

to use nuclear energy, but it is really in its infancy. We don't know yet what applications this will have.

Senator FANNIN. I understand the Kennecott project near Safford is one that has great hope.

Mr. UDALL. This is another that I had forgotten about. I should remember my own State first and I apologize to the Senator.

Senator FANNIN. Yesterday I was talking to Mr. Shenhope of the Atomic Energy Commission in Arizona. He was telling me about the program to open up caverns for water storage with atomic blasts. Have you done any work in that regard?

Mr. UDALL. Yes; there are two aspects of this that are promising with regard to using nuclear devices as a tool. The one you have described is in an area that is arid, where water is absolutely vital if you are going to carry on a mining operation because water is scarce, so you might be creating in effect an underground aquifer.

Another good example of the use of nuclear devices, and this is Project Bronco, would be where there is oil shale with a heavy overburden, 600 to 1,000 feet of overburden. You would have to have an enormous disturbance of the earth, more so even than with some of the great copper pits, in order to get down to the oil shale if you were going to mine it by open pit. With Project Bronco you could have what is called the *in situ* process where you would create great underground caverns and carry on your extraction by a fire method that would liberate the shale oil so that you could extract it and not disturb the surface at all. So nuclear energy may be tremendously helpful to us in that regard.

Senator FANNIN. It is also utilization of chemicals, is it not? I notice that they pump chemicals down and back up again and float them down.

Mr. UDALL. That is right.

Senator FANNIN. So in other words, they are doing it right on the spot rather than to remove the ore and then have to dispose of it in some other way. I know that near Tucson, the mines are landscaping to prevent mined areas from being an eyesore.

Mr. UDALL. Even in the desert country, as you and I know, if you try to work with nature you can make things grow and you can stabilize banks. There are some of these areas, and I think eastern Kentucky probably is one example, where the slopes are so steep and the damage that can be done to other resources is very great, that you might decide to go to a different type of mining or not to mine at all. Or you might try to develop new machinery and new techniques that would leave the surface undisturbed. I think the mining industry is challenged by all of this, as well as the industries that produce machines, and if we continue to see the sort of technological development that has come along in recent years, we may find more and more situations where mining doesn't greatly disturb the surface.

We may get it out cheaper and more efficiently some other way. I would hope so.

Senator FANNIN. But as I understand it is your desire to in every way possible encourage the States, and not have the Federal Government take over any program if the States adopt a satisfactory one?

Mr. UDALL. The approach that we have suggested in this legislation