Besides hydraulic control of the well field to limit the potential for excursions, geochemical aspects of the aquifer(s) can provide mechanisms that attenuate the plume of lixiviant and and/or mobilized constituents of the aquifer. Mass balance considerations can be used to constrain the distance a plume can travel. As described in the GEIS, it is thought that the original ore front deposit was formed by the intrusion of an oxidized groundwater solution into an aquifer whose conditions were generally more reducing. The porous medium of the aquifer contained dispersed minerals with redox-sensitive elements in lower oxidation states. Uranium in its IV oxidation state is relatively insoluble. On oxidation to the VI state, the uranium solubility increases significantly. The result is that reduced uranium in the solid is converted to oxidized uranium that dissolves in the groundwater. The dissolved uranium is transported in the oxidized groundwater. As the oxidizing solution advanced through the aquifer, it reacted with reducing minerals, including those that contained uranium, which gradually depleted the intruding solution's oxidizing capacity. Eventually that capacity reaches a state at which the intruding solution could no longer efficiently mobilize uranium. It is at this location where the uranium minerals are concentrated as a result of the precipitation of dissolved uranium.

The roll front ore deposit formed millions of years ago. (ref) Their presence today suggests these features are relatively stable and processes that would tend to disperse the accumulation of ore has been ineffective.

The introduction of lixiviant containing unnaturally high concentrations of oxygen and carbonate is an effort to remobilize the front.