

## Appendix A18

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*B. Townsend, M. Cerpak, M. Keenihan, M. Nelson, "DENR  
Underground Inspection Report", June 13, 2003*

## **HOMESTAKE UNDERGROUND INSPECTION**

**June 13, 2003**

### **Executive Summary**

On June 13, 2003, DENR staff inspected portions of the Homestake Underground Mine. This was a continuation of the underground mine inspections conducted May 28 and June 6 to determine whether Homestake has done what it said it would do in preparation for mine closure, and whether mine closure activities comply with environmental laws.

The inspectors did not look specifically at mine geochemistry issues during the inspections, although they collected water samples that will provide additional information on the quality of water in the various mine workings. Department and Homestake personnel continue to discuss ongoing modeling of ground water quality that may occur following closure and flooding of the underground mine.

The focus of the June 13 inspection was the upper portion of the mine. A previous underground inspection on May 28 concentrated on the lower mine levels. On June 6, 2003, a follow-up inspection was conducted to complete inspections on the 7850 and 8000 Levels. On June 10, Homestake shut off the mine pumps on the 8000 Level and the lower part of the mine began to flood, ending the ability to inspect the lower part of the mine. The June 13 inspection was conducted in parts of the mine not affected by mine flooding.

The inspections targeted fuel storage areas, maintenance shops, electrical substations, abandoned equipment, backfilled mine stopes and other areas where water samples could be collected. The inspectors checked for substances of concern, including petroleum products, solvents, chemicals, explosives, etc.

The inspectors began the June 13 inspection on the 1700 Level and walked down the 7 Ledge ramp system to the 2000 Level, inspecting mine areas along the way. The inspectors then rode the Ross Shaft to the 3800 Level and walked down the 9 and 11 Ledge ramp system to the 4100 Level. Although the inspectors looked at both upper and lower levels of the underground mine over the course of the May 28, June 6, and June 13 inspections, they covered only a small portion of the underground mine.

Based on the May 28, June 6, and June 13 observations, and the document review conducted on May 29, the inspectors believe the quality of the closure work is adequate. Homestake has followed its internal mine closure protocols, and the closure work observed was consistent among the areas inspected. The inspectors observed only small quantities of potential

contaminants related to mine equipment and infrastructure; primarily oil and grease residues and a slight sheen on water accumulating in one fuel storage area. The inspectors noted white and reddish precipitates in underground mine areas during this inspection. The inspectors believe these precipitates are primarily calcium carbonate, magnesium sulfate, gypsum, and iron hydroxides. The potential for these precipitates to be future sources of contaminants to surface or ground water is currently being evaluated.

Based on the information obtained during the inspections and the paucity of safe accessible mine workings at the current time, the inspectors believe additional inspections of the underground mine areas should not be completed.

Homestake plans to close the entire underground mine by June 27, 2003. No one would be allowed to enter the mine after that date.

## Inspection Report

**Operator:** Homestake Mining Company  
**Project:** Homestake Underground Mine Inspection  
**DENR Inspectors:** Bob Townsend, Mike Cepak, Mark Keenihan, and Mark Nelson (Minerals and Mining Program)  
Don Rosowitz (Ground Water Quality Program)  
Jon Epp (Surface Water Quality Program)  
Kevin Christensen (Waste Management Program)  
**Operators Present:** Karl Burke, Steve Mitchell, Tom Regan, Matt Zietlow, and Todd Duex  
**Inspection Date:** June 13, 2003

At 6:30 a.m. MDT, on Friday, June 13, 2003, the DENR inspectors arrived at Homestake's Yates Mine Office. The inspectors met with Donna Smith, a reporter from the Black Hills Pioneer, and provided information on the underground inspection. After completion of safety training by two inspection team members and preparation of field gear, the inspectors proceeded to the Ross Dry. At 7:40 a.m., the inspectors went underground at the Ross Shaft with Burke, Mitchell, and Regan of Homestake. The inspectors began this inspection on the 1700 Level and walked down the 7 Ledge ramp system to the 2000 Level, inspecting mine areas along the way. The inspectors then rode the Ross Shaft lift ("cage") to the 3800 Level and walked down the 9 and 11 Ledge ramp system to the 4100 Level.

### **1700 Level to 2000 Level, Ross Shaft Area - Closed Homestake Mine Areas Inspected**

9 Ledge, 7 Ledge, Main Ledge and Ellison S-Curve Drift Areas. The inspectors arrived on the 1700 Level at 7:40 a.m. MDT. The inspectors walked generally north through Main Ledge, the Ellison S-Curve, 7 Ledge, and 9 Ledge on the way to equipment shop areas in the 7 Ledge area. Homestake personnel pointed out the integrity of mine drifts in these upper areas remains in good condition overall, with only minimal rock spalling from the drift walls and ceiling.

Approximately 200 yards north of the Ross Shaft station, the inspectors performed field measurements of ditch water. The pH of the water was 8.2, and the temperature was 12.7 degrees C. Further along the drift, past a ventilation ("air") door another field sample of ditch water was taken that had a pH of 8.1 and a temperature of 11.9 degrees C.

In locations where water was seeping into the 1700 level drift, secondary calcium carbonate stalactites were observed. It was noted that in Main Ledge, stalactites were present in wet areas, and that they decreased in abundance towards 7 and 9 Ledges. These features were not observed in other areas of the mine. The stalactites range from <1 inch to several inches in length. The mineral textures indicate that the stalactites formed in the drift since it was constructed. One area of calcium carbonate flowstone was observed and is shown in Figure 1, although this photo is not representative of the overall quantity of calcium carbonate in the drift. As calcium carbonate precipitates were extensive in some areas, the inspectors discussed with Homestake personnel the buffering capacity they may provide to counteract potential acid mine drainage. Homestake personnel also pointed out that ballast rock used for laying the railroad track in many of the mine areas consists of crushed limestone, adding additional potential buffering capacity.



Photo 1. 1700 Level, Main Ledge, calcium carbonate flow stone.

In Main Ledge near the Ellison Shaft, after the Yates “Y”, water in the drift was field tested and had a pH of 7.1, temperature of 10.8 degrees C, and an electrical conductivity of over 2000 uS/cm. A sample of red iron hydroxide precipitate was taken in this area. Iron hydroxide precipitates may sequester arsenic and other potential contaminants in a form which can re-dissolve based on the oxidation-reduction potential and pH of the water. As these conditions will change once mine ventilation ceases, the precipitates are a potential contaminant source. Additional evaluation is in progress. The field paste pH of the precipitate was 7.4.



Photo 2. 1700 Level, Main Ledge, near Ellison, red precipitate.

Abandoned infrastructure observed in these areas consisted primarily of narrow-gauge railroad tracks and ties, air lines, and water lines. The inspectors also noted electrical junction boxes, air-handling equipment, wood stoping, sand pumping equipment, empty explosive storage areas, dry transformer pads, and rock chutes abandoned in these areas. The inspectors observed a large 125 HP, four-foot diameter ventilation booster fan abandoned in place in the Ellison S-Curves area, and noted this fan still turned freely on its bearings. Homestake personnel said this fan had sealed bearings that contained minimal quantities of lubricant.

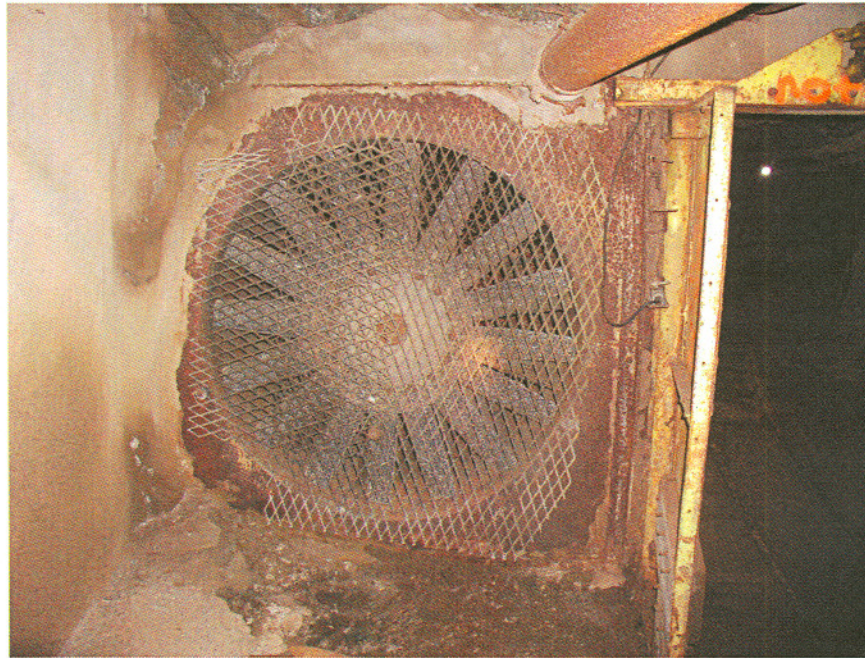


Photo 3. 1700 Level, near Ellison S-Curves, 125 HP booster fan abandoned in place.

After processing the ore for gold recovery, Homestake historically backfilled mine stopes with tailings, commonly referred to as “sand.” The inspectors observed both older wood timber and newer concrete block sand backfill retaining walls. The faces of the concrete block retaining walls are typically covered with a “shotcrete” cement grout material to reduce air infiltration into the backfill areas as a fire prevention measure.

Along the drift to South 9 Ledge, at 26 crosscut, a paste pH was taken of a sand spill. The sand had a paste pH of 7.2.

At 8:30 a.m. MDT, the inspectors observed a concrete pad abandoned in place at a dry transformer location in the 7 Ledge 46 Crosscut area. Homestake removed the transformer during closure work, and abandoned the concrete pad in place, as this location did not use PCB-containing transformers. The inspectors observed signs posted at several locations noting the areas had been inspected and were ready for closure.

1700 Level, 7 Ledge Fuel Storage Area. After walking through the areas noted above, we arrived at the equipment shop and fuel storage areas in the 1700 Level, 7 Ledge area, nearly one mile

from the Ross shaft. The inspectors looked at this area to assess whether Homestake cleaned mine areas at further distances from shafts as thoroughly as areas close to the shafts. The inspectors noted the work practices appeared consistent throughout the areas observed.

Homestake personnel reported this Fuel Storage Area (FSA) required extensive cleaning work during closure because Homestake used it for a long time. They removed the FSA door, concrete pad, and expanded metal floor grating, and mucked approximately 60 tons of loose, contaminated rock from the FSA with a loader. They placed the excavated material into ore cars and removed it from the mine for management at a petroleum contaminated soil landfarm. Homestake personnel said the company managed all contaminated rocks and soils at the Rapid City landfarm or a permitted landfarm in Wyoming. After removal of the contaminated materials, Homestake personnel placed clay-based absorbent onto the floor areas to collect remaining residues and repeated this process until observations indicated they were no longer removing visual contamination. They left Spill Shark™ petroleum-based spill absorbent on the floor of this area after closure. Only a slightly noticeable petroleum odor was present during the inspection. The floor areas appeared stained, but observations indicated the cleaning operations had been thorough. There was no water accumulating on the floor of this area. Homestake personnel verified this fuel storage area did not have a permanent diesel fuel tank, but used a railcar-mounted tank that was removed from the mine during the closure work. A closure sign posted at the entrance indicated Tom Regan inspected this FSA on February 22, 2002, and conducted a subsequent quality assurance inspection with Ron Waterland (Homestake employee) on November 21, 2002.

1700 Level, 7 Ledge Load-Haul-Dump (LHD) Shop. The inspectors noted Homestake had thoroughly cleaned this shop area during closure work. Homestake personnel reported they removed oils and solvents from the shop area, steam-cleaned the shop floor, applied absorbent to the floor, and then swept the absorbent up to remove any remaining residues. There was not a holding tank floor sump in this shop area. Homestake had removed most materials from this shop area, and the remaining materials were primarily pieces of fabricated steel. The inspectors noted Homestake abandoned a three yard Wagner LHD chassis in this shop area. Observations verified Homestake personnel had removed the engine, transmission, hydraulic hoses, radiator, and other components that typically contained fluids. The hydraulic oil reservoir was empty and had absorbent placed inside the reservoir. The inspectors were also able to verify oil had been removed from the axle and the drain plug was left open. No oil residue had accumulated below the removed plug, indicating company personnel had done a thorough job of removing the oil.



Photo 4. 1700 Level, 7 Ledge LHD shop, 3-yard Wagner LHD chassis abandoned in place.

In drift areas adjacent to this LHD shop, the inspectors noted abandoned electrical equipment, a locomotive battery charger, timber cribs shoring up ceiling areas, a rock chute to the 3000 Level, an abandoned LHD boom, an abandoned “boss buggy” (or man car), a transformer core (dry core type), and quite a bit of steel pipe, rock bolts, and drill stem.



Photo 5. 1700 Level, 7 Ledge LHD shop, “Boss Buggy” chassis abandoned in place.





Photo 6. 1700 Level, 7 Ledge shop area, dry core transformer abandoned in place. Note cribbing for roof support.

7 Ledge Ramp from 1700 to 2000 Levels. At 9:05 a.m. MDT, after inspecting the 1700 Level shop areas, we walked the 7 Ledge ramp system down to the 2000 Level. We observed numerous backfilled stopes and crosscuts along the way, and an abandoned ore raise grizzly.

A water sample was collected at an old sandwall in 7 Ledge on the 1850 Level. A field check of the water indicated a pH of 7.2, temperature of 13.8 degrees C, and an electrical conductivity of over 2000 uS/cm. The water sample was from a puddle that appeared to result from water draining out of the backfilled area. The puddle had dark red to orange iron hydroxide precipitates in the sampled area. Tailings in the 51-54C 7 Ledge 1850 Level were also sampled. The sample results indicate that this water is very high in sulfate and total dissolved solids (TDS). The very high TDS concentration in the water is compatible with the hypothesis that the water had interacted with backfilled tailings.

Below the 1850 Level, on the ramp below a borehole grizzly, a field check of the water indicated a pH of 7.3, temperature of 14.4 degrees C, and an electrical conductivity of over 2000 uS/cm.

2000 Level. We arrived on the 2000 Level at 9:40 a.m. MDT. We observed an abandoned concrete pad, office or “doghouse”, electrical equipment, and an empty trash can near the ramp bottom. The phone still worked in the doghouse.

A field check of ditch water at the bottom of the ramp indicated a pH of 7.6, temperature of 15.5 degrees C, and an electrical conductivity of 1010 uS/cm. A water sample was also collected at this location. Mr. Reagan informed the inspectors that the origin of this water was primarily water from the surface that infiltrated into the mine and was being diverted through the ditch towards the mine sumps. The chemical analysis of this sample shows the water contains approximately an order of magnitude (10 times) less sulfate and TDS than the previous sample.

We then proceeded to the Ross Shaft area of the 2000 Level. Along the way, we walked through a section of mine drift where six to 10 inches of water had accumulated on the floor. Homestake personnel said they were working to remove this water from the mine and that it might be related to infiltration of recent surface rains. The inspectors observed water flowing from an opened pipe and estimated the flow at about 20 gallons per minute. In another area a significant volume of water was passing through a drill hole to the next level below.

After leaving this area, the inspectors observed a concrete switch gear pad. Homestake personnel said this location might have previously housed a dry core transformer. The inspectors noted railroad track ballast in this area was crushed limestone. We observed abandoned three ton Granby ore cars on track in the 2000 Level Ellison access drift entrance. A field check of ditch water done at this location indicated a pH of 7.4, temperature of 15.9 degrees C, and an electrical conductivity of 947 uS/cm.



Photo 7. 2000 Level, 9 Ledge drift, limestone track ballast.

Homestake had posted a sign at the Ellison access entrance that said to check water levels in the 1700 Level #2 Air Raise before entering this area. The inspectors did not enter the Ellison access drift, but continued to the Ross lift area. After the Ellison drift, we observed another location where water was draining into the drift through a pipe. We estimated this flow at 10 to 20 gallons per minute. At 10:15 a.m. MDT, we arrived at the Ross Shaft area and looked at the shaft station infrastructure. A jug partially filled with oil was found in this area by one of the Homestake personnel. The jug was moved to the shaft station and tagged for removal by Tom Regan. Homestake staff indicated this area had not undergone final closure yet, so it was not representative of the final closure condition. Homestake personnel also moved some ore car Granby wheels with grease residues to the shaft station for removal.

A field check of water in the Ross Pipe Drift near the shaft station indicated a pH of 7.9, temperature of 15.3 degrees C, and an electrical conductivity of over 2000 uS/cm. A sample of this water was also collected. Mr. Mitchell told the inspectors that this water drains from several mine levels above. The chemical analysis of this water indicates that the water has very high TDS and sulfate concentrations of similar magnitude to the first sample collected from water that had flowed through backfilled tailings.

We then rode the shaft cage to the 3800 Level.

### **3800 Level to 4100 Level, Ross Shaft Area - Closed Homestake Mine Areas Inspected**

3800 Level Drift Areas. We arrived on the 3800 Level at 10:31 a.m. MDT, and walked generally south to the 9 and 11 Ledge areas to inspect shop areas on this level. The 3800 Level was noticeably warmer and seemed more humid than the levels above. In the drift on the way to the shop areas, we observed a water collection sump, abandoned rock chute infrastructure, and an abandoned 30-ton refrigeration unit location that Homestake abandoned after removal of the refrigeration equipment. These areas were closed in a manner comparable to similar mine areas observed previously.

2 Crosscut South 9 Ledge 3800 Level Backfilled Drift. In the drift on the way to the shop areas, we observed a backfilled stope that had water running from it. There was a large accumulation of iron hydroxide precipitates in the area where the water entered the drift (photo 8). Homestake personnel said this backfilled drift was the location where a fire started in a backfilled timber stope that they flooded to extinguish the fire. The inspectors collected a sample of water and precipitates at this location.

A field parameters of the water indicated a pH of 6.6, temperature of 25.9 degrees C, and an electrical conductivity of over 2000 uS/cm. The laboratory analysis indicates that water had very high TDS and sulfate concentrations similar to previous water samples that had interacted with mine rock. As a result of low flow rates and the large accumulation of iron hydroxide precipitates, the water sample contained a large quantity of suspended solids estimated at 2.4%. The total digestion of this sample (including the suspended solids) resulted in an extremely high arsenic concentration of 8.128 mg/l and a mercury concentration of 0.004 mg/l. Arsenic in the dissolved fraction of the sample was much lower and in the range previously observed in mine waters. This suggests that the precipitates contain both arsenic and mercury that had migrated from the backfilled timber stope and had coprecipitated or adsorbed to iron hydroxide forming in the oxidizing conditions of the ventilated drift. A solid sample of the precipitates was also collected and will be analyzed to test this hypothesis.



Photo 8. Iron hydroxide precipitates present where water was draining from flooded timber stope.

Near the backfill retaining wall were located several ore passes that extend to the next level above. Water was clearly draining through the ore passes. Steve Mitchell explained that all of this moving water is one of the reasons Homestake is concerned about trying to maintain the mine for the lab. He said when the mine was operating, there were always people moving around in the mine who could routinely check to make sure that there was no blockage of water flow. Mr. Mitchell said it is not uncommon for these ore passes to plug off with rock spalling from the walls of the ore pass. When that occurs, water can back up behind the blockage. If the blockage then fails, a column of water up to 150 feet high will gush through the pass and into the drift and create a catastrophic situation. This is a major personal injury liability concern.

At 6 crosscut South 9 Ledge another field check of ditch water was done that indicated a pH of 7.3 and a temperature of 25.9 degrees C.

3800 Level Motorbarn and Fuel Storage Area. After walking through the areas noted above, we arrived at the 3800 Level motorbarn and fuel storage area. All the tires in a tire storage area had been removed. Storage bins and racks were still in place. The inspectors noted this FSA had water accumulating on the floor and this water had a visible sheen on the surface. Homestake personnel said they had cleaned this area twice previously, the initial closure cleaning and an additional cleaning when they noted a sheen similar to the one we observed. Homestake personnel said they would return and clean this area again because of the observed sheen. The inspectors did not collect a sample from this area because the presence of Spill Shark absorbent in this area would preclude laboratory testing for petroleum hydrocarbons, as noted during lab testing of a FSA sample collected during the May 28 inspection. The inspectors noted that, with the exception of the visible sheen on the water surface, the condition of this area appeared consistent with the final closure condition of the other fuel storage areas observed. The inspectors noted a slightly stronger petroleum odor in this area compared to previous locations.

Homestake personnel verified this fuel storage area did not have a permanent diesel fuel tank, but used a railcar-mounted tank that was removed from the mine during the closure work.



Photo 9. 3800 Level Fuel Storage area. Note Spill Shark absorbent has been liberally applied.

Ramp Areas from to 3800 to 4100 Levels. After inspecting the 3800 Level, we walked the 9 and 11 Ledge ramp system down to the 4100 Level. We observed numerous timber and concrete block backfilled stopes and crosscuts along the way. On the 3950 Level we saw an ore dump area and an ore car and shop area with empty metal shelving, abandoned unused rockbolts, abandoned electrical supplies, abandoned wood and metal wire spools. On the ramp system below the 3950 Level we saw three abandoned pallets of concrete block, a pipe storage area, an empty explosives magazine, and an abandoned grout machine used for cable bolt placement. These areas were abandoned in a manner comparable to similar mine areas observed previously.

A water sample was collected from a sump along the ramp just below the 3950 Level. A field check of this sump water indicated a pH of 7.9, temperature of 22 degrees C, and an electrical conductivity of over 2000 uS/cm.

4100 Level LHD Shop. This shop was near the old 2 – 8D II Ledge 4100 mechanized cut and fill stope. The inspectors noted Homestake had thoroughly cleaned this shop area during closure work. There was not a holding tank floor sump in the shop area. Homestake had removed most materials from this shop area, and the remaining materials were primarily pieces of fabricated steel. The inspectors noted Homestake abandoned a three yard Wagner LHD chassis in the shop area. Observations verified Homestake personnel had removed the engine, transmission, hydraulic hoses, radiator, and other components that typically contained fluids. The hydraulic oil reservoir was empty and absorbent had been placed inside the reservoir.



Photo 9. 4100 11 Ledge LHD Shop. Three yard LHD chassis abandoned in place.

At this point, we returned to the Ross Shaft area on the 4100 Level to exit the mine. On the way to the Ross shaft area, we collected water samples at the 4100 Level 11 Ledge, where mine water was flowing from an open pipe. A field check of this water indicated a pH of 7.9, temperature of 22.1 degrees C, and an electrical conductivity of over 2000 uS/cm.

We arrived at the Ross shaft at 12:02 p.m. MDT, and observed some abandoned flat rail cars and man cars. Because the phone system was not working, Homestake personnel alerted the lift operator of our presence by using the horn signal system. The lift then picked us up and we returned to the surface via the Ross Shaft. We arrived back on the surface at the Ross Dry at 12:20 p.m. MDT.

At 1:10 p.m. MDT, the inspectors held a closeout meeting with Homestake personnel. In addition to Burke, Mitchell and Regan, Todd Duex and Matt Zietlow also attended. Homestake personnel said they would return to the 3800 Level FSA to conduct additional closure work because of the sheen observed on the water surface. The inspectors and Homestake personnel discussed the closure work observed, and the inspectors noted the quality of the closure work appeared adequate and was consistent with the areas inspected on May 28 and June 6. We left the site at 1:45 p.m. MDT.

Water chemistry data for samples collected during this inspection as well as the May 28 and June 6 inspections will be included in a separate mine water quality report.

## Conclusions and Findings

Although the DENR inspectors covered only a small part of the mine, it was sufficient to determine Homestake was making a conscientious effort to properly close the mine. The inspection was done for two purposes:

- To determine whether Homestake has done what it said it would do in preparation for mine closure; and
- To determine whether Homestake's mine closure activities comply with environmental law.

During the June 13 underground inspection, DENR personnel noted the presence of a sheen on water accumulating in the 3800 Level Fuel Storage Area. Homestake personnel said they cleaned this area again after the initial closure cleaning because they noted a sheen similar to the one the inspectors observed. Homestake personnel said they would return to clean this area again because of the observed sheen. The inspectors surmise this recontamination occurs because small quantities of petroleum product present in small fractures in the floor of the fuel storage area continue to slowly emerge from the fractures. Therefore, it is possible other fuel storage areas will yield a similar condition when the mine begins to flood. However, the inspectors noted the minimal quantity of sheen present did not appear to indicate the presence of significant quantities of petroleum product and the inspection observations indicated Homestake had done a thorough job in cleaning these areas during closure work.

Based on the inspections and document reviews completed to date, it is the opinion of the DENR inspectors that Homestake is following its internal protocol for the underground mine closure, and that the closure activities observed appear to be adequate. The inspectors found the quality of the closure work was consistent among the areas inspected on May 28, June 6, and June 13. Only small quantities of potential contaminants related to mining equipment and fuel storage were noted, such as fuel, oil, and grease residues. The closure work conducted by Homestake is also well documented. Homestake has assembled an extensive database system of spreadsheets, photographs, and paperwork documentation of the mine closure work.

The inspectors did not look specifically for potential contaminants related to backfilled tailings or other mine rock geochemical issues, although some water samples were taken that may provide information on ground water quality and water draining from mine workings. Department personnel are continuing discussions with Homestake personnel and contractors regarding ongoing modeling of the ground water quality that may occur following closure of the underground mine.