mound. I would suggest, however, that if this corrective measure is to be implemented that a more precise delineation of the plume be attempted. The present delineation is based primarily on the geometry of the pond, monitor well DW9 and the geometry of the seepage emergence zone. These sample stations are limited at best. Because it is not desirable economically to withdraw any more contaminated ground water than is absolutely necessary, I would suggest that a detailed resistivity survey be conducted over the area prior to the implementation of any withdrawal system if such a withdrawal system is deemed desirable.

Sincerely,

Roy E. Williams

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Ph.D. Hydrogeology
Registered in Idaho

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