

Senator Moss (continuing). Of *in situ* retorting.

Mr. KELLY. Let me say the nuclear explosion merely crushes the rock and the *in situ* retorting is an operation that follows the nuclear explosion.

Development of the retorting process is primarily being done by the Bureau of Mines.

Senator Moss. Would the same energy that fractures the rock and develops the chimney also furnish the heat that would extract the kerogen from the fractured rock?

Mr. KELLY. No, sir.

Senator Moss. That has to come in addition to this?

Mr. KELLY. There is tremendous heat released by the nuclear explosive. The temperatures are far too high for retorting and they are far too localized for retorting.

What probably would be done is to actually locate the explosive below the shale formation so that the heat energy would be expended in inert rock and allow the chimney to progress up through the shale and then to artificially, probably chemically or electrically, ignite the heavy carbon fractions and inject oxygen to sustain the combustion for retort.

Senator Moss. Thank you.

The Senator from Colorado.

Senator ALLOTT. I have two or three areas I would like to ask you about, Mr. Kelly, if I may.

The first relates to the formation in the Piceance area. It is my understanding, I am sure I am correct about this, that in the tests in that area, they have run across large amounts of water which are saturated with sodium bicarbonate or baking soda as it is ordinarily called.

Isn't it a fact that these are more susceptible than ordinary water to the absorption of nuclear activity?

Mr. KELLY. I don't know the answer to your question right off-hand. I don't know of any reason why they should be, but I think this is something I would have to ask one of our laboratory people about.

Senator ALLOTT. I wonder if you would do that?

Mr. KELLY. Yes, sir.

Senator ALLOTT. And supply a short statement for the record.  
(The information requested is printed on p. 71.)

Mr. KELLY. Yes, sir.

Senator ALLOTT. Assuming this is true—and I have been told that it is, that sodium particles are more apt to absorb the effects of radiation than ordinary water—but assuming this is true, have you considered the effect that such an explosion would have upon underground streams?

Mr. KELLY. Yes, we have. Let me go back to your question on the sodium a moment ago.

What you may have been referring to is the fact that sodium 24 is a highly radioactive substance and ordinary sodium, if bombarded by neutrons, would be artificially transformed into sodium 24 which is radioactive. If one fired a nuclear detonation in such water so that the neutrons reached the sodium in the water, you could artificially activate that sodium and make it radioactive.