

Groundwater Pollution at the Partially Reclaimed Flambeau Mine

A Summary of the Chambers & Zamzow Report ¹ Provided by Wisconsin Resources Protection Council - June 2009

Flambeau Mining Company (FMC), a subsidiary of Kennecott Minerals of Salt Lake City, Utah constructed an open pit copper sulfide mine on the banks of the Flambeau River near Ladysmith, Wisconsin in the mid 1990s. The river formed the western boundary of the project area, and the pit itself was constructed to within 150 feet of the river. The Flambeau Mine was operational for four years. It ceased production in 1997 and has since been partially reclaimed.

In 1991 (prior to ore production) FMC began submitting surface and groundwater quality data to the Wisconsin Department of Natural Resources (WDNR) on a regular basis in an effort to track potential mine impacts on water resources. Data collection continued through the mining years (1993-1997) and continues to this day.

Dr. David Chambers and Dr. Kendra Zamzow of the Center for Science in Public Participation (Bozeman, Montana) did an independent analysis of FMC's water quality data for the Wisconsin Resources Protection Council (WRPC). They identified two areas of concern with regard to contamination of water coming from the partially reclaimed Flambeau mine site: ²

First (surface water): Contaminated water from a pond designed to collect runoff from the mine site is draining into a small creek known as Stream C. This water does not meet Wisconsin **surface water** quality standards and is flowing into the Flambeau River.

Second (groundwater): **Groundwater in a monitoring well between the pit and the Flambeau River** (on the Flambeau River side of a man-made slurry wall designed to separate pit water from the river) **does not meet Wisconsin groundwater quality standards.**

As summarized in the Chambers & Zamzow Report: *[In surface water] copper contamination in excess of Wisconsin water quality standards is reaching the Flambeau River from the Flambeau mine site, and [in groundwater] the Flambeau pit is leaching contaminants that exceed Wisconsin groundwater quality standards to beyond the slurry wall designed to separate pit water from the Flambeau River.*³

This summary outlines Chambers and Zamzow's findings with regard to groundwater pollution at the Flambeau Mine site; a separate summary is provided for surface water pollution.

To view the Chambers & Zamzow Report in its entirety, please go the WRPC web page: www.wrpc.net

GROUNDWATER POLLUTION: As described by Chambers and Zamzow in their report:

The Flambeau Mine ... yielded 181,000 tons of copper, 334,000 ounces of gold and 3.3 million ounces of silver over the mine's brief four-year lifespan. Approximately 4.5 million tons of waste rock characterized as "high sulfur" and 4 million tons of "low sulfur" waste were generated and stockpiled on site for eventual return to the pit.

*When mine operations ceased in 1997, the open pit was 220 feet deep, a half mile long and 32 acres in size. Backfill operations commenced promptly, and over 30,000 tons of limestone was blended into the sulfide-bearing waste rock ... groundwater has infiltrated the backfilled pit, and the combination of neutralizing limestone and submergence of the [waste rock] in water ... is meant to slow the generation of acid and dissolution of metals in this material to an acceptable amount. ... It is not known how limestone will perform over the long term.*⁴

So did the technique used by Flambeau Mining Company (FMC) by which limestone was blended with the waste rock to decrease groundwater pollution in the pit actually work? As described by Chambers and Zamzow:

*To monitor pit chemistry, two pit monitoring well nests ... were constructed in September 1998 after the backfill had roughly a year to settle. ... Sampling has indicated and continues to indicate that pit chemistry reactions have not stabilized. ... Original modeling [done by FMC] predicted concentrations of manganese, iron and copper exiting the pit [and moving toward the Flambeau River] would be near background concentrations early on. **In the case of manganese, and occasionally iron and copper, this has not proven to be the case.***⁵

So how high have the metal levels in the pit gone? And how much higher are they than what FMC predicted? Chambers and Zamzow include a series of tables in their report that show the levels of copper, manganese, and iron reported by FMC in groundwater within the backfilled pit between 1999 and 2008.⁶ FMC's own data shows that manganese levels in one of the pit monitoring wells (MW-1013B, which is 86 feet deep and about 600 feet from the Flambeau River) exceeded the company's prediction by a factor of 75 (See Figure).⁷

Is the contaminated water in the backfilled pit moving into the Flambeau River? According to Chambers and Zamzow, the answer appears to be "Yes." They cite FMC's own report, in which the company stated that: "groundwater flowing through thepit will exit....through the [fractured] rock in the river pillar and flow directly into the bed of the Flambeau River.....Since there will be no dispersion, dilution or retardation in the river pillar, the concentrations of these constituents in the groundwater leaving the pit will be the same as the concentrations entering the river bed."⁸

Chambers and Zamzow also point out that FMC constructed an underground "slurry wall" between the mine pit and river to try to limit the flow of water between the two, but that contaminated water from the pit has reached the other side of the wall. They state the following:

*Pit contaminants are moving out of the pit, as evidenced by concentrations of elements in the intervention boundary well MW-1000PR, located [about 125 feet from the Flambeau River] on the river side of the pit slurry wall. ... There have been consistent and statistically significant exceedances of 1991 Flambeau Mine permit standards for manganese, calcium, conductance and total dissolved solids; manganese exceeds standards by an order of magnitude.*⁹

Chambers and Zamzow include a summary table of FMC data in their report that shows the amount of manganese in this particular well, MW-1000PR.¹⁰ The data indicates that the permit standard has consistently been exceeded ever since the pit was backfilled in late 1997. Latest readings (October 2008) show the manganese level at about 5 times the permit standard. No fines have ever been imposed on FMC by the Wisconsin Department of Natural Resources for violating the permit standard.

Are there enough monitoring wells at the mine site to track what's happening to the groundwater? According to Chambers and Zamzow, the answer is "No." The authors explain: *The compliance boundary [established in the Mine Permit] marks the point where groundwater quality must be in compliance with the state's groundwater protection law.¹¹ ... Pit contaminants are moving out of the pit, as evidenced by concentrations of elements in [a] well located on the Flambeau River side of the pit slurry wall ... [but] currently there is only one monitoring well ... on the compliance boundary, which surrounds approximately 180 acres of the mine footprint. To ensure that contaminants are not crossing the compliance boundary, further monitoring wells, particularly in the direction contaminants are known to be moving, should be installed and monitored.*¹²

SUMMARY: Chambers and Zamzow conclude the following in their report:

Long term monitoring [of groundwater at the Flambeau Mine site] will determine whether permit violations continue to occur ... Since 1999, measured concentrations of manganese and iron in [a well located just 125 feet from the Flambeau River] have repeatedly been greater than the enforcement standards cited in the 1991 permit, and manganese significantly greater.

*... There appears to be insufficient monitoring to determine either the quantity of groundwater movement, the quantity of contamination entering the Flambeau River, and/or the groundwater contamination migrating toward the [mine's] groundwater compliance boundary.*¹³

References:

1. Report on Groundwater and Surface Water Contamination at the Flambeau Mine. David M Chambers, Ph.D.. Kendra Zamzow, Ph.D., Center for Science in Public Participation, June 5, 2009. To view the complete report, go to www.wrpc.net
2. *ibid*, p. 2
3. *ibid*, p. 16
4. *ibid*, p. 1
5. *ibid*, pp. 7, 10
6. *ibid*, pp. 25-27
7. *ibid*, p. 24
8. Foth & Van Dyke, 1989, Mining Permit Application, Vol. II, App. L, p. L29, as quoted in Chambers & Zamzow Report, p. 11
9. Chambers & Zamzow, pp. 11, 13
10. *ibid*, p. 28
11. *ibid*, p. 12
12. Recommendations for Changes to Groundwater, Surface Water, and Biomonitoring Specified in the Stipulation Monitoring Plan at the Flambeau Mine. David M Chambers, Ph.D., Kendra Zamzow, Ph.D., Ken Parejko, Ph.D., April 22, 2009, p. 3.
13. Chambers & Zamzow, pp. 15, 16