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NEIC

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NEIC CIVIL INVESTIGATION REPORT
Teck Alaska Inc. Red Dog Operations
Kotzebue, Alaska

Investigation Dates:
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- B APDES Permit No. AK0038652 (48 pages)
- C APDES Permit No. AK0040649 (40 pages)
- D October 1, 2021, Email Re: pH Measurement from the Port IX Plant (2 pages)
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and provides a clear indication of the end of this report.**

INVESTIGATION OVERVIEW

PROJECT OBJECTIVE

At the request of the U.S. Environmental Protection Agency (EPA) Region 10, EPA's National Enforcement Investigations Center (NEIC) conducted a National Pollutant Discharge Elimination System (NPDES) compliance investigation of Teck Alaska Inc. Red Dog Operations (Red Dog) mine and port facilities. As part of the on-site investigation, NEIC evaluated wastewater treatment and stormwater management at the main mining complex and the associated port facility. Photographs taken during the inspection can be found in **Appendix A**.

Table 1 lists the project team members.

Table 1. PROJECT TEAM MEMBERS		
Team Member	Organization	Project Role
Trent Rainey, P.E.	NEIC	Project manager
Daren Vanlerberghe	NEIC	Field team member
Michelle Lanzoni	EPA Region 10	Regional representative
John Wendell	ADEC	State representative

FACILITY CONTACT INFORMATION

Table 2 lists the primary facility contacts.

Table 2. FACILITY CONTACT INFORMATION		
Name, Title	Phone No.	Email Address
Michael Gonzales, Superintendent, Tailings and Water Management	907-754-5320	michael.gonzales@teck.com
Robert Napier, Environmental Team Lead	907-754-5145	robert.napier@teck.com

FACILITY OVERVIEW

Red Dog is a zinc and lead mine and processing facility. It is located approximately 90 miles north and slightly east of Kotzebue, Alaska, and approximately 55 miles east of the Alaskan coast on the Chukchi Sea. The main mining complex consists of three open-pit mines (one closed), a gravel pit, a tailings storage facility (TSF), a freshwater lagoon, ore processing facilities, finished product storage facilities, housing and dining facilities, vehicle maintenance shops, and an air strip. In addition, there is a port facility for finished product storage and ship loading and unloading. The port facility is located on the coast on the Chukchi Sea and is connected to the mining complex by a gravel-surface road. Red Dog began development in 1982 and began ore production in 1989. Current projections are that the mine will continue to operate until 2031.

Red Dog is permitted to discharge treated wastewater and stormwater under two Alaska Pollutant Discharge Elimination System (APDES) permits. APDES permit No. AK0038652 (**Appendix B**) covers the main mining complex. The most recent permit became effective September 1, 2017 and expires on August 31, 2022. The permit authorizes discharge from a single outfall, outfall 001, to Middle Fork Red Dog Creek. The authorized discharge includes wastewater from ore processing, treated sanitary wastewater, and collected drainage from the mine site. A minor modification was made by the Alaska Department of Environmental Conservation (ADEC) and issued on May 19, 2021. The modification addressed changes in the operation of the TSF facility as well as the compliance schedule in the permit. The effective and expiration dates of the permit were not affected. Discharges from the Delong Mountain Transportation System Port Facility (port facility) are authorized under APDES permit No. AK0040649 (**Appendix C**). Permit No. AK0040649 became effective on June 1, 2014 and expired on May 31, 2019. An application for permit renewal was filed with the Alaska Department of Environmental Conservation (ADEC) on November 29, 2018. The expired permit has been administratively extended pending issuance of the new permit.

According to the EPA Envirofacts database, this facility has the following North American Industry Classification System (NAICS) codes (**Table 3**):

Table 3. APPLICABLE NAICS CODES	
NAICS Code	Description
1031 (Mine)	Lead and Zinc Ores
1044 (Mine)	Silver Ores
212230 (Port)	Lead Ore and Zinc Ore Mining
488310 (Port)	Port and Harbor Operations
488320 (Port)	Marine Cargo Handling

FACILITY OPERATIONS SUMMARY

There are two operating mining pits, Aqqaluk and Qanaiyaq. The main pit closed in 2012. Mining is conducted with conventional drill and blast methods. The underlying rock strata is primarily shale. Bore holes are drilled into the rock and primed with explosive. After blasting, the fractured rock is excavated with front loaders and deposited in open-bed trucks for transport to the ore processing facilities. Ore processing consists of crushing and grinding the ore-bearing material, followed by successive floatation operations to separate the lead and zinc concentrate from the rock. Separated rock material is deposited in the TSF. Concentrated lead and zinc are stored in an enclosed building before being trucked to the port. Approximately 500 personnel are employed at the mine and processing facility.

The principal source of discharge water from the main mine area consists of mine drainage and industrial stormwater, process water from the ore processing operations, and sanitary

wastewater from throughout the facility. All waters are collected in the TSF, then pumped to one of the three water treatment plants (WTPs) located in the facility.

Wastewater Treatment Plants Summary

WTP 1 is the primary wastewater treatment plant at the mining complex and is the only one of the three that operates year-round. Based on information provided in the renewal application for APDES permit No. AK0038652 submitted in 2014, WTP 1 can operate in one of three modes. It can provide treated reclaim water for ore processing; discharge treated reclaim water to outfall 001; and treat seepage and runoff from the main waste stockpile and mine sump prior to discharge to the TSF.

Water entering WTP 1 is treated with sodium sulfide using an in-line mixer, to precipitate dissolved cadmium into cadmium sulfide. The reclaim water is dosed with lime in a rapid mix tank to pH 10.3 standard units (s.u.). The rapid mix tank discharges to a reactor tank to allow sufficient residence time for complete precipitation of dissolved metals. From the reactor vessel, the reclaim water is discharged into a circular clarifier to settle out the precipitates. Clarifier overflow is directed to a splitter box which feeds into 12 (in 4 banks of 3 each) single-media sand filters. pH and turbidity of the filter discharge is monitored. If the discharge is within the desired limits, it is sent to outfall 001. If the discharge exceeds the required pH or turbidity levels, it is directed to the TSF.

WTP 2 is configured similarly to WTP 1, but the unit sizes are smaller. It is only operated during the late spring to early fall, as needed. WTP 3 began operations in 2005. It is also a smaller plant that uses lime precipitation to treat seepage and runoff from the main waste stockpile and mine sump before they enter the TSF. Like WTP 2, it only operates during the late spring to early fall.

Reverse Osmosis Treatment System

In 2020, Red Dog began operation of a reverse osmosis (RO) treatment plant to further reduce total dissolved solids in the discharge from outfall 001. The plant receives flow from the TSF via WTP 1 and WTP 2. Incoming water with a pH below 9.7 s.u. is diverted away from the RO system. The incoming flow is stored in two feed tanks before being pumped through a microfiltration system. The microfilters are mounted on three skids within a covered building and filter particles down to 0.1 micron (μm). The filtered solids are pumped to a sump for eventual return to the TSF. The filtrate from microfiltration serves as the feed for the RO system. There are three racks for the RO system, each equipped with 14 pressure vessels. Each pressure vessel contains four RO membranes. The permeate from the RO system is collected in plastic tanks located next to the RO plant. The permeate is then discharged to the sand filter

building. It is either co-mingled with the effluent from the sand filters or discharged separately to outfall 001 if the WTPs are not discharging. The concentrate from the RO system is returned to the TSF.

Port Facility

The port provides facilities for the storage and loading of concentrated zinc and lead and the offloading of fuel, supplies, and material to support the mining operations. A pier extending from the shore provides docking for barges and loading/unloading facilities. Zinc and lead from the mining complex are stored in concentrate storage buildings (CSB) 1 and 2. Concentrate is delivered by haul truck along a gravel-surface road connecting the mining complex to the port. Concentrate is transported by an enclosed conveyor system from the CSBs to the pier and loaded onto the barges. The barges then carry the concentrate to ships anchored offshore for loading. Ships bringing supplies and material for the mine offload onto the barges, which deliver the supplies to shore. A fuel lighter barge makes periodic deliveries of diesel for generating power and fueling mining equipment. Approximately 150 personnel are employed at the port. Housing is provided on-site.

There are two principal wastewater treatment systems on-site. Domestic sewage is treated by a package (Zenon-brand) activated sludge wastewater treatment system (Zenon WTP). The Zenon WTP uses a rotating drum screen to remove large solids from the influent. An ISCO® automatic composite sampler collects influent samples from the discharge of the drum screen. Screened wastewater is pumped to the Zenon WTP proper, which consists of an anoxic tank, an aerobic tank, and a membrane filter for solids separation. Separated solids are pumped out once a year and deposited in the TSF at the mining complex. Filtered effluent is disinfected with ultraviolet light before it is discharged. An ISCO® automatic composite sampler collects effluent samples from the discharge line after disinfection. The Zenon WTP discharges treated effluent through outfall 001.

Stormwater runoff from the vicinity of the CSBs is captured in ditches surrounding the buildings and pumped to an ion exchange (IX) treatment plant (IX plant). The IX plant consists of three separate trains. Each train has two bag filters in series, followed by two ion exchange resin tanks, also operating in series. Samples are collected from the discharge line with an ISCO® automatic composite sampler. The treated effluent is discharged through outfall 005. The effluent streams from outfall 001 and outfall 005 are co-mingled and discharged into the Chukchi Sea.

FIELD ACTIVITIES SUMMARY

The inspection team arrived on-site the evening of August 23, 2021. A safety and COVID-19 protocol orientation was held that evening. The opening conference for the inspection was conducted on the morning of August 24, 2021. Credentials were presented to Michael Gonzales, tailings and water management superintendent, and Robert Napier, environmental team lead. Red Dog personnel provided an overview of the facility and operations. A walking tour was conducted of the WTP 2, WTP 1, and the RO system. A helicopter tour was taken to observe the stream monitoring locations required by permit No. AK0038652. On August 26, 2021, the inspection team drove from the mine complex to the port. The inspection team visually inspected the Zenon WTP, the IX plant, and the area around the CSBs. On the return, the inspection team observed conditions at the stream crossings along the haul road between the mine complex and the port. The inspection team interviewed facility environmental personnel and treatment system operators. Documents related to the APDES permits, permit applications, monitoring reports, and operating reports were reviewed on-site. Additional documents were provided by Red Dog for review after the field inspection was completed. A closing conference was held on August 27, 2021. The inspection team continued reviewing documents and discussed remaining issues with facility personnel during the morning of August 28, 2021 and departed the site that evening.

INVESTIGATION OBSERVATIONS

NEIC identified the following observations during the CWA compliance inspection. The inspection team members discussed all observations with facility representatives during the closeout meeting unless otherwise noted in the observation description.

These observations are not final compliance determinations. EPA Region 10 will make the final compliance determinations based on its review of this report and other technical, regulatory, and facility information.

Observation: 1
Observation Summary: Red Dog was not collecting a grab sample for pH monitoring at outfall 005 at the port facility.
Citation: APDES permit No. AK0040649, 1.3.1 Effluent Limitations and Monitoring for Outfall 005 – <i>The permittee must limit and monitor discharges from Outfall 005 as specified in Table 3. All figures represent maximum effluent limits unless otherwise indicated. The permittee must comply with the effluent limits in the tables at all times unless otherwise indicated, regardless of the frequency of monitoring or reporting required by other provisions of this permit.</i> APDES permit No. AK0040649, Appendix C, Definitions <i>Grab Sample – Means a single instantaneous sample collected at a particular place and time that represents the composition of wastewater only at that time and place.</i>
Evidence: Appendix D – October 1, 2021, Facility Email Re: pH Measurement from the Port IX Plant Appendix C – APDES Permit No. AK0040649
Description of Observation: Red Dog is required to monitor for pH once a day by collecting a grab sample at outfall 005 at the port facility and to report the results. Outfall 005 is the permitted compliance monitoring location for the discharge of treated effluent from the IX plant. A continuous pH meter is used to measure the pH of treated effluent from the IX plant. According to Michael Gonzales, tailings and water management superintendent, the pH monitoring result for outfall 005 is taken from a single reading from the continuous pH meter, as described below from an October 1, 2021, email (Appendix D). “Based on discussions with the operators. The pH meter is displaying instantaneous readings and during the first time the operators make their rounds, early at the start of the shift, they take a reading as part of their rounds. They can take multiple readings with multiple rounds throughout the day, but they always record the first reading on the paper work. It was noted that the times are not recorded, which is something we want to correct in the process.” Therefore, Red Dog was not collecting a grab sample for pH monitoring at outfall 005. The requirement to collect a grab sample is separate and distinct from the requirement to monitor by using a continuously recorded measurement. The Red Dog port facility permit does not include provisions for monitoring pH by using a continuously recorded measurement.

Observation: 2
Observation Summary: The automatic samplers for the Zenon WTP at the port facility were not set up to collect representative samples.
Citation: APDES permit No. AK0040649, Appendix A, Section 1.11.1. <i>Samples and measurements taken for the purpose of monitoring must be representative of the monitored activity.</i>
Evidence: Appendix A – Field Photographs Appendix C – APDES Permit No. AK0040649
Description of Observation: NEIC inspected the automatic samplers used to collect samples at the mine and the port facility. The samplers draw aliquots from the discharge through a flexible length of Teflon™ tubing. The tubing for the influent sampler for the Zenon WTP draws from the drum screen that screens the influent wastewater. The tubing is installed in a manner that causes it to bow between the drum screen and the sample. Water is retained within the bow and does not drain completely between sample aliquots. NEIC inspectors observed standing liquid in the tubing (Appendix A, photograph P8260024.jpg). The effluent sampler for the Zenon WTP draws from a port in the discharge line as it passes directly over the sampler (Appendix A, photograph P8260029.jpg). NEIC inspectors also observed standing water in the tubing, and the tubing showed evidence of attached solids and debris. The effluent sampler for the IX plant draws from a plastic bottle that receives continuous flow from a tap on the effluent discharge line (Appendix A, photograph P8260038.jpg). NEIC inspectors observed that the tubing was clean, but also had a bow in it that would obstruct water from draining out after the sample aliquot was collected. Inspectors observed standing water in the tubing. The APDES permit requires samples to be representative of the monitored activity. For representative samples to be collected with an automatic sampler, the sampler must draw from the discharge so that the aliquot only represents the discharge at the time the sample is drawn. To do this, the sample tubing must be free of standing water when the sample is collected. Therefore, the tubing must be installed in a manner to allow any water drawn into the tubing to drain freely once the sample has been collected. In addition, tubing should be free of solids so that any sample is not biased. This observation was discussed at the closing conference, and facility representatives indicated they would correct the installation issue.
Observation: 3
Observation Summary: The biochemical oxygen demand (BOD) and total suspended (TSS) loading results for outfall 001 at the Red Dog port facility were not correctly calculated and reported during May, June, and July 2021.
Citation: APDES permit No. AK0040649, 1.2.1 Effluent Limitations and Monitoring for Outfall 001 – <i>The permittee must limit and monitor discharges from Outfall 001 as specified in Table 2. Outfall 001 discharges treated domestic wastewater. All figures represent maximum effluent limits unless otherwise indicated. The permittee must comply with the effluent limits in the tables at all times unless otherwise indicated, regardless of the frequency of monitoring or reporting required by other provisions of this permit.</i>
Evidence:

Observation: 3**Appendix C** – APDES Permit No. AK0040649**Appendix E** – Red Dog Port Discharge Monitoring Report Calculation Spreadsheet**Description of Observation:**

Red Dog is required to monitor for BOD and TSS once a month at outfall 001 at the port facility and report both concentration and loading (in pounds per day [lbs/day]) results. Red Dog uses a spreadsheet to calculate the BOD and TSS loading results using a formula of multiplying the flow rate (in million gallons per day [MGD]) by the concentration result (in milligrams per liter [mg/L]) by a conversion factor of 8.34. While reviewing how Red Dog prepares discharge monitoring reports, NEIC inspectors observed that, in some instances, the flow rate used in the loading calculation in Red Dog's spreadsheet was taken from the wrong date. Red Dog used an incorrect flow rate to calculate BOD and TSS loading results during May, June, and July 2021. The table below summarizes the reporting discrepancies. The spreadsheet error resulted in a negligible difference in May 2021 and overreporting by Red Dog in June and July 2021. This observation was discussed during the inspection and was corrected by the facility.

Incorrect Flow Rate and Date (MGD)	Correct Flow Rate and Date (MGD)	BOD Concentration Result (mg/L)	TSS Concentration Result (mg/L)	Reported BOD Loading (lbs/day)	Correct BOD Loading (lbs/day)	Reported TSS Loading (lbs/day)	Correct TSS Loading (lbs/day)
0.00371 5/3/2021	0.00388 5/4/2021	2.0	1.2	0.06	0.06	0.04	0.04
0.005766 6/7/2021	0.003969 6/8/2021	2.0	1.0	0.10	0.07	0.05	0.03
0.007144 7/12/2021	0.005512 7/13/2021	2.2	1.0	0.13	0.10	0.06	0.05