

purpose is to show the type of thinking and investigation and research and engineering that is going into the mining and development of oil shale.

There is just one other thing. The Secretary in his statement indicated that we had enough liquid petroleum reserves in this country to go on through the end of this century and I think he said at about the same cost. I placed in the record, and I have it in my hands here, the hearings of May 12, 1965, in which I inserted a statement and a record which shows that in this country our demand rate had increased in just a few years 47 percent more than our reserves increased. It is a fact that from the standpoint of national interest, the demand is increasing at a far greater rate than the reserves are increasing, and the costs of the new reserves being brought in are far more expensive than they have been in the past. Is that not so?

Mr. CAMERON. I believe that is so; yes, sir.

Senator ALLOTT. Thank you very much.

The CHAIRMAN. Senator Moss?

Senator MOSS. I am very interested in your personal testimony as well as the statement you read for us, Mr. Cameron. In this description of mining oil shale, which sounds very intriguing, I wonder if you have also done any experimental work on this *in situ* operation we have been referring to off and on here—attempting to extract the kerogen oil without taking the rock out?

Mr. CAMERON. Yes, sir; we have. We have studied *in situ* retorting for many years and my company is one of the participants among 25 in this cooperative effort between industry and Government to conduct a test using nuclear means of breaking up the shale.

Senator MOSS. Has there been any research and development on that done in Brazil where you have been working recently?

Mr. CAMERON. No research and development recently really. We have made studies of the possibilities of it and did not come up with any very good possibilities for *in situ* operation. I might say that I am somewhat skeptical of the possibility of developing an acceptable *in situ* method. When I say I am skeptical, this does not mean that I do not feel that a great amount of research should not be aimed at *in situ* methods, because it has obvious possibilities for being more advantageous than mining and retort. In my opinion the experience to date does not give us too much encouragement. One of the reasons for this definition—of wondering whether there is an acceptable method—would be the percentage of recovery of oil that might be obtained from an *in situ* method. I think that if we look at the recovery of oil from petroleum reservoirs and even with the best of methods in many reservoirs we cannot get more than 50 percent of the oil. In some reservoirs we can get more. But in many reservoirs we cannot get nearly half of the reserve that is there, and oil shale, as we see it now, looks even more difficult and possibly quite expensive.

Senator MOSS. What is your percentage of recovery on the removal of the rock in the crushing and retorting process?

Mr. CAMERON. I think that that method probably will ultimately remove a very high percentage. Being from Utah, you well know that out at the Utah copper pit, in the early stages this development was mined by one method in which high grade ores were recovered. As