In March 1943. I was employed at the Ilion, N. Y. plant of Remington Arms Co., a DuPont Company subsidiary. I had joined DuPont upon getting my degree in mechanical engineering seven years earlier. Remington was making Springfield rifles for the U.S. Army. My job. Area Supervisor of the Wood Shop. was the basis for my deferment from the draft. It may have been an important war job, but apparently it wasn't a key one. About the middle of the month. I was summoned to the office of the Plant Manager, Bill Wood. Bill told me that he had been asked by the Du Pont Personnel Department in Wilmington not to offer a transfer, but to advise me of one. Bill went on. "I don't know much about your new job. You will be at the University of Chicago without your family for three months. About July 1. you will be transferred to Site X. which is in Tennessee. It is anticipated that you will be there for about a year and then will move to Site W. I don't know where that is." My wife. Dot, and I were expecting our second child in August and I asked for and got permission to check with the obstetrician. With the doctor's assurance that there should be no problem and with Dot's concurrence, I agreed to the transfer.

I had been instructed to report to Du Font's Personnel Manager at the University of Chicago, Dr. Walter Dew, whom I would find in the Metallurgical Laboratory. This seemed a strange assignment for a mechanical engineer with no training and no experience in metallurgy. Dr. Dew enlightened me. "Metallurgical Laboratory" was the code name for the project on which I would work. Dr. Dew covered some administrative details, including hours of work (eight per day, six days per week), salary (10% increase). overtime compensation (20% vs. 40% I had received at Ilion), living expense allowance at Chicago ($3.50 per day, less than half my actual cost).

With the preliminaries out of the way. Dr. Dew withdrew from his desk drawer and handed to me a metal rod about an inch in diameter and six inches long. Except that it was unusually heavy, it seemed quite unremarkable. "That." he said, "is pure uranium. The objective of our project is to produce from uranium a weapon using atomic energy for its explosive power." I can't remember my exact response to this revelation, but I think it was restrained. I was insufficiently informed concerning nuclear energy to be shocked, as I should have been.

Dr. Dew went on to tell me that there were about 40 Du Pont employees at the Met Lab. I was one of nine assigned to the Instrument Group, which was headed by Bill Overbeck, a university employee recently brought over from the Raytheon Corporation. During our three months at Chicago, we were expected to learn enough about the technical aspects of the project to qualify us for supervisory assignments at other sites. With that he handed me my pass to the Met Lab.

The next morning, as instructed, I reported to Bill Overbeck in the West Stands of Stagg Field, where the Instrument Group had offices, a small conference room and a small shop area. Bill had an imposing job. His responsibility was to develop. design, build and later maintain all of the special instruments required to monitor nuclear radiation in the laboratories and production areas of the Met Lab and the Clinton Laboratories (code X-10). To carry out the day to day work of the Instrument Group his resources consisted of a Ph.D. physicist, Rudolph Kanne, a graduate student, Gerry Pawlicki. Tom Brill, whose function and organization spot I don't remember, a technician, Dick Fox and the nine Du Pont assignees, all mechanical or chemical engineers with no background in electronics or atomic physics.

Bill's first job was to teach the Du Ponters the fundamentals of electronics. He sent us to the University Book Store to buy texts on the subject. Much more effective, however, were the lectures he gave us. A locker room in the West Stands had been converted to a small lecture room. Within weeks we understood the circuits for direct and alternating current amplifiers, full-wave rectifiers, oscillators and flip-flop circuits. These lectures on electronics were supplemented by talks on instruments peculiar to nuclear physics, including ionization chambers, cloud chambers, proportional counters and Geiger counters. In the shop we learned how to solder joints, lay out and punch holes in metal chassis from schematic circuit diagrams, lay out circuit wiring and tie it into cables for ease of maintenance.

In addition to our training in instrumentation, we were introduced to atomic physics. Our group bought all the copies the Book Store had of a recent book, Applied Nuclear Physics, by Pollard and Davidson. More exciting and more informative than the book were the lectures we attended two evenings a week. All 40 Du Ponters and several of the scientists came to hear these talks. Many of the lectures covered work in atomic physics which had already been published. We were issued notes on these talks labeled "Restricted", the lowest classification under the security system. When I left the project in 1945, classification of these notes was canceled and I still have them.

Three lectures dealing with the chain-reacting pile and the transuranic elements were classified "Secret", which required that our notes be recorded in a bound notebook registered by number and charged to each individual. Pages were pre-numbered, so removal of a page could easily be detected. Notebooks could not be removed from the Met Lab. Each day as we left work, our notebooks were deposited in a locked safe. We signed them out each morning in a logbook kept by a custodian.

Although I have no notes, the substance of these lectures is indelibly inscribed in my memory. One, by Dr. Arthur Holly Compton, gave us an overall view of the project. The objective of the Metallurgical Laboratory was to develop a pile to produce element 94. plutonium, and to find a practical way to separate the plutonium from the uranium and mélange of elements resulting from the fission of uranium in the pile. He told us that if a few kilograms of pure plutonium were concentrated in a small volume, an atomic explosion would result. The Clinton Laboratories, code name Site X, located near Clinton, Tennessee would be a semi-works to further develop the pile and separation process, to produce small amounts of plutonium, and to serve as a training site for the production facility. It would be under the direction of the University of Chicago, although it would be designed and built by the Du Pont Company and many Du Pont people would help operate it. Du Pont would be responsible for design, construction, and operation of the production facility to be located at Hanford, Washington, Site W.

Dr. Compton explained that ours was one of several projects administered by the Manhattan District of the U.S. Army Corps of Engineers. Other projects at other sites were seeking to isolate uranium 235,

which, like plutonium was believed to be capable of detonation in a bomb. We were to be given access to technical information on the plutonium project, but not on the U235 project, nor would we have any information on the design of the bomb. Stressing the importance of our project and the need for absolute security, he told us that we had no knowledge of the status of German physics, but they were known to be working on atomic research. Dr. Compton concluded by saying it took many people of diverse backgrounds to accomplish our objective. He asked for full understanding and cooperation between those with academic backgrounds and those who had come from industry.

Dr. Compton was a handsome man of about fifty with deep-set penetrating eyes. I felt that he was talking directly to me and later I learned that my colleagues had that same impression. We left the room awed by the words we had heard and the intellect and sincerity of the man who had spoken them.

The second secret lecture was by Enrico Fermi. About forty years old. Dr. Fermi was a small, energetic, enthusiastic man. He spoke his fluent English rapidly with a slight Italian accent. This theoretical physicist gave a clear picture of a complex process to a group of engineers whose only background in atomic physics was the few lectures they had recently heard. In about an hour. he described the fission of U235 by neutron bombardment to produce free neutrons and several elements near the middle of the periodic table, the conversion of U238 to plutonium by the capture of neutrons and emission of Beta particles, the slowing of high energy neutrons by graphite, the neutron flux required for a chain reaction, the use of a neutron absorbing material such as boron to control the pile. Finally, he described the pile which had recently been operated in the squash court of the West Stands. We were immensely impressed by the work of this giant among physicists and equally impressed by his ability to communicate with us.

A great mathematician and theorist, Dr. Fermi was also a superb experimentalist. By the time of our arrival in Chicago, the pile had been moved to a safer location at Argonne. Some time later, Bill Overbeck arranged for the nine Du Ponters to visit the Argonne Laboratory. At the time of our visit, Dr. Fermi was seated at the control panel and his assistant. Leona Woods, was on top of the pile. I believe they were measuring the neutron cross-section of various elements. They communicated by walky-talky phones over loud speakers, so we could hear their exchanges. Dr. Fermi was reading instruments and controlling the pile, recording data, doing calculations with a 24" slide rule and plotting results on graph paper. Leona introduced the samples into the pile. At one point we heard the shattering of a glass beaker she apparently had dropped. Without missing a beat in his experiment. Dr. Fermi said, "Leona, what are you doing? Having a tea party?" A remarkable man!

The third secret lecture was given by Dr. Charles Coryell, a member of Glenn Seaborg's group, which was developing the chemical process for the separation of plutonium. The problem was akin to the proverbial finding of a needle in a haystack. Here the challenge was to isolate a few grams of plutonium from a huge mass of uranium contaminated by thirty or so radioactive fission products. As a mechanical

engineer, I remember only that he said the process involved the use of lanthanum as a carrier for the plutonium and a succession of oxidation-reduction steps.

Our workdays were busy ones, building instruments in the shop and in the classroom soaking up science and technology completely foreign to our backgrounds. Weekdays we ate breakfast and lunch together in the student cafeteria and went our own ways for dinner after work.

Saturday night was our time for relaxation. Most of the instrument group met at a designated bar in the loop after work. After a couple of drinks, we dined well at one of Chicago's many fine restaurants, then made the rounds of the bars until almost closing time. It was a time of food rationing and shortages, but the Chicago restaurants always seemed to have a bountiful supply of fine beef, plenty of coffee and sugar for desserts.

During these war years, Chicago was teeming with young men and women in uniform. As I walked along the street, one sometimes felt that passersby were staring at me and asking themselves why I wasn't in uniform. On one occasion, while having my hair cut by a young woman, I had the distinct impression that she was looking at me with disdain. She may have had a loved one in the European or Pacific theater, or even have been a war widow. I wanted so much to blurt out. "Hey, I'm doing my part.", but of course, I couldn't say a word.

My assignment at the Met Lab ended on July 2. Although I had missed Dot and my two-year old daughter, Jean, I had the excitement of my work and the three months went by quickly. For Dot, it was a different matter. She was pregnant and caring for Jean and running the household alone. That included many of the chores I usually handled, such as wiping the dishes while she washed, stoking coal into the furnace, shoveling the ashes from the ash pit to a barrel, coping with ration coupons, paying the bills and balancing the checkbook. Fortunately, there were friends to lend a helping hand. Dot and a great many other wartime wives and mothers were unsung heroes. We enjoyed two weeks of vacation before I reported to my next assignment at the Clinton Laboratories Oak Ridge

The plant was under construction by DuPont when I arrived on the site. Bill Overbeck and a few others of his group were already there. We spent our time in Bldg. 717-B, the Instrument Shop, writing manuals and ordering supplies. From the two and a half exciting years that I spent there, I have selected to highlight a few incidents.

November 4, 1943 is a memorable date for X-10 veterans. When I arrived on the plant that morning, word was being passed among those cleared for the information that, "A baby was born last night." The pile had gone critical. About mid-morning, I went up to Bldg. 105, the pile building, to take a look, although there wasn't much to see. At the Control Desk, the indicator of neutron flux was a D'Arsonval

galvanometer, which measured the current from an ionization chamber in the center of the pile. The operator gave me a big grin as I peered over his shoulder. I walked over to the side of the pile. There was virtually no sound and certainly nothing to see to indicate the intense nuclear events going on behind the concrete shield. An eerie feeling crept over me and I got goose bumps.

I jump ahead to the spring of 1944. The transfer of Du Ponters to Hanford had begun. About two weeks before my move date, I was summoned to the office of Red Schwertfeger, the Works Engineer to whom Bill Overbeck reported. Red told me that my transfer to Site W had been canceled. My immediate reaction was one of disappointment. Red went on. "Du Pont has offered Bill Overbeck the position of Superintendent of Instruments at Site W. and he has accepted. Effective May 1, you will be the new Superintendent of Instruments here. Congratulations!" I was overwhelmed. Red went on to assure me that I was not expected to fill Bill's shoes. The development and start-up had been completed. Now it was mostly a job of maintaining the equipment and building more of the same. Dot's reaction to the change of plans was a request for a larger house. Although we had been entitled to a ? sq. ft. "C" cottage, we had continued to live in the 770 sq. ft. "A" cottage.

I take another leap ahead to August 6, 1945. I received a call from the office of Martin Whitaker. the Director of Clinton Laboratories, summoning me to a staff meeting in the conference room. At the meeting Dr. Whitaker read a portion of a statement that had just been released by President Truman. An atomic bomb had been dropped on Hiroshima. The bomb had the destructive force of 20,000 tons of TNT. The Manhattan Project had succeeded. Before leaving the meeting we were handed a typed statement telling us exactly what to tell our people. It included excerpts from the President's release and then a statement saying that Clinton Laboratories had been a part of the project and had made important contributions to it. It congratulated each employee for his or her personal contribution and warned that security was still important. We were to say no more about the project than was included in official releases.

In a state of euphoria, I hurried back to the Instrument Shop and asked my secretary to summon all members of the group to a meeting in the machine shop, the only room large enough to accommodate the entire crew. While people were assembling, I called Dot and told her to turn on the radio and tell the neighbors to do the same.

When the group was assembled. I climbed up on a bench at the side of the shop and read Dr. Whitaker's statement. Those who had been cleared responded with a cheer. The others may not have understood the full significance of the announcement, but they obviously were pleased to have been a part of so important a war effort. I knew as I jumped down from the bench that I was experiencing a moment in history and, for what reason I don't know, a couple of tears rolled down my cheeks.

From the start of the project, I had experienced a mixture of feelings about and reactions to our work: the challenge of this amazing new science and technology, the share in making history, the fear of failure, the hope for success. I went home that night with a feeling of great pride in what had been accomplished. Mine had been one of the lesser roles, but I was proud of what I had done for the war effort. 1 was confident the bomb would bring an early end to the war and for that I was thankful.

The next day there came the sobering realization of the terrible destructive force of the new weapon. War, already horrible, had been made more so. Some of the scientists said they had been told that the bomb would be used only as a threat to Japan and would never be dropped. Some were openly critical of the President's decision to drop the bomb. The Du Pont people, those with whom I worked most closely, had never heard of any such strategy. We had been told that the military needed this ultimate weapon to bring the war to a quick end. Our concern throughout had been that the enemy might get it first. Although the euphoria of the previous day was moderated by the full realization of the effects of the bomb, we felt that we had done our work well and that President Truman had made a good decision to use it to end the war.

My last contact with the Manhattan Project was a bill I received for rent on our house. The movers had come one day later than planned and I owed $1.67 rent. I sent the check.