7-1 [Jones 3-9] A copper valve is used in the waste exit line from a pharmaceutical process reactor which is producing iodine-containing organics. The waste stream is composed of air-saturated 15% sulfuric acid with the following impurities: ferric sulfate, ferrous sulfate, potassium iodide and iodine. From the following electrochemical data, determine the corrosion rate of copper in this brew. Assume all Tafel constants to be 0.1.

\[
\begin{align*}
\text{Cu}^{2+} + 2e^- &= \text{Cu} : E = 0.350 \text{ v}, \ j_o = 10^{-4} \text{ A/cm}^2 \\
\text{H}^+ + e^- &= \text{H}_2 : E = 0.020 \text{ v}, \ j_o = 2 \times 10^{-7} \text{ A/cm}^2 \text{ [on Cu]} \\
& \quad i_{[\text{H}^+ \text{ to } \text{H}_2]} = 0.2 \text{ A/cm}^2, \ i_{[\text{H}_2 \text{ to } \text{H}^+]} = 10^{-4} \text{ A/cm}^2 \\
\text{Fe}^{3+} + e^- &= \text{Fe}^{2+} : E = 0.850 \text{ v}, \ j_o = 8 \times 10^{-5} \text{ A/cm}^2 \text{ [on Cu]} \\
& \quad i_{[\text{Fe}^{3+} \text{ to } \text{Fe}^{2+}]} = 6 \times 10^{-3} \text{ A/cm}^2, \ i_{[\text{Fe}^{2+} \text{ to } \text{Fe}^{3+}]} = 2 \times 10^{-4} \text{ A/cm}^2 \\
\text{I}_2 + 2e^- &= 2\text{I}^- : E = 0.430 \text{ v}, \ j_o = 10^{-3} \text{ A/cm}^2 \text{ [on Cu]} \\
& \quad i_{[\text{I}_2 \text{ to } \text{I}^-]} = 2 \times 10^{-3} \text{ A/cm}^2, \ i_{[\text{I}^- \text{ to } \text{I}_2]} = 2 \times 10^{-2} \text{ A/cm}^2
\end{align*}
\]