

[SQUEAKING]

[RUSTLING]

[CLICKING]

**RICHARD DE NEUFVILLE:** Now, the bidding process was two stages. There was a big penalty if you kept it but didn't develop it. Why would that be? Well, because what would happen is, a company might want to say, well, I will acquire the site, but then I'm a big copper company and I have assets elsewhere, I won't use it right away. I'll use my other assets and only use this one and spend the money to develop this particular project when it's worthwhile for me.

Now, the country that owned it, Peru, was not interested in that because they were interested in having the jobs. They were interested in having the exports. They were interested in having investment. So they wanted to be sure that the company that bid for it would, in fact, either develop it seriously or walk away from it if it turns out not to be geologically or, in terms of timing, to be interesting.

So the timeline was, you could explore the geology and the topography and the access and the technical aspects in phase 1, and in phase 2, you had to spend three years or more developing-- three years or less developing the project before getting your profits. So that's the timeline for it.

So in a decision and analytic point of view, a decision tree, if you won the bid, you had two years to explore. You could then walk away from it or, if that was your flexibility, you could decide it wasn't a good deal, or spend three years developing it and then produce metal or ore, and then metal for as long as you want until you closed them off. So the question of flexibility was to walk away.

This was flexibility on the system because at this level it didn't say whether you did anything to design the mine one way or the other. It was simply, is it worthwhile? Now, here's where the flexibility analysis came in and the simulation came in.

I've said to talk about that. So the system model was, so the NPV depended on a lot of things. It depended on the oil quality and quantity. Was it 2% copper or 1% copper? What other materials might be associated and how valuable might they be? What was the cost of mining? What was the price of metals once you got them out of the country and into the market? What's the price of copper?

They had the distribution of the key parameters. You had estimated ones on the technical cost model. Like, how is this factory going to work, this smelter going to work? You had to do something about the market data based upon history, but guessing in for the next 25 years.

You had to have expert judgment based upon the test boards that you might have going down a couple thousand feet through rock. You couldn't spend-- you couldn't drill that many. They cost about a million dollars apiece at least. But what did it all add up to? So you had a number of uncertainties to value of the outcomes of this process.

So here's a listing of the sources of uncertainty in terms of the mine's life. What happened? So there's the mine's life. In this case, they determined it was 20 years. Why was that? Well, at the discount rates that they're using, they figured out the value beyond 20 years didn't amount to very much, given the other uncertainties, so they didn't calculate out beyond that. They could easily have done it if they wanted to, but it didn't seem worthwhile.

You had the future prices of zinc and copper, particularly. That was done through a stochastic process. And a lattice analysis is a technical term used here for it. I won't explain this for now. Then there was the quantity of the ore, the cost and so on. These were all done by probability distributions and Monte Carlo simulations.

Now, just a side note on the historic copper prices in the past. And this is the-- well, somehow my footnote on this-- This is actually the price that was quoted in about a week ago. I had a footnote to say that right up here, but it seems to have disappeared. I'm sorry. And here is the prices.

And what happened in this particular case, it's illustrative that there was an event that occurred around here, which really was the commitment by China to build an enormous amount of things-- cities and apartment buildings and railroads and so forth consuming a lot of copper for electric wire and so forth. So then a huge jump in demand.

And there was a before and an after. So a simple analysis, everything that occurred over this time would not have been so appropriate. The question of whether this phenomenon will last forever, and maybe this will continue on at more or less this level or not, that's yet to be determined. But that's the situation with it. So looking at the more recent was the idea.

So the sources of uncertainty I've listed there. The simulation drew from the various distributions that happened. It can draw from all kinds of ones here. You had the probability distribution, selection of factors, the determination of each NPV. And you repeated this 2,000 or so times to get the NPV distribution.

And here is the results of it with no flexibility. That is, if you were committed to doing this, and you could not walk away from it, here is their assessment, or their view of the assessment, with a mean value of a half a billion dollars. But it could be loss of a billion dollars and could be a gain up here of as much as \$3 or \$4 billion if everything turned out the best. And so it was a very risky thing without the flexibility. So base case, no flexibility.

Now, I'm analyzing it with a flexibility, which meant if it's not looking good, we're going to walk away from it. You say, aha. If at the end of the two years it's not looking good, it means that we are not going to do it. So you walk away from it. We drop all of this, and we only look at the positive side, then it has a value of \$800 million. So you walk away in case it looks bad, it doesn't look profitable. So this analysis was done before they committed what the bid was. So it looks like it has a value of \$819 million.

So the rule here was, you only have one chance to walk away from it. You either do it and get the value, or you walk away from it. So having the flexibility changes your value from with the flexibility to without, the value of the flexibility is about a quarter of million dollars, 269 in terms of this analysis. And that's the value of the flexibility.

So now the question was, what do they bid for? And they have to now think about what the competition might do and so forth. What you bid for something is another aspect of it. But the value of the flexibility to abandon, that was the question, is an estimate of \$269 million. Going back, it is-- the values without it, taken away from the value with it, and left over the 269.