Nerses (Krik) Krikorian in conversation with Sig Hecker

Los Alamos, February 1, 2017.

KK: Krik Krikorian; SH: Sig Hecker

SH: **Krik, you've been with the lab from the very early years. How did you get involved in the nuclear business in the first place?**

KK: Oh, it is easy. I went, believe it or not, to a Catholic university, because I could not afford to go to any other place. Niagara University in Niagara Falls in New York. We had a small uranium plant and my professor told me there's some interesting work going on there - he did not know what it was – but they are interested in scientists, chemistry majors, so why don't you go get interviewed. The people who were in charge of the Union Carbide Research Labs did the hiring. Well, they hired me to make high-purity uranium. So I started making high-purity uranium in Niagara Falls. I kept wondering about all these analytical methods for trace elements that I did not even know much about but we kept doing the analytical work. I could not figure out why these minute amounts of material were important until I got to Los Alamos. We were checking and analyzing and making high-purity uranium in quantities of pellets about 8 inches long and a couple of inches in diameter.

Then we boxed them and shipped them, and they shipped them in a peculiar way that did not make sense to me with all this wasted space. When I got to Los Alamos, in a few weeks' time I knew all the answers.

Nerses (Krik) Krikorian in his Los Alamos home

SH: **So you went from Niagara Falls directly to Los Alamos?**

KK: It was the Electro-metallurgical lab at Niagara Falls under the auspices of Union Carbide and we had a team of at least six technical people in the lab. It was a small operation, but we made a lot of uranium - high-purity stuff. We started with UF 4, reduced it with magnesium. Would you believe, to get samples, I would use the hack saw under a hood, to slice a piece of uranium.

SH: I believe it.

KK: Today they would kill you if you're that way, they would say you are unsafe. Here I am aged 96 and still alive from all that. This fear of radiation bothers the hell out of me. You live in it, you try to avoid it, and it surrounds you all the time.

SH: **So Krik, when did you come to Los Alamos?**

KK 1946. I stayed here, and guess what I was assigned to work with - polonium. Compared with the macro quantities of uranium, now I was in the micro world. What a drastic change, and somehow, I adapted to it, because that was a fundamental part of the nuclear weapons program. Because I made the initiators for the gun-type weapon particularly, I knew how many we were making and what was needed at that time.

SH: I remember meeting you – you were at that time, I think, in CMB-Division (Chemistry Metallurgy-Baker).

KK: CMB. First, CMR, then CMB-Division. Specifically, Group CMB-3. We then became the Nuclear Propulsion Chemistry Group. That was a beautiful thing because we had to start with cryogenic media and pump it thorough a reactor, and extract it at roughly 2500 degrees Centigrade to get a specific impulse we needed to propel the nuclear rocket – which we never did on a systems basis. All the components worked but we never tried it out as a system. We know we could put it together, but the DOE in 1972 killed that program. I say DOE, but it might have been a predecessor.

SH: In 1973, it still was AEC. In 1973, it changed from AEC to ERDA (Energy Research and Development Administration) and then to DOE in 1977.

KK: Those were the days. We were allowed to meander in science – as long as you were tied to programmatics one way or other, with a vision of what could be taking place five years later, they allowed you the freedom to meander into the areas of interest. I ended up making materials that were superconducting, but I was doing it in the high-temperature chemistry group that was making materials that would withstand hydrogen being pumped through it at 2500 degrees Centigrade without reacting with a container, and that was quite a challenge. And then, suddenly, Harold Agnew [Los Alamos director] decided he needed a Technology Assessment group, and I was sort of handpicked. I was one of maybe six people, Jane O'Neil was our secretary, Lara

Baker, an administrator, and few others, I've forgotten – oh, Johnny Russel, he was in charge of a gas reactor that we proposed. The AEC killed that program, but Johnny Russel started as a naval officer in explosives, and he was in charge of the gas propulsion reactor.

SH: **So you were doing technology assessments.**

KK: And we were allowed to roam. I became a generalist in that period. I had vision of how everything could fit together better than most, I suppose. Because later on it was explained to me, how did I put all of this together, because from the educational point of view, I was the least qualified. On the other hand, I could have a sense of creativity that let things come together. It worked! For some reason or other.

SH: **Krik, you were one of the very first laboratory people who developed relationships with the Russians. Particularly, you were friends with Vladimir Fortov already in the 80s?** [Vladimir E. Fortov was a brilliant young Soviet physicist, who several years ago became the president of the Russian Academy of Sciences.)

KK: It took years to develop the trust, the individual trust. If I would go back all the way, I guess to 1979 and 1980, when Fortov and a guy who was in charge of the Institute of High Pressures came down to Los Alamos from a conference in Colorado Springs. This was an outgrowth of an even earlier stuff when Al Graves in the 1950s was part of the negotiation team with the Soviets at the time. Al was among the first interaction guys, and Al was in charge of our testing program.

My friendship with Vladimir started because he was explaining something on the board and his cohort was trying to stifle him and I pointed out, you can't connect that to this, and he explained it to me in a way that made sense. So that friendship started and it existed ever since. He was a bright young guy, 25 years to the day younger than I am.

He has not been here in about, my guess is, 11 years. The last time he came, he met the director and they got together.

SH: **So 1979-80 that you mention was his first visit. I met him several times here after that.**

KK: And you've gotten to know him pretty well. But you guys, at a higher level, had it a lot easier because the avenues were open. When you are at a working level like me, you don't have that much freedom, there's always a restriction. The chances of making things happen are easier when you have the authority.

SH: Yes, that's true. But on the other hand, when I got to the higher end when I was Director and when I had a chance to deal with Fortov, the person I went to was you. I went back to the lower level, because you had a relationship that can't be bought.

KK: In other words, the door opened because of the contacts. The personal contacts at the lowly level opened doors at that time that you could never make happen today. We aren't allowing it. I don't know why. It may exist, but it does not exist in the same way.

SH: **You were one of the very early US lab visitors to the Russian weapons labs. Tell us how it happened**.

KK: In August of 1991 we received a Xerox from Fortov directly from Moscow. It was inviting me and my wife to Russia. At that time, I felt that things were changing. Jim Williams, a 3-star general who was on our Advisory Board, happened to be in my office, and he said, "is that directly to you?" Moscow yeah. But remember it started 1979 or 80, and we had been casually communicating over the years, so the thing was in the process. Jim looked at it and said, "I need a copy of that to take to Washington," which he did. At that point, when he said things were beginning to change, it registered with me. But back then, they didn't want anybody to go by themselves.

SH: Which was a good practice

KK: Yes, a good practice. So, we both got invited, and Pat looked at me and said, "You know, if you go in November or December, it's no place for me." You know, it was cold - 20 to - 17 for up to 17 days. That was November - December of 1991 when we [Danny Stillman of Los Alamos accompanied Krik] got there and for 17 days we visited almost 17 labs. The Russian Academy of Sciences had arranged these visits, first Chelyabinsk-70 (Snezhinsk) and then we came back to Moscow and went to Sarov. At that point, they were having abundant economic problems because of Gorbachev 1985-1986 perestroika. Through Nunn-Lugar we were able then to support and help, so that got things started. I remember my introduction to Belugin [Vladimir A. – director of VNIIEF] and the top people who were now out of the Soviet system into the Russian system. They asked Danny and me to look at the letterhead that they were going to use for the Russian Academy of Sciences after the collapse of the Soviet Academy. We got to know them and they got to trust us.

SH: **So how did Fortov get you into A-16 and C-70?**

KK This is a good question, Sig. He knew A.I. Pavlovsky [VNIIEF Academician who worked on pulsed power]. Pavlovsky did a lot of work dating back even earlier with Max Fowler. And right at this time he was Deputy Scientific Director. All of this was under Khariton [Yuli B. Khariton, Scientific Director], who was their equivalent of our Oppenheimer. And Yuli Khariton had been trained at Cambridge and spoke perfect English.

SH: **So, you met him of course when you went.**

KK: Oh yea, for two and half days side by side. But first we'd been to Snezhinsk. Avrorin [Academician Evgeny N. Avrorin] was scientific director at Snezhinsk. We went to Snezhinsk

first. As a matter of fact, Fortov met us at the airport. We were supposed to spend the night in Moscow. They were short of jet fuel, so they could not fly me to Chelyabinsk, or to Sverdlovsk. We took a ride through Moscow, it was snow and ice, and they brought us to the station and the train left shortly thereafter. Security people brought food, sausage, vodka, and sandwiches for the long ride to Snezhinsk in the Urals.

SH:The train? That's a long ride.

KK: The train. You talk about the scenery in Doctor Zhivago. I saw this scenery for real in Russia; it was pretty good. So we got there, and Avrorin walked us around the lake. Albert Vasiliev was a scientific escort who worked at Snezhinsk at the time. He showed up later on many occasions on the nuclear side.

Then we spent a few days there at Snezhinsk, and we flew back from Sverdlovsk to Moscow. You could see the striation in the social culture that dated back to the communist system even then, in 1991, because the beautiful airport room we were in wase beautifully paneled, and the people were sleeping in the halls, elsewhere in the same structure. We finally got back to Moscow, then from there to Sarov. It was an incredible trip, because they were totally open. For instance, the guy who picked up my bag to go to Sarov facility said I was the first foreigner he had ever met. I've forgotten his name now. The first place they opened up was the statue of Saint Seraphim Sarovsky. They had taken a holy site and converted it into a science center for nuclear. We got there, and we met with Khariton, and he was with us for two and half days, side by side, and he narrated his version of the history. It must have been early December of 1991, because the following February we had them here [at Los Alamos] and you guys visited their place. It was even before Secretary of State James Baker even got to Snezhinsk. Danny and I were already there.

SH: Right, Baker got there February 14, 1992.

KK: And we were there in November-December, 1991.

KK: The last dinner we had with Khariton, he spent at least an hour to two hours giving his version of their nuclear history, which was a very popular thing when you guys eventually wrote it up.

SH: He went through the same thing when I got there two months later. I was there on February 23,1992 in Sarov, and we also, of course, met with Khariton. He was with us that whole two days.

KK: His English was impeccable.

SH: With a British accent.

KK: Khariton's talk, in early December of 1991 when we met with him, was to explain the history of the Soviet atomic bomb program according to him.

SH: And I had the same version in February of 92, he explained it all, and it was remarkably straightforward, about Klaus Fuchs, and all of it. He laid it out, it was just fascinating.

SH: **So Fortov, when he came down in 1979, was he the first Russian from the scientific community that you met? Did you go to Russia beforehand?**

KK: No. When I was studying Russian, it was after I came here, the lady who taught me Russian said, Krik, you handle the language pretty well, why don't you learn to speak it, and I said, What the hell for? I am never getting there. So I could read it, but I could not speak it. I did not practice it. And I never learned to understand. It was one of those situations when you wonder why was I so stupid. On the other hand, though, my parents insisted that I learn to speak, read and write Armenian, and later on that became a very important thing, because the Armenian Academy had very bright people. Fortov told me they were probably in the top three among the fifteen of CIS states. He said they were very sharp, and he did not want them to migrate into Iran or elsewhere. So my value increased, because I could speak and write Armenian and deal with the Armenian scientists.

SH: And you went there several times.

KK: Oh yea, six or eight times, on export control issues. Incidentally, that's where we fall through a bit. We have not followed up on export control to the same extent over the years. I don't know what is the status of it today, but the export control program and NPT, all of this has helped us maintain the integrity of controlling nuclear materials, which is the key to proliferation, really. In spite of the fact that we sometimes berate Washington, they recognize that as a problem.

SH: Khariton was a legendary figure. We were fortunate to have met him. That was late 1996 when he died.

KK: He was given the worship of the hero who took part in the military side. Whereas we, we don't give much credit to Oppenheimer; we don't laud him, we don't honor him in the same way. We just don't do it.

SH: Krik, just an interesting story along that line. I gave a Khariton talk in Sarov, and it would have been the 95th anniversary of his birth, and I gave this talk, and I showed a few view graphs and I showed Khariton and Oppenheimer side by side, and then I gave the contrasts which was in that case, the similarities: both born in 1904, both at Cambridge around 1926 - 1928, and so forth. Then, after the talk, Yuri Trutnev came up to me and he said, Sig, it was a wonderful talk, but I have one question – you had Khariton and Oppenheimer side by side, and Khariton, who was a small guy, had his chest full of medals, and Oppenheimer had none. He said, why is that?

KK: We don't have hero worship.

SH: Yes, Oppenheimer was treated poorly when the AEC revoked his security clearance after a hearing in 1954. We don't treat our heroes well.

SH: **Krik, where were you born?**

KK: You want to go through it all? I was born in Harput, Turkey during the genocide that the Turks were creating at the time between 1915 and 1923. I was born in 1921 in Harput and in Armenian it's Artzvest, it's not Harput. My parents were married in 1919. They were both on the trail. They were both single at the time. I don't know how they managed to get together, but they were being exiled from their own ancestral home. My brother was born two years later in Aleppo. The Syrians refer to it as Aleppo but it's Haleb. Then from there we went to Greece, France, Canada, and then ultimately to the US, 1924-25. I joined the nuclear project right out of college in 1943, worked on the uranium from 1943 to 46 until I came here. I don't know how they decided that I should work on polonium at the time.

SH: **You said you were at a Catholic university in Niagara, so you got a bachelors –**

KK: I got a bachelors degree with honors in chemistry, but I never pursued a Ph.D. They gave me an honorary doctorate of science in Armenia as well as at Niagara. The Armenian Academy gave me a doctorate. I got two honorary doctorates but no Ph.D.

SH: It has not harmed your career exactly.

KK: No, it has not. You know, Sig, I thought about this. I wonder if they even allow that consideration today. Because, how many people make it to that level, competing with the quality of people we have.

SH: It was certainly very different then. For a few decades, I would say, some of our very best innovative scientists and engineers did not have doctorate degrees. And it was possible to do that. But then when the postdoc program came in and when more and more scientists and engineers were graduated, then the chance of getting into the job without a doctorate degree with more or less a bachelors, you'd became a technician.

KK: That's right. I realize I am the exception, but why? And then I think back and you know, you wonder, how could have all this happen, starting where I did?

SH: Yes, it's amazing.

KK: You know, like your career. You were foreign born… What is the difference between the American standards and say, European standards. If you are not one of them, chances you are making up to the top are rare. Whether you are in England, in France, or in Germany, you've got to be a national, almost, to make it to the top. That's not the case for the US. That speaks for

America, really. The greatness of America is not the triviality of the politics. It speaks in a broader sense to the opportunity that lies when people want to do well and do something about it.

SH: I agree completely. Krik, as you now look back at your career, and of course you now tell this story to other folks and Alan Carr will do a great job I am sure on the history, so now that you look back, with our focus on Russia, where would you place what you've done with Russia, and the doors you opened, how would you characterized that?

KK: I'd characterize it by saying that two people can get together if they have enough will and ability to recognize what the problems are to mold it into something workable. It does not mean that you are sharing knowledge, but you at least begin to trust one another. And that's where the failure occurs. The politics and the propriety of it gets in the way, because a lot of that is based on personal interactions.

SH: There is no question, you helped to pave the way for what we did in the 1990s and 2000s, because you know, at that time, we wound up having hundreds and hundreds of people going back and forth, to work on nuclear safeguards, nuclear weapon security, research – pulsed power, as you know, Irv Lindemuth and company. But first, there were just a couple of contacts. I hope that you feel a sense of great satisfaction that what you did helped to open the doors.

KK: I believe that, but on the other hand I look at that and think, we have not maintained that.

SH: Krik, I agree that the situation right now is not good. But, what we cover in the book is to say when the Soviet Union came apart, there was a whole new danger, a big danger. And through these relationships, and the efforts, particularly lab-to-lab, which had lot to do with your early contacts, we got through that period, and that was not self-evident at the time.

KK: No, it was not, and we were even criticized pushing it that hard. Because when Danny and I came back, he gave you a memo what we were willing to cooperate on, and Terry Hawkins added a couple of items to it. At least it gets communication started. But those avenues get closed when you have everything in the formal channel and you don't allow any liberties at all. Partly it is true of any bureaucratic system. It is like trying to get menial things through channels here.

SH: That's true. The way we look at it now, this period after the dissolution of the Soviet Union, the next 20 years were a very special period. We did manage to get through. Now we've got new problems, and one of the things we'd like to do is that experience that you talk about, meeting Fortov after a conference, can one learn enough from those so one could use that experience so we could take things back and turn in a different direction?

KK: Yea, but you've got to find somebody who is willing to stick the neck out a little bit.

SH: That's the hard part.

KK: But bureaucracy's tendency is to stifle it.

SH: Absolutely. And that's a hard one to fight, because they are organized and they are abundant whereas you, you are screaming from the edges.

That's our challenge. Krik. We greatly appreciate your sharing your thoughts, your memories, and I am sure they will be done in more detail.

Krik Krikorian and Sig Hecker. Feb. 2017