Los Alamos, 1944

CHAPTER 15

LOS ALAMOS, NEW MEXICO – 1944

NOW THAT WE were engaged, leaving Washington was even harder. Our brief courtship was something special. I was in love. Elena was beautiful. Our love making was decadent. I would never have imagined a woman being so assertive, so attentive, so bold, so creative. I had a great job. Out of harms' way. A career after the War. No one my age had it this good.

I typically spent several weeks at the various Manhattan Project sites, returning to Washington D.C. for a week. After briefings at headquarters, General Groves would give me a new agenda and off I went again.

Even with my uncertain schedule, Elena and I were married by an Army chaplain at Fort Meyers in September. General Groves graciously consented to be my best man, taking away from his limited precious personal time he reserved for Sundays.

By the end of 1943, the Manhattan Project had grown into an undertaking of monumental scope. The Hanford, Washington site for the production of plutonium selected early in the year was well advanced in construction by year-end. Hanford fit the criteria for ample water with the Columbia River, sufficient electrical power with hydroelectric sources, and sparsely populated.

Like Oak Ridge in Tennessee, it was a vast industrial installation. By War's end, it would occupy an area half the size of the State of Rhode Island and employ tens of thousands. It was now part of my regular assignment sites along with Oak Ridge, Chicago, Berkley, and Los Alamos.

But it was Los Alamos where I spent most of my time. That suited me. The intellectual atmosphere was stimulating. I felt at the heart of the Project, which it was. But the most difficult challenges were associated with engineering the processes to produce quantities of fissile material. Not as glamorous as the Los Alamos work. Oak Ridge and Hanford were just gigantic factories. Although the achievements of the brilliant, dedicated people associated with that side of the Project made the atomic bomb a reality, they were still industrial processes. Los Alamos was a university; a university with the most brilliant research faculty in the world.

I was feeling fairly cocky. As a civil engineer by training, nuclear physics was beyond my educational background. While General Groves had scientific advisors to tutor him in the science, I was expected to fend for myself. By any account, Groves was also brilliant with the ability to immediately grasp the most complex issues. Yet I was not only able to keep up with him, but often able to sufficiently explain scientific details unfamiliar to him. There was never a word of praise from the General, but continued acceptance of my reports received with more questions than criticisms suggested he trusted my work.

Elena's roommate Alice moved out just before we married. According to Alice, she was moving in with her latest boyfriend, a lawyer with the Justice Department. Alice was always convenient with her absences. Now we had a home to ourselves, although I was there very little.

I had a few days back in Washington D.C. for Christmas in 1943 before returning to the various sites. Under Leslie Groves' hard-driving project management the Manhattan Project had

swelled in scope. New milestones related to producing fissile material in sufficient weapons quantities started to materialize. With progress came more demanding deadlines.

The first phase of the Y-12 electromagnetic separation plant at Oak Ridge became operational in November, 1943. The Oak Ridge X-10 reactor, intended to produce test quantities of plutonium, went critical that same month. Construction of the massive production reactors to extract large quantities of plutonium began at Hanford, Washington in October.

Project W-47, code named *Project Alberta,* was created at Wendover Army Air Field in Utah. *Alberta* was the parallel program to develop the means of delivering an atomic bomb. A bomb that was not yet created, its physical size unknown, nor the parameters for aerial delivery known. *Alberta* was not an expression of confidence, only of Groves' pursuit of all Project elements simultaneously. Everything subordinated to urgency.

All of these gigantic industrial projects were being started without the entirely new processes being fully designed. The equipment was being designed then continually modified, often after delivery to the site. It was organized chaos. These design concepts to extract uranium-235 from uranium-238 had never been tested beyond the laboratory. Same for the concept of a reactor to sustain a constant nuclear fission process which could produce the man-made fissile element plutonium as a byproduct. Engineering techniques were being invented. Much remained to be understood about the behavior of uranium-235 and plutonium-239. Nothing that was being attempted had ever been done on this scale. The Project had an artificially imposed deadline dictated by the War. Cost was not a constraint. Pragmatism had no place. Science did not proceed like this. Problems were inevitable. Even problems that could derail the project. Success within the imposed timeframe of less than two years was by no means a certainty. Early 1944 proved a dark period for the Manhattan Project.

The first problem occurred at the Y-12 electromagnetic separation plant. Operational for less than a month, the first Alpha racetrack failed.

The electromagnetic separation process grew out of Ernest Lawrence's work at Berkley. It consisted of a process whereby a material in gaseous form was bombarded with high energy electrons and then accelerated through a strong magnetic field. The magnetic field would bend the arc of elements with different atomic weights. These were then collected at different places at the end of the process. The purpose was to increase the concentration of the trace U-235 found in the naturally occurring U-238.

To do this required magnets a hundred times more powerful than anything ever made. These 15-foot electromagnets would be arrayed in an oval, hence the label *racetracks*. The Alpha tracks were the first to be installed. Problems materialized immediately. The first two tracks failed because of contaminated cooling oil and a fundamental design flaw. By January, only one track was limping along producing far from the expected output, at less than expected enrichment.

The racetracks proved a constant maintenance headache. Controlling the process was as much a black art as engineering. Rows of women sat at stations continually monitoring gauges and making slight adjustments. It was soon determined that the Alpha tracks would never achieve the enrichment goals.

Colonel Nichols took me into the Y-12 plant. There were few workers inside. The plant was effectively shutdown. For weeks, they struggled with trying to maintain operation by controlling the fluctuating magnetic fields through adjustments. In desperation, a decision was finally made to take apart several of the magnet assemblies in the first Alpha track. Regardless what they found, the huge magnet assemblies would then require return to the manufacturer. We were now looking at the disassembled Alpha-3 being prepared for return to the factory for rebuilding.

"Two problems. First, the cooling oil is contaminated," Nichols said pointing into the guts of the magnet. "Appears to be contaminants from the welding of the piping joints. Rust as well. We thought that was the cause of the magnetic field fluctuations. But it was eventually concluded that the conductors were spaced too closely together. That's a more difficult fix."

"I've read the reports," I said. "What's the status on the rebuilds?" I asked.

"The Alpha-1 magnets have just returned. The Alpha-2's are due back from Allis Chalmers in two weeks."

"Is Allis Chalmers confident about the rebuild fixes?"

"Yes. General Groves himself was involved in the discussions. But that's only part of the problem," Nichols said.

"What do you mean?'

"Well to start with, there're problems with the K-25 gaseous diffusion process as well."

The K-25 plant was eleven miles away on the Clinch River. In simplest terms, this process forced uranium hexafluoride gas through a porous barrier that progressively separated higher concentrations of the lighter U-235 isotope from the heavier U-238. This was repeated through successive cascades of diffusers, or barriers, to enrich the uranium to higher concentrations of the fissile U-235. The process was simple, the engineering challenging, and the size colossal. The building covered forty-two acres, four stories high.

Uranium hexafluoride was highly corrosive. It was also highly reactive to any organic materials. Therefore it posed problems with most metals, gaskets, and lubricants. I had read the reports about the contentious problem of finding a suitable barrier material.

"Nothing except nickel has been found to resist the uranium hexafluoride," Nichols said. "The problem is creating the millions of submicroscopic openings per square inch. Compressed powered nickel simply proved insufficiently fine enough for the

openings. Alternative techniques are undergoing lab trials right now."

"What about this electro-deposited nickel material the reports sight?"

"Kellex is working in that direction. Prospects are encouraging. It might be months away though."

"And the problems with the sealing?" Gas-tight pump seals had always required grease which could not be used with the uranium hexafluoride.

"Without the ability to use a grease-based design, they've been a source of continuing problems. Seems to have been solved with the new seals using a new DuPont polymer called polytetrafluoroethylene. But that's not certain yet."

"What do you think about the Boss altering the enrichment approach?" I asked Nichols.

Because of the continuing problems with the K-25 diffusion barriers and the delays and low projected output of the Y-12 electromagnetic process, Groves made a tactical decision. The diffusion process would be used to only enrich the uranium to 50% U-235. This enriched stock would then be fed to the electromagnetic process for enrichment to greater than 80% as required for a bomb. As part of that thinking, Groves had ordered the construction of the Y-12 Beta racetracks to augment the Alpha racetracks to provide the electromagnetic processing with a secondary enrichment process. But this also seemed reactionary since questions were already arising about the viability of the electromagnetic process to yield large enough quantities of fissile U-235. The hope had always been on the gaseous diffusion approach. Groves was jerry-rigging making the bomb material.

"You mean are we going to make it?" Nichols said, obviously referring to the timeline. "Frankly I'm not at all optimistic, Major."

"It does seem like a spit and bailing-wire fix," I added. "The bright spot appears to be the X-10 reactor. At least that's working."

"True. But that's a slow process. It will still be a couple of months before we produce enough 49 to send to Los Alamos. And that'll still be just test quantities."

"But that's still amazing progress," I said. "Fermi's Chicago Pile, the first ever nuclear reactor, only went critical a year ago. X-10 is functioning as expected. The physicists at Los Alamos have high expectations for 49. It appears to have properties that might make it more suitable than 25. But the problem is there's still a lot about 49 that's still unknown. The theoretical work suggests the critical mass of plutonium might be only a third of 25. So it's important stuff. Especially if we can produce greater quantities than we can of 25."

Nichols and I were of course using the prescribed code designations of 49 for plutonium-239 and 25 for uranium-235. Plutonium was produced in trace quantities as a byproduct of naturally-occurring uranium-238 undergoing controlled fission in a reactor. Extracting the plutonium from the uranium-238 was a complex chemical process that was also undergoing development for large scale application.

"But the reactors are already under construction at Hanford. Even with everything we *don't* know. The chemical extraction process hasn't even been fully developed yet, much less the equipment designed. Are you comfortable with that?" Nichols said.

"No, especially after witnessed the scientific arguments about the reactor cooling system. But I've talked to Dr. Seaborg at some length about the chemical extraction process. There's been good progress using his oxidation-reduction cycling method. Seaborg is confident they'll be ready once the Hanford production reactors are operational."

Glenn Seaborg had been the first to produce plutonium in the laboratory. He had also developed an ingenious method for extracting the trace quantities of plutonium from the U-238 within the reactor that had undergone a sustained chain reaction. At best, the new element plutonium was found in a concentration of only about 250 parts per million. That was the quantity of a dime comingled in two tons of highly radioactive material.

I continued. "But I know what you mean. I was at the meetings with the General and the scientists about the debates over the reactor cooling method. There are a lot of assumptions. Problem was that all of the ideas appeared technically sound."

"What was the outcome?"

"The Boss forced them to reach a consensus. The risk has to be taken. But it didn't instill confidence."

"I understand the General's need to take risks. But we must expect problems if we force the science. No reason to believe the reactors at Hanford will be any different from the problems experienced here at Oak Ridge. I hope I'm wrong," Nichols said.

It was a train this time to Los Alamos. Given the time to write my assessment report, I was thoroughly depressed about the prospects of the Project. Without sufficient fissile material, the atomic bomb was just theoretical. For that matter, the design for the bomb had not yet been determined. More experimental work was required to understand the behavior of the fissile materials. So again, everything rested upon producing U-235 and P-239.

I was picked up at the Lamy rail station mid-morning. It was the first of February. The sky was clear with a few wispy clouds. The temperature was expected to reach 50 degrees. My first stop was to check in with Dr. Oppenheimer but I was informed that he was in Chicago. It was close to the lunch hour so I went to the library assuming Charlotte Serber would be there.

The outspoken Charlotte Serber was not only the wife of my friend Robert Serber, she was also the scientific librarian. She

and her husband had been close friends to Robert Oppenheimer for many years. Project security had objected to the Serbers' extreme left-leaning political backgrounds to the extent they wanted them removed from the Project. Oppenheimer brushed aside the objections. In a slap in the face to the Army's security people, he made Robert Serber a group leader in the Theoretical Division, and Charlotte the librarian in charge of all of the documentation for all of the weapons laboratory work.

"Mike!" Charlotte said, and then came from behind her desk to give me a hug and a kiss on the cheek. "How's Elena?"

"Great."

"I hope to meet her when this is all over. Must be difficult being newlyweds and being apart so much."

"Can't complain. At least I get to see her every few weeks. You and Robert are very fortunate to be here together."

"Yes we are. And speaking of Robert, I was to meet him in the cafeteria for lunch. Join us?"

The original Fuller Lodge from the Boy's School was now the cafeteria. I shook hands all around with several of the scientists. Robert Serber greeted me warmly. He wanted to hear about how things were going with the production of fissile material but those discussions would have to wait until we were in a secure environment.

"Elena is fine I trust?" Serber said.

"Yes. It's tough with me being gone so much but she understands. Things have changed here in just the few weeks I've been away. Does the construction ever stop?"

Serber said. "It's a real city now. Schools, a hospital, municipal services. Colonel Ashbridge does an adequate job administering this place. Can't be easy."

"It's not all that good, Robert," Charlotte said. "It's still a prison. Shortages of various food items. Water restrictions. Then the security. That just gets worse. Particularly that asshole de Silva."

"Watch your language, Dear," Robert said.

"I don't care. De Silva's a Nazi. He's never liked Robert or me. Thinks we're not loyal. Doesn't trust Oppie either. All that washes over into petty restrictions. The Army has no regard how tough it is for civilians to be locked up like this. I don't mean to include you in my pique about the Army, Mike."

"No offense taken, Charlotte. I'm familiar with Major de Silva. He's a zealot. Sees things narrowly. Obviously General Groves has confidence in Oppie and by extension his team." Even so, I suggest you avoid any serious security breaches to stay out of the sights of Army intelligence."

I had already had my own run-in with Major Peer de Silva. Like Colonel Pash, he wanted me to keep alert for any security breaches in my unique role interacting with the scientists. I told him flat out that wasn't my mission. After a heated argument, I told him that I was not in the business of passing along what amounted to gossip so he could go on a witch hunt. I invoked the overarching priority of achieving project success, not satisfying security protocols. If he didn't like that, he could take it up with the General. I challenged him to see which of us had more clout. That was the last time we spoke which was months ago.

But I also knew Groves true feelings about the civilians locked up at Los Alamos. To his staff, he openly regarded them as 'children'. The base Army staff was tasked with not allowing living conditions or anything else to interfere with the Project's work. They were to see after the creature needs of the 'children'. Security on the other hand was a balancing act. No one was more paranoid about security than Groves himself so there was always friction.

"Did I hear a discussion about security?" Richard Feynman said as he walked over to our table and shook my hand. "Good to see you, Mike."

"Richard is our singular counter measure to the over-reaching security people here," Charlotte Serber said smiling

broadly as Feynman joined us. "Tell Mike about your most recent adventure, Richard."

"Just a diversion to relieve the boredom, Charlotte. Nothing more than a little practical joke."

"Oh no. Richard is being too modest. This was an experiment to test the intelligence of the security guards. You see Richard found a hole in the fence. So he walked out the main gate, returned through the hole, and then walked out the gate again. He repeated this several times before the retards at the gate caught on that something wasn't right. De Silva wanted to arrest you didn't he, Richard?"

"All bluff and bluster," Feynman said. His mischievous grin identified his delight in harmlessly challenging the rigid security environment at Los Alamos.

Richard Feynman was the youngest of the senior scientists. He was recruited from Princeton through Robert Oppenheimer's personal efforts. Feynman was reluctant to come to Los Alamos because his new wife had tuberculosis. Oppenheimer personally arranged for her to go to a sanitarium in Albuquerque where Feynman could visit every couple of weeks. Oppenheimer recognized the young Feynman's brilliance and assigned him to Hans Bethe's theoretical division. Bethe took to him immediately. The renowned Danish physicist Niels Bohr, frequently consulting at Los Alamos, would seek out Feynman to discuss physics. Although Feynman was the youngest scientist at Los Alamos, he was the only scientist to speak his mind to the great Bohr. Their loud arguments became legend. Both Bethe and Bohr found Feynman's pure approach to arguing science useful in debating without consideration for exalted reputations.

Feynman was also a consummate prankster. That had a salutary effect on the stressed civilian population. Army security accused him of corresponding with his wife in code, demanding the cipher key. Feynman explained he didn't have the key since it was a game he played with his wife to practice code breaking.

Throughout his time at Los Alamos, Feynman's most audacious prank was repeated safecracking. All the division heads had personal safes. Technical papers were to be locked up when not in use. Feynman was already an accomplished lock-pick so doors and file cabinets were easy game. To this he developed ingenious methods of discovering the combinations for safes. His escapades were legendary. He drove security to distraction, never owning up as the culprit. Only years later did he reveal his secrets.

Everyone liked Richard Feynman, except of course Army security.

"It's Friday night. Robert and I will be over at Oppie's and Kitty's for cocktails. Richard will be there too. Will you join us?" Charlotte said.

"Shouldn't you ok that with Oppie or Kitty, Charlotte?" I asked.

"It'll be fine. You're one of us."

Cocktails were well underway when I arrived. Kitty Oppenheimer gave me a kiss. I greeted all of the scientists and their wives. All asked about Elena. They did in fact treat me as one of their social group. I was again the only uniform at the gathering.

Oppenheimer arrived around seven. After making the rounds with his famous martini in hand, he pulled me off to the side. "Mike. Good to see you. You just came from Oak Ridge?"

"Yes, Sir."

"Your assessment? Are things really that bad there?"

"Bad enough, Sir. Everyone there is quite down, including Colonel Nichols and the civilian contractors. They're working like mad to resolve the problems. Eventually they will. The issue is when? Frankly the problems seem so difficult I would not even venture a timetable."

Oppenheimer lit another cigarette and signaled Kitty to refill his martini. "Well things are not much better here on the Hill.

Without fissile material in larger quantities, the experimental work is delayed. Without the experimental work, the theoretical work cannot advance. We're at a point where we need to move beyond the approximations to tighter calculations. But I guess we shouldn't discuss that here. I can block out at least an hour tomorrow morning to bring you up to speed. Nine o'clock in my office?"

With that, Oppie left to find his martini.

Robert Serber joined me. We were both getting a little tipsy. Gin at this altitude had a more pronounced effect.

"Oh, there's someone you must meet," Robert said. "Come with me."

I followed Serber across the room. We joined a group of three men.

"George, I want you meet Major Mike Voronin. Mike, this is George Kistiakowsky. George just joined the team. He's been working at Harvard."

I was hoping to Kistiakowsky. We shook hands. He was tall and slender with thinning hair. He appeared to be in his forties. There was a trace of an East European accent.

"George is a fellow Russian, Mike."

"Not quite, Robert. I'm Ukrainian."

"But you fought in the Russian Civil War. Am I correct?" Serber said.

"That I did. I was studying in Moscow when the Bolshevik Revolution broke out in 1917."

"You fought in the Russian civil war? For which side?" I asked.

"For the Whites of course. I wasn't a tsarist, but the Bolsheviks were a bunch of fanatics with an ideology to simply give themselves power. Another dictatorship only with a different name. Joseph Stalin is the result."

"George is heading up the implosion program under Deke Parson's division. We'll talk more about that tomorrow. I'll be

joining your meeting with Oppie." Serber said. "By the way, George, Mike may be Army but we don't hold that against him. He's more like one of us. A civil engineer by training so he understands the work. Works directly for Groves but we don't hold that against him either. Since the Army runs the lab, we have to expect their involvement. Believe me, dealing with Mike is a lot more pleasant than dealing with Groves."

"Your name, it's Russian, Major?" Kistiakowsky asked.

"Yes, Sir. First generation American. My parents came here from Moscow in 1913. They're academics. Too much political turmoil. It was fortuitous. They missed World War One, the Revolution, and the Civil War," I said. I omitted the fact they had returned to Russia.

Serber took my arm and moved us to a quiet corner of the Oppenheimer's large living room.

"Tomorrow when we meet with Oppie. Don't be surprised about his manner. He might seem a little depressed, at least not his usual self. It's about more than these recent difficulties with the Project. Have you ever heard the name Jean Tatlock?"

"No."

"Oppie was in love with Jean before Kitty. They almost married. Unfortunately, she was a troubled person. Suffered from severe depression. Even as a psychiatrist with a medical degree herself, she couldn't cope. About six weeks ago she committed suicide. The coroner's report said she died of drowning in her bathtub. They found the sedative chloral hydrate in her system."

Serber was right. Oppenheimer seemed subdued, maybe even a little remote when Serber and I joined him in his office. Not his usual ebullient engagement. His eyes, renowned for their piercing quality, appeared sad.

"Los Alamos has grown in just the few weeks I've been gone. Do you see the effects of the added staff yet, Doctor," I said.

"Too early, Mike. Ultimately it will make a difference. We have the best minds in the world right here. This directed scien-

tific effort is unprecedented. The Army has even augmented the technical resources by setting up their so-called Special Engineering Detachment. These are people with scientific skills that provide us with talented technicians. Many of them were drafted from graduate studies. But all that breeds a whole new set of practical problems. We've grown to thousands. I believe the logistics involved with managing the care of so many is just as difficult as the scientific work."

"My opinion is you're doing an outstanding job. That's what my reports read," I said.

"What does the General think, Mike?"

"I believe he feels the same, Sir."

"Does he ever say so?"

"No, Sir. You know that's not the General's style. But there are never any negative comments I have ever heard from him about your leadership. He's not sensitive about criticizing others though."

"Thanks, Mike. Now, any good news from Oak Ridge?" Oppenheimer said.

"You've read the reports, Sir, so I won't rehash the technical details. As much as the setbacks with Y-12 and K-25 are serious, I believe there is an overall confidence that they will *eventually* be overcome. All the contractors are working non-stop on resolving the problems. Colonel Nichols is doing an outstanding job in managing this bewildering agenda. But no one appears confident about achieving the necessary production goals within the allotted year's time."

"That is of course the issue; *time*," Oppenheimer said. "All of us understand we are pushing the science. I'm proud how our team of scientists has adapted to the wartime demands to approach their work in a manner counter to all their training. But that still does not resolve the kinds of problems we are facing. For every two steps forward, there is a step backwards. Every new discovery we make changes something we had already

built upon; the theoretical basis, a design, even the equipment under construction."

"Can you give me an overview of how work is progressing here at Los Alamos, Sir?" I asked.

"I'm not sure we're fairing any better than Oak Ridge. The gun design work is progressing. We're confident that the concept will work with 25 as the fissile material. Most of the work is now concentrated on the tamper and the initiator. But we are still a ways off from anything approaching a finalized design," Oppenheimer said.

"We're pretty confident about the performance of 25," Serber said. "Not so sure about how 49 will perform. What we do know is suggesting we would need to achieve a much higher velocity compared to 25 to drive the slug into the rings to achieve a super critical mass. Too slow a velocity of the slug would result in a fizzle. The problem is we need more 49 to do the necessary experimental work."

"Well you asked about the good news," I said. "Everyone is confident about the X-10 reactor at Oak Ridge. Things are on schedule. Fermi, Szilard, Seaborg are hovering over the work. That means you should receive working quantities of 49 for experimental work sometime in April. But I know what you mean about the potential for setbacks. Colonel Nichols said something along those lines about the reactors under construction at Hanford, when the prototype X-10 reactor is still not operational."

"What we don't know about 49 is part of the reason we are looking more closely into the implosion method," Oppenheimer said. "It's elegant in its concept compared to the rather crude mechanics of the gun design. Implosion represents a host of design possibilities not afforded by the gun method. But, and that is a big caveat, the thing is infinitely more complex. The theoretical work remains incomplete. But even with what we know, the engineering of a practical working design still remains well beyond our reach."

Serber said, "Richard Tolman originated the concept of implosion two years ago. Nobody was high on the approach at the time because of the obvious practical engineering hurdles. However, Oppie liked the possibilities it offered and set Seth Neddermeyer to work on the project. Neddermeyer's been doing experimental work for some time, but he still hasn't solved the problem of uniform shock wave propagation. That's why Oppie brought in George Kistiakowsky from Harvard. He's the best chemical explosives guy around. After the start of the War, he headed the National Defense Research Committee's Explosives Division."

"It's not only a chemical problem, but a mathematical problem of the highest order," Oppenheimer said. "Do you know John von Neumann?"

"I know the name from various reports. Mathematician isn't he?"

"Yes. Among other expertise. I believe he's the smartest mathematician of the century. He was one of the original four people selected for Princeton's Institute for Advanced Studies along with Albert Einstein. He's been consulting on the implosion problem. The problem is how to achieve the necessary symmetry of the shock wave to uniformly compress the plutonium core. The mathematics of the interacting physics is daunting."

"Speaking of the mathematics of implosion," Serber said, "Talk to your friend Feynman. He has taken on the task of marshalling the number crunching using IBM's new punch-card machines. Up to a short time ago, the calculations were done by manual computing with a cadre of scientists' wives using mechanical calculators."

Oppenheimer revealed a grin and the characteristic sparkle returned to his eyes. "That's because Feynman got bored with repairing the mechanical calculators. You see they were always breaking down requiring replacement. Feynman learned how to

repair them. Drove Bethe nuts. Bethe thought it was a waste of time until they started to run out of working machines. But now Feynman has these new IBM toys."

"And true to his ingenuity, Feynman's already finding ways of getting faster results by an order of magnitude," Serber said.

"Is the implosion method going to be viable, Dr. Oppenheimer?" I asked.

Oppenheimer lit another cigarette before answering.

"Yes. I believe so. When the problem is solved it will most likely prove to be rather simple. But like everything else, when that will be accomplished is by no means certain."

I spent the next three weeks digging into the various areas of the project. If this were a normal research project one would have a feeling of confidence. We had the best minds in the world working on the problem. Resources were unlimited. But this was wartime. An enemy still remained that might well be engaged in the same work. Science did not operate along deadlines.

It was less than eighteen months from the target deadline to produce atomic bombs. There was currently no viable process for producing fissile materials in quantities sufficient for even one bomb, much less multiple weapons. Oppenheimer was discouraged. Groves must be also although he would never show it.

At least I was returning to Washington D.C. and Elena. It was spring. The cherry blossoms were in full bloom. Ironically the cheery trees were a gift from the Japanese over forty years ago.