Oral History Interview
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JS: If you would just start real briefly a little bit about your education and how you ended up working for the Chemical Warfare Service.

EE: OK. I went to the University of Illinois 1939 in the fall, and graduated in chemical engineering in May of June of 1943. The University of Illinois was a part of the history of chemistry, Chemical Engineering, and I did my under graduate bachelors degree paper, if you want to call it that, under professor (b)(6) Subsequently, I found out that the Chemical Warfare Service Division Nine of the National Defense Research Committee was at the University of Illinois. I didn't know that as a student there and I subsequently found out that (b)(6) was the inventor of the Cummings smoke candle, which I found very interesting after I got clearances and was working here at Edgewood

(b)(6)

I reported there in late May or early June of 1943.

JS: What were the facilities like when you first got there?

EE: The interesting thing to me was, that they had a traditional chemical engineering building. It was a three-story building in the middle of the campus with a central bay, three-story chemical engineering bay, where you could have pilot plants. It was designed in that traditional sense. My understanding later was that the army built that laboratory and it's now, or was then, after the war the chemical engineering building for MIT. Everybody was well aware that MIT was famous for radiation laboratory, which became Lincoln Laboratories and developed radar. It was to my surprise that so few people remember that the Chemical Warfare Service Development Lab was then at the forefront of the Chemical Warfare Service Development Program. It's my understanding that then Captain Jack Rothschild, who subsequently became Brigadier General Jack Rothschild, head of research and development for the Chemical Corps, was sent up there early in his career to essentially to establish a laboratory to take on advance work, instead of having it all done here at Edgewood Arsenal. It was staffed originally with some hand picked people who transferred up here from Edgewood, perhaps a half a dozen. Those people gave up their civil service position with the understanding that they would get it back after the war and became a nucleus in areas such as filter design, charcoal, and other areas of the defense program. These people when they returned to Edgewood 1945 at the closing of the lab, got half time credit for their time at MIT towards civil service retirement, which is an interesting aspect. Those of us who were hired directly into the laboratory did not get that credit. We just started our careers there.

I started out in the aerosol group of the Protective Division. I was terribly impressed with the quality of the military personnel. They were all reserve officers who were called to active duty, and it was my understanding that talking subsequently with Lt. (b)(6) in later years, he almost could hand pick the officers that would be assigned up there. (b)(6) was the head of the Protective Division, and he had been a vice president of a large paper company in Maine. Our division chief, whose name will come to me, I can't think of it at the moment, had been the director of research and development of Standard Oil of Indiana. The chief administrative officer, Major Hunter, had been a professor of chemistry at Georgia Tech. So, the lab was staffed with high quality professionally- trained people. I worked directly with a (b)(6) (b)(6) Captain (b)(6) if you asked around how to write a PhD thesis at MIT, and they would say read (b)(6) and you'll get it done. Dave Beaumont subsequently went on after the war to become a professor at Indiana University, and unfortunately died in the early 50's of leukemia. But he was certainly an outstanding individual, so we were all technical people. There weren't too many civilians; in fact, I was the only one in the aerosol group under (b)(6) one other Lt. and a couple of technicians.

Our job was to develop the DOP (di-octyl phthalate) test into a plant tester for the acceptance testing of canisters in all of the production plants. We had two consultants, Professor Wayne Nottingham, in electrical engineering, was our consultant in electric circuits of the high gain amplifiers for the DOP tester; and professor Hans, Muller of the Muller Matrices fame, was our expert in Aerosols Detection because the .3 micron particles size aerosols was the optimum size determined for penetration of filter material. Those smaller would be removed by [inaudible] motion and those larger than .3 micron would be removed by inertial impact as they flow through a filter. So the design was built around a .3 micron test aerosol DOP test was evolved out of Columbia University and worked by Victor Lamare and Bernie Vonagot, and Dr. Vonagot had left MIT by the time I joined them. He was an early staffer and went on to other aerosol work. We developed principally the MIT E1 test apparatus, and had it built at the Dumont Laboratories in Passaic, New Jersey.

JS: What is that – Dumont. . .?

EE: Dumont, Alan B. Dumont Laboratories. Alan B. Dumont was one of the early developers of television. Unfortunately, Dr. Dumont, in fact he had an experimental television station in New York from the late 30's, but his was a mechanical system of developing a television raster as apposed to a electric system which had been developed by RCA. So he had a large wheel that went in front of television set, he had a broadcast station in New York and receivers in New Jersey. That was his main business, developing early versions of television and other electric devices.

JS: So he was your producer, kind of.

EE: He had the contract to build the units at the Dumont Laboratories in Passaic, New Jersey. And I was the resident engineer. After we had developed the prototype at MIT,

we took it down to the Dumont Laboratories and the Dumont Laboratories built the electronics and assembled the final items. In those days, you were design engineer, the development engineer, the acceptance test engineer, and we put them in the plants. So we installed, I say we, the team from MIT, having developed the item and Dumont Laboratories having built them. [The] mechanical work was done by a garage mechanical shop down in Hoboken, New Jersey by a really good machinist who had converted his machine shop to war work. We assembled the units, we tested them, we then shipped them to the various gas masks production plants. They were installed on the production lines, there were some six or seven producers of gas masks, M10A1 canister and the M11 canister during World War II. Let me see if I can recall where they were. Firestone Tire and Rubber in Fall River, Massachusetts; Johnson and Johnson in Chicago-right next to Midway Airport; Simmons Bed Company in San Francisco; Clarksville, Tennessee (and I'm sorry I can't remember the name of the company) had a production line; and there was a production facility here at Edgewood.

After we got them installed, we turned out to be the super trouble-shooters. Each plant had its own maintenance contract for the equipment. But when all else failed, they called MIT and we got on the airplane and went out and fixed them to keep the lines running; because all canisters were 100% acceptance tested for aerosol filtration by the MIT E1 testers.

JS: To stop you for a moment, on the testing, how did you challenge the canisters, by agent or ...?

EE: No. It was challenged by an aerosol produced of di-octyl phthalate (DOP), which was a nontoxic material. Although, it has just been replaced because it has been subsequently identified as a carcinogen. I noticed just this last couple of months, that a couple of people here at the center just received recognition for replacing DOP with a less toxic aerosol.

JS: So, you never used live agent though?

EE: Never used live agent. Aerosol filtration was done with .3-micron particles generated by heating in oil bath, the DOP, vaporizing it and then quenching it in an air stream to produce .3-micron particles. We also developed what's known as the Owl, which is a set of cross Polaroid's that measures the annual polarization of light passing through a test aerosol, to measure the fact that it was .3 of a micron in diameter. [The .3 micron particle] was determined to be by filtration theory the most penetrating size for the aerosol filtration traditionally used in all filter media, whether its individual protection canisters or whether it was large collector protectors. So, the balance of my time at MIT was building some these, as we call them, Owls for measuring the aerosol particle size. We developed it there with the help of the Polaroid Corporation that were just down the street and LAN had just developed polaroids to measure, and we used cross polaroids to measure the angle of angular dispersion of light passing through a monochromatic beam.

Anyway, at the end of World War II, the laboratory was closed, I was asked to bring this aerosol and electronics laboratory which we had at MIT in the protective division down here to Edgewood and set it up. Edgewood had had a very minimal capability in aerosol testing and aerosol development work and in developing such things to measure the efficiency of filter material. I brought the laboratory down in the fall of 1945. We set it up in building 3330 and they gave me a room that had been an office on the 1st floor of what's now the JA Wing and said convert it into an aerosol lab. So we built an aerosol lab and installed all the equipment in the old respirator branch of the chemical labs now here.

Right after Thanksgiving of 1945, they asked me whether I wanted to stay on as a civilian and I said yes and became a GS-9, P3 in those days. [I] stayed until June 1946, it was rather interesting of course, because they were riffing chemical engineers from the plants area and every pay period I got a reduction in force notice, people would interview who were bumping me out of job and then the following Friday I would get a cancellation of reduction of force notice and then the next Friday I would get a new one. That went on until June and I had an opportunity to take Dr. Frank Gocur (sp?) over to Fort Detrick. Dr. Gocur (sp?) had been with the Northwestern University Division 10 of the National Defense Research Committee and I had worked out there for a month when I was at MIT building laboratory version of the DOP tester so that we would have one of those at MIT. In the course of picking up Dr. Gocur (sp?) in Baltimore and taking him to Frederick with a staff car for a meeting we were have over there, I was talking to him about going to graduate school, and he made me an offer to be a research associate on his team at Northwestern. He had a contract with Fort Detrick working on developing means of generating non-pathogenic biological test aerosols. So I accepted the next rif notice and went the Northwestern University, having the opportunity then to work on my masters degree in chemical engineering while a research associate in Dr. Gocur's (sp?) laboratory in the chemistry department. We had a good team, Dr. Chet O'Conski (sp?) was a graduate student also, subsequently got his PhD at Northwestern and went on to become professor of chemistry at the University of California. Ed Pitts was another group member, he went on to get PhD in chemistry and became a professor at University of California at Riverside. I finished my masters degree in chemical engineering, at that time, Professor Gocur (sp?) was offered the position as head of the chemistry department at Indiana University and he moved in the fall of 1947 to Indiana. I had a job offer with the Dupont Company in Wilmington, having finished my masters in Chemical engineering. I jokingly say that I made the mistake of stopping by to visit old friends at Edgewood who ask me what Dupont offered me, and I told them and they said we'll match it, go up and sign the papers, and so I did and became a P4 and came back instead of taking the job at Dupont.

It was a good move. Unfortunately though, in 1947 when I'd been married at Northwestern, my wife and I moved back here and immediately the Chemical Corp budget got slashed. In 1947, it was cut almost two thirds and 4 of us locked ourselves in a room in the corner of building 3330, a right front corner room on the 1st floor – a lieutenant colonel. who was the protective division chief and 3 of us civilians and we wrote the Army's Radiological Defense Program. Radiological Defense Program was

put together, we hand carried it to Washington. We had a couple of young staffers up there by the name of Majors (b)(6) . (b)(6) subsequently General Stone and Dan York and they worked it through the system and we got the whole budget cut back as the Army's Radiological Defense Program. So we kept Edgewood open.

Matter of fact, there was an effort under way at that time as to whether to close Edgewood and move it to, of all places, Camp Sibert, Alabama. The Ordnance Corp was going to transfer some of their funds to allow the Chemical Warfare Service to do this. It was a well orchestrated move on the part of the Office of the Chief Chemical Officer who came up with the strategy as to whether -- how many people would move. We concocted a write-in move, we wrote how many people would go to Rocky Mountain Arsenal in place of going to Camp Seibert, Alabama and the results came out all in favor of Rocky Mountain Arsenal, of course. Certain high level people took that information to the congressional delegation from Colorado and said look at this opportunity; [then] got together with the people from Alabama and the Congress and the whole thing died. So we kept Edgewood open.

Now we had a radiological program however, and the question was how are we going to execute it. They established then, a radiological division as the steward of all this money, and we wrote projects for each one of the existing divisions, an analytical chemistry for example in the chemistry division, we had a project written to determine the use of chemical methods for detecting radiation. We had protective projects in the effectiveness of the filler materials and charcoal and absorbing radioactive gases or aerosols. So we had projects that would maintain the existing organization to look at the effectiveness of our equipment against the new fallout threat of nuclear weapons.

Radiological division became the steward of that program and I was the assistant to the chief of the Protective Division, Lieutenant (b)(6) was the chief of the branch and we had a Colonel (b)(6) who had just finished his PhD at University of Chicago after the war. Col (b)(6) became the division chief.

JS: Which buildings did you use? And what were they like?

EE: Well, it was rather interesting. The then Chief Chemical Officer came down and kind of said, where do you want your laboratories. I started out with building 89, which is not the building 89 today. I would have to look at your map. It's the small one story building that is just beyond building 5101, it is now the Bio Technology Laboratory, and the reason we got that building was, of all things, that it had a lead lined chamber in it for testing with gases. Everyone said well, lead lining if you've got radiation, therefore you can use a lead lined laboratory. So we had a lead lined laboratory. We set up test aerosols in there of radioactive sodium iodide, radiated out in the nuclear reactor out in Oak Ridge and shipped to us. And we made radiated sodium iodide and used it as a test aerosol at high radioactive concentrations to test to whether it had any deleterious effect filter materials. So that was our first lab, and then the Chief Chemical Officer said, "Well you need to have a radiological laboratory down there", so we picked building 716. Building 716 is the large warehouse just inside the Magnolia Gate. We converted that

into laboratories as a radiological division complex. We built some Quonset huts on top of knee walls 4 feet high, had a health physics group, a machine shop, had 15 laboratories in that building and that became our radiological complex here at Edgewood.

JS: Did you use the building across the street? Used to be Collective Protection.

EE: We used the buildings across the street. We built filters in building 714, which is on the same side as the Magnolia Road before you get to 716. That was our filter building. We were building filters at the time there. I was not directly involved, because I was on the aerosol side, but there was a group in collector protection who were making filters there and shipping them to the Atomic Energy Commission. We had installed filter banks on the Oak Ridge X10 reactor stack and we had also built filters there for Fort Detrick. We also built filters there for what is called the Mound (?) Laboratory today of the Atomic Energy Commission, which is the underground facility at Miamisburg, Ohio. [The] Chemical Corp had provided all the filters for those facilities to filter the air that was used in the Miamisburg Mound Laboratory facility, which built the plutonium initiators for the nuclear weapons. I went out there to test the filter bank after it was installed as part of the aerosol group. So 714 was part of that complex too.

JS: Where did you store your radioactive materials?

EE: We had vaults. We had lead lined vaults. Most of it was short half-life, though. The item was a very short half-life material, so that after 10 half-lives essentially it had deteriorated or gone down below measurable levels. Our Cobalt 60, we had a Cobalt 60 source, of course if was stored in a special facility which was built for that purpose, because it has a much longer life.

I was in the first radioisotope technique class that was put on by the Atomic Energy Commission at Oak Ridge; a one month long course, at Oak Ridge. Sometime in that time frame and I was in the 1st or 2nd class that Oak Ridge gave on the peaceful uses of Atomic Energy, although we went down there to learn more about handling radioactive isotopes.

Subsequently, the early tests, the first participation by the Chemical Corp in atomic weapons effects testing was at Operation Crossroads. We had one observer, (b)(6), who went out there as a civilian. Subsequently, in late sometime 1948 period, then (b)(6) was head of the laboratories here at Edgewood. I can remember very clearly that he put out an order abolishing the radiological division because the chemical budget had built back up again. But, he was overturned by General Creasy who said you only make a recommendation, you have to have a one over one approval, and I disapprove the recommendation to abolish the division. By that Col. (b)(6) had been reassigned. Col McCormick -- we had set up a joint program with Oak Ridge, and Lt. Col. (b)(6),(b)(7)(went to Oak Ridge as the head of a team that included three civilians, and the Atomic Energy Commission, and the Health Physics Division at Oak Ridge put in an equal number of people, and we had a joint program down there that ran for several years on protective aspects of radiological materials.

I ended up as assistant chief of the division, in charge of atomic weapons effects testing. We never had a strong chemical budget, we had a chemical budget of about $300,000 thru the Army, but we got extensive funding through the then Armed Forces Special Weapons Project of the DOD, which is now the Defense Nuclear Agency. So that we probably had several million dollars a year budget to support the atomic weapons affect testing.

The Chemical Corp originally did most of its work in the area of aerosol filtration business. The earliest project of substance was at operation Green House, when we had a joint project with the Navy. I was the program manager and I had a deputy from the Naval Radiological Defense Laboratories at Hunter Point, California. Our job was to sample the atomic bomb clouds. The US Air Force had drone B17 aircraft and were flying them at 2000 ft. intervals from 12000 ft to 30000 ft. under mother ship control. The purpose of the drone B17's was to fly through the bomb cloud right after its formation, being far enough away from the cloud not to be damaged by blast or thermal radiation, and collect samples for the Atomic Energy Commission under wing samplers on the aircraft which would determine fission yield of the bombs by measuring the ratio between the fission products. The Chemical Corps, Chemical Warfare Service our project, jointly with the Navy was to install all kinds of sampling equipment on that B17. We had samplers that would collect isokinetically filter samples, which we would come back for analyses, large bag samples which we would bring back to the states and analyze for particular size and radioactive concentration and other information. We had something called the conofuge(?) which was a centrifugal particle size separator, which had been developed at Fort Detrick, and we adapted it to play out sizes of radioactive particles. We had multi-stage cascade impacters, which are devices used to measure particle size of aerosols. All of this equipment was installed ahead of the team that went to Einiwetok for 3 months.

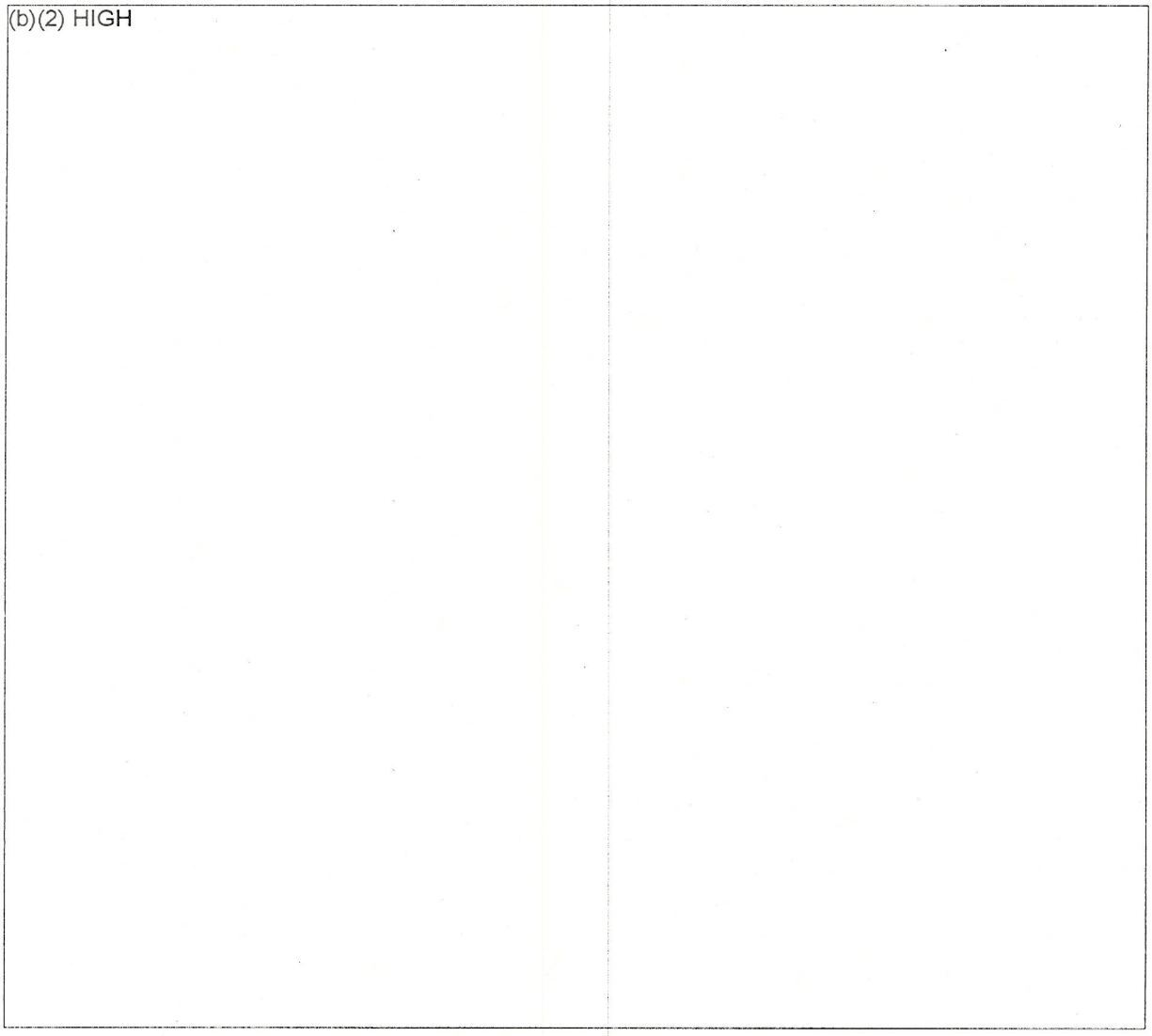
All the stuff had been installed on the aircraft, we calibrated it in practice runs of the aircraft every night, as they practiced flying these airplanes by drone control. [We took] our samples after the planes return, we had special shielded fork lift trucks which would allow us to go up and remove the samples from the hot aircraft safely without overdue radiation exposure. [We] package[d] them up and put them on courier aircraft and flew them back to the United States, to both Edgewood and Hunters Point, California along with the fission yield samplers to Los Alamos for measuring bomb yield; and that early data collected in projected in 3.1 of Operation Green House was the basis for developing all of the fallout prediction models, that are even current today.

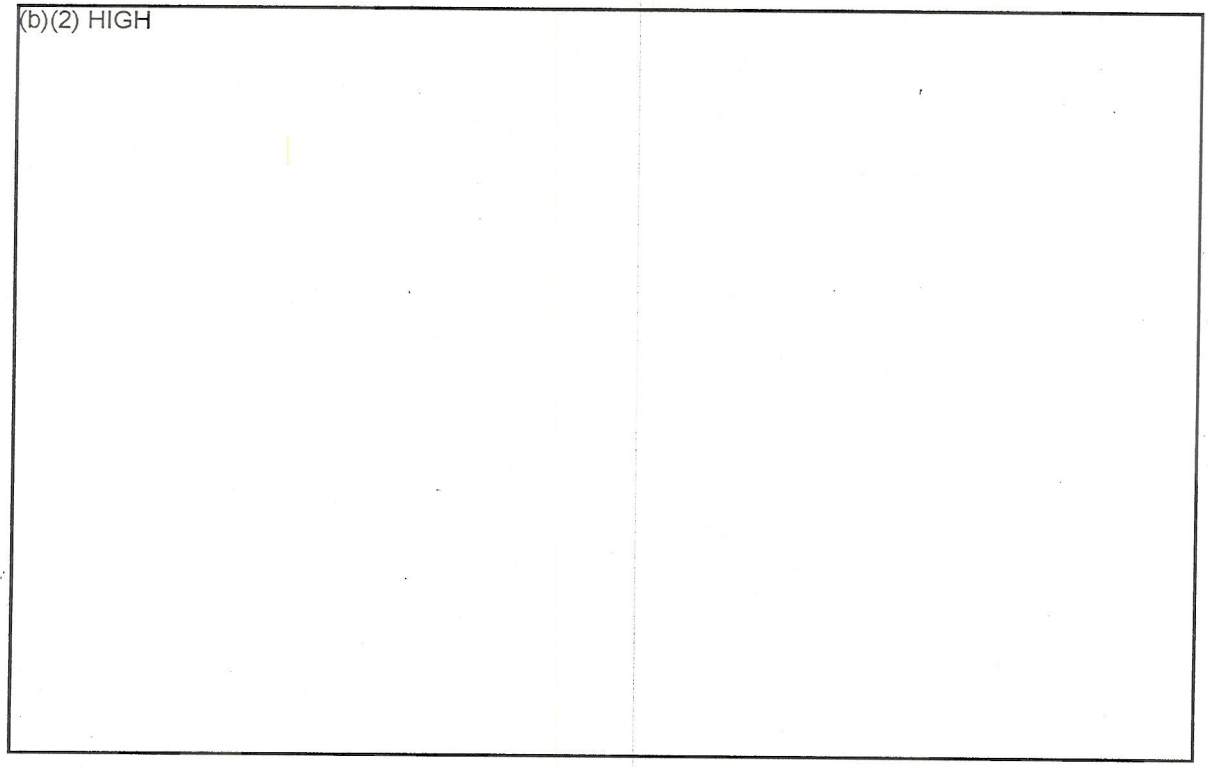
We did some other work. We had a team that went out and put various kinds of building materials, etc. on the wings of the B17, [they] glued them on. [It] may be roofing materials, military materials, and that airplane scarcely looked that an airplane anymore when it flew. But these samples were all removed; our objective was to determine the contamination levels of the various materials and bring them back for analyses; that was run by our decontamination branch under Lt. Col. (b)(6) (?) of the Radiological Division. I was the overall senior representative on sight and we had a team

of 50 + people on Einiwetok for 3 months on Joint Task Force 3. At the end of that operation, we got involved in the underground and surface test and Nevada Test Site operation _____, hum; there are too many code names. But anyway, it was the 1.2KT surface shot and the 1.2KT underground shot, which was conducted at the Nevada Test Site in the fall 1951. Again I went out as the senior representative and took a team with me.

We had a number of projects there, those projects involved measuring the radiation shielding of military vehicles, and so we had teams that rode inside of various types military vehicles, such as armor personnel carriers into the hot areas after a ground shot and _____ surface shot and measured the shielding of the vehicles on the radiation doses that crews would get inside. We also had various contamination/decontamination projects deal with military equipment that had been exposed to these prototypes, if you will, of tactical nuclear weapons and those were decontamination studies on how to decontaminate radioactive contaminated vehicles, of military interest.

(b)(2) HIGH





Following that program, we did a study on St. Louis, Missouri, as to how to emplace generators in an optimum way such that we could smoke to protect cities. Again against reducing the effect of strategic use of nuclear weapons on United States targets. That report was published on how to emplace and utilize civilian gas stations, if you will, and mobilize other capabilities to use [to protect cities]. Subsequently, I gave a paper on that subject, unclassified "Thermal Radiation Attenuation of Clouds" to the National Academy of Sciences and Engineering held in Washington in the late 1950's. That was a completed close out project. My role was more of an oversight except for running these major projects through the later 1950's.

JS: You went to become the executive assistant to the Deputy Commander for Scientific Activities?

EE: Right!

JS: So that got your other Radiological...

EE: No! That was rather interesting. Very simply, I came back from spending the holidays at Thanksgiving in Chicago, which is our hometown, in the fall 1955, and came back that Monday morning and was told to go over and see (b)(6), who was our deputy commander for scientific activities at the time. I had known (b)(6) for a long time, and went over and he said that you don't know it ,but we are going to reorganize on the 1st of February, 1956, and I want you to be my executive assistant. I said, "Is it a permanent job or a temporary?" He said it's really a training job, I said I'm

not interested; he said I made it permanent, I said I'll take it; he said don't back to your office, just move into General Burns office in 5101 and put it together." I became the guru along with a person from Civilian Personnel and a Woman's Army Corps Major, who was the orchestrator of putting together the new organization, which integrated the then Chemical Corp Medical Laboratories into the Chemical Corp Research & Development capability. We went operational on 1st February 1956, and I became his executive assistant.

(b)(6) was a toxicologist, he came out of medical laboratories and I being an engineer, I guess their rational was that we could balance each other in overseeing the technical program. And it was a most interesting assignment, both the reorganization portion of the planning that went up to the 1st of February, and then putting into effect the new organization and getting it established. Then I was very fortunate, much earlier I had applied for a Rockefeller Public Service Award, which would give you a years study at a university of your choosing. [I] and went through the whole interview process and was nominated by the Secretary of the Army to the Rockefeller Foundation for such an award, [it] would [have] given me full pay and all expenses, and a year of graduate study for whatever my project was. Unfortunately, none of the ten recommendations that the Secretary of the Army made were accepted by the Rockefeller Foundation. The Secretary of the Army, I was told, was quite upset at this and he established his own program, which was the Secretary of the Army's Research and Study Fellowship. I was the first one to actually to go on one of those fellowships. I was accepted. The Secretary of the Army named three of us initially, for one those awards, and the Secretary of the Army's Fellowship, of course, is still in existence today. I remember (b)(6) who was the commander giving me a call from Washington, walking down the hall in the Pentagon, and some General Officer stopped him and congratulated him on one of his employees getting one of the first ones of these. And he picked of the phone and called me how fast you get to the University of Michigan. In two weeks, I was at the University of Michigan, in graduate school with one of these Fellowships. So I spent a year at the University of Michigan, in Nuclear Engineering, got my masters degree in Nuclear Engineering from the University of Michigan.

I had earlier proposed this of course, having been associated with the Radiological Division as part of a program on peaceful uses of atomic energy. Of course it took some time to get it, by the time I got it, I was already in a different position, and only overseeing the radiological program as the executive assistant to (b)(6). By that time, the Radiological Division had become the Radiological Laboratory and subsequently spun off as a separate entity in the early 1960's. But anyway I spent a year at the University of Michigan and came back then to Edgewood after getting my masters degree in Chemical Engineering under the fellowship program, and became deputy director of Research to (b)(6). (b)(6) was an eminent biochemist, developer of the Klett-Summerson spectrophotometer and again I was the counterpoint to (b)(6) as an engineer, as his deputy, where he was essentially a biochemist.

Those were the early days when we were running the industrial liaison program and accepting compounds from industry that would not pass their toxicological screens,

but might be an interest to the Chemical Corp for the use as offense chemical weapons or to study them because they might be used against us for defensive reasons. So we had an extensive program in which we were looking at highly toxic compounds going up to things like botulinum toxin, which were three or four orders of magnitude more potent than VX and GB and studying those kinds of materials for both defensive aspects as well as potential offensive use in the chemical warfare program. I was his deputy and he moved to become chief scientist of the Chemical Corp and Dr. Hurgot (?) replaced him as the Director of Research until we reorganized in 1961.

I had gone back to Michigan to do additional graduate work in Nuclear Engineering for a year in that interim period and to finish some additional work under Army sponsorship as a graduate student leading to a doctorate. Unfortunately did not have sufficient time to finish my doctoral thesis. Had all the other requirements except the thesis and that was a political/technical problem that the University of Michigan had at that time with the number of graduate students. I came back here then I became the Director of Defensive Systems in the reorganization and then four years ran the entire defense program of then chemical warfare, Chemical R&D Center program.

That was an interesting program, because Project 112 under President Kennedy had ramped up the chemical defense ten-fold. I can remember very well inheriting an organization roughly 112 people with 116 on board, so I was four over strength and suddenly getting a ten-fold increase in budget with no additional help. We conceived the idea of having five prime contractors; today you call them mission support contractors, in which we would contract out a major portion of our budget increase. We had a large contract in detection with the Melpar Corporation down in Virginia who agent laboratories and we had decontamination with the W.R. Grace Company, we had individual protection with the Rockwell Company in California and the biggest one of course, and the big emphasis, was on detection. We had no capability for point sampling in the field prior to this point and we were developing the E41 alarm based on the _____reaction for a field point sampling detector. We completed the development of the E41 and it was typed classified and they went to get production and unfortunately the Army proposed, and this is my version of it, buying enough detectors to equip the entire army and the reserve forces. That wasn't the way to go. I argued against it, I didn't win. They wanted to get these in the field and went to the Vice Chief of Staff. The Vice Chief of Staff asked how much it would take to maintain them and, of course, you had to have a little chemistry set as a refill set that was replaced every 12 hours, and I forget the number of personnel it would have taken. It was a number like two out of each company and they would have had to give up two riflemen, and the Vice Chief of Staff said no in very emphatic terms. So we were never able to type classify the E41 as a system or procure it. A number of us that were in the technical side wanted to buy enough to put out with a field unit and begin to get experience. But the decisions were made above our level, way up at the chiefs' office to go for broke and they lost.

We were directed than to develop a program, which would be a non-chemistry set. After all, the physicists can build these things that can detect radiation in small units, why couldn't we do the same in chemistry? We had an item called short path infrared,

we had been working on a long path infrared, LOPAIR, from the late 50's in principle. We had a concept of packaging infrared detectors into a small hand held package that would fold the infrared path back and forth between mirrors and get sufficient path link that you could make a detection by infrared spectroscopy. Unfortunately though, dust on the battlefield causes you all kinds of problems, and it's not possible to filter out the dust without filtering out the aerosol. But, we had a directed program to work on SHOPAIR and we had a back program, which we fought for very hard, to keep and enzyme detection system as a backup mechanism. Subsequently, SHOPAIR failed and the enzyme system became the system of choice. It didn't require all the chemistry of the _____ reaction, but certainly the enzyme system became type classified and then in the early 70's we did a product improvement on it to come up with the ionization detector that's now fielded as the point detector.

One of the other significant areas that we developed in the early 60's was we developed the drinking capability into the voice-mitter assembly of the M17 mask. That gave us significant improvement to the ability to wear the mask under prolonged periods of time because you could replenish water loss by hydration by wearing protective ensembles. There were other developments. The concept of modular collective protection in which we would develop a standard set of collective protectors, 50cfm, 100cfm, 300cfm, and then adapt these into and apply them to various shelters and bands systems to provide collector protection with essentially a selection of sizes in collector protectors. It was an exciting period until they reorganized again in 1966 and went from Director of Defense System, Director of Weapons System into another structure back to more of a research and development structure of directorates and I ended up in charge of first the Dissemination Research Department and the Physical Research Laboratories.

That was an interesting period of time, probably the only time I have been closely associated with what might constitute an offensive program in the chemical business, because we were working on CS and foam as technique to essentially contaminate tunnels and keep people from Vietnam from occupying tunnels and the tunnel rats. In the process of that program in the dissemination research department we came up with the hydrophobic form of CS, which is known as CS2, which was really a non-wetable form of CS. It would maintain its aerosol characteristic in the presence of water; in the presence of foams and it was a very useful, almost too useful, because you couldn't decontaminate the darn stuff.

One of the more interesting projects was suggested by.... actually the President of Franklin Research Institute, Aristid B. Grossman was one the original atomic scientists that worked putting together the reactor under Stagg Field in Chicago. He went to visit retired General Leslie R. Groves to convince him that we could use foam more aggressively in Vietnam and offered to put on a demonstration. Retired General Groves then visited the Chief of Staff, of course, (General Groves was head of the Manhattan Project) and suggested this, and the Chemical Corp got a sudden phone call to invite Dr. Grossman down for a demonstration. We hosted him here for a meeting that was chaired by the head of the Army Materiel Command, of all people. During the course of the briefing, after the demonstration of foam for the purpose of denial of terrain, which was

put on by the Walter Kiddie Company and Franklin Research Institute, I suddenly was asked how much it would cost to develop the process and field it. Literally, at that time I remember coming in with a number on the back of an envelope of $785,000, and the CG of AMC said how soon could the piece of paper be on his desk. Somebody told him two weeks. So we suddenly had a program to develop foam generators for field use.

Two young lieutenants were putting in their active duty, (b)(6) now (b)(6) of the reserves and one other. They both were surface chemists and they saved the day, because they knew more about surface chemistry as PhD's than anybody here at Edgewood would ever know. We came up with CS2, we came up with foam, we built about half a dozen foam generators on the back of ton and a half trucks and demonstrated the capability of establishing a foam in the field that would include CS, it would be a barrier to penetration by personnel. In fact, we got a request out of Washington that (b)(6), who was then commanding the post for the Center as to whether these were available for use in the Washington riots and fortunately he did the right thing, he said no. Though they would have been very effective, because they weren't type classified, they hadn't been tested, they hadn't gone through all the medical screening, while they would have worked, they probably would have put the Army at risk having had very premature development of an item fielded. Foam with CS2 in it was a very effective means to create barriers, for example: in an alley, in a city, so that you could control mobs or riots and that sort of thing. It was looked at subsequently for use in a defensive role in critical facilities such a nuclear weapons cite. If people tried to break in or something, you could foam the area, you would really be so disoriented you wouldn't know where to go. Those were some of the interesting things that we work on in that period of time.

Looking at highlights in my career, I then became chief engineer of Development and Engineering and we had a few interesting projects. One was as I jokingly say, the famous first week in December of 1974, I believe, when the Army had asked for, Chief Scientist of the Army (b)(6) had asked for a program....he asked four questions: What have we done to develop smoke obscurants what have we done to determine the effect of smoke obscurants on electro-optical devices in the field? what have we done in modeling of smoke? what have we done in the testing of smoke? It had come down here to Edgewood to answer the mail and unfortunately, we had a reply due back in December and we weren't getting anywhere. We could tell them all about what we weren't doing in smoke, we weren't doing anything. Smoke hadn't been tested since I ran the test 1955 against the atomic weapon. I suddenly became the czar....and we weren't getting any co-operation out of the electro-optics community in the Army. They essentially said, "Who are you guys?" So I became the czar and with the instruction to come up with program and we got an extension and by early January we had developed a program with the exception of the effect of smoke on electro-optical devices. The Army made a decision to establish the PM of Smoke Obscurants at the time, (b)(6) (b)(6) and give him oversight of the 6.1/6.2 program. [He was] probably the only PM that ever had that oversight in the Army, because there was no focus 6.1/6.2 program. I became an adviser to (b)(6) and subsequently, the PM shop got established and still exists today, and was very successful and are still running tests in the field under

Tony Vanderval (?) on the effects of smoke on electro-optic, or the operational ability of electro-optical equipment for target acquisition in adverse atmospheres, broadened out from smoke obscurants. I'm sorry I had the wrong date that was a couple years later in the 70's.

Earlier than that in the 74 time frame, we had a problem at Rocky Mountain Arsenal when Colonel Watson was commanding out there, in which they were spray drying the neutralized GB and VX from the rockets. Again, being chief engineer, the 1st week in December, the question came up, it turned out that when they spray dried the salt cake, they were actually emitting GB. Of course, it had been neutralized, everyone said how could this happen? Dr. Joe Epstein had published a paper that talked about how GB could be reformed and everyone thought that this was ridiculous, when you neutralize the chemistry; you're done. But the State of Colorado shutdown Rocky Mountain Arsenal and we couldn't continue the demil program. So, I became the czar again as chief engineer to meet with General Sam Bass who was the PM at the time for Demil every Friday afternoon on what do we have to do to solve the problem and then every Monday morning with the Commander and his staff as to what resources did we need. I became very popular, because I had carte blanche, if I needed somebody, I could get them regardless what he was work on, and I had 80 people work for me on the problem and spent about $1,000,000 in December/January/February and we included a whole assessment of if we couldn't solve the problem, what alternatives existed other than spray drying the salt cake.

We did solve the problem, the problem was solved by proving that the GB was being reformed in the spray dryer when we got a high buildup of salt cake within the dryer and you had a large surface area to produce just enough GB to be emitted out the stack and be measurable. The solution was simple, put on rubber suits twice a week and scrape down the inside of the dryer and eliminate the surface area. So they subsequently completed demil of the rockets at Rocky Mountain Arsenal using that chemical neutralization technique.

Then I went on to become in 1978 --- we sudden received authority to now get bulk funded in the 6.2 arena. We had three tasks, one for smoke obscurants, one for defense and one for the offensive program. The Commander was now bulk funded instead of line item funded for the 6.2 efforts. I established the systems assessment office with is now the Advanced Concepts Directorate, Joe (b)(6) has it; that was to become an integrating operation with both. We had a branch for interface with the users, the Air Force/Navy /TRADOC; we had a systems analyses group which is what Jack ____ now has as an system analyses group and we had a budget and analyses group under Sam (b)(6) which is still here. That systems assessment office was suppose to produce a basis to integrate the program so that it was balanced across all aspects of defense. That is you wouldn't be spending more on detection than you should be as opposed to decontamination/individual collective protection. Because the Commander now had authority, the tech director of course, was the instrument to do that, to produce a balanced program given a lump sum of 6.2 resources. So we developed the mechanism to produce a balanced defense program and offense program, although the defense program was by

far the biggest. It was my pleasure to be the principle defender of the budget up at the Munitions Command and higher each year, as a budget presentation process.

Subsequently then, we had a problem with the XM29 mask which couldn't be produced and we were going to DTOT testing and I was asked to go down to take over that program and straighten it out. We terminated the XM29, unimolded (?) mask program, developed the peripheral face piece with the separate lens as an alternate of the XM30 and got that program on the street under Jim Cauller, and then I retired. I decided to hang it up, I was running the decontamination and the mask program at the same time. Having done the spray drier program and then having done the smoke obscurants program I put together the Army's decontamination program and defended it up to Under Secretary LaBerge[?], who had asked for a reassessment of what we were doing and asked for a decontamination program. Having completed that assignment, as a reemployed annuitant, when I retired I came back as a half time reemployed annuitant.

JS: What year did you retire?

EE: I retired in June 1979.

(b)(6)

Then I got associated with Battelle in a rather interesting way, part of the program that we proposed was to answer Dr. LaBerge's question on the decon management plan, was that we would have a industry conference, after all industry is cleaning up things all the time and that's decontamination; so part of our program was to have a big industry conference and we'd gone to Battelle to put on that conference in the spring of 1980. I did not intend to go although I organized the program until the commander at the time, asked why he had not seen my orders because I was working directly for him and I told him that I was part time. He said its your program, get out there, so I put in a set of travel orders and went to Columbus. It turned out that General Watson was the keynote speaker for the meeting as a brigadier general, but they didn't have a dinner speaker. Somebody at Battelle called me up and said we need a dinner speaker and I had about 3 days, said alright I'll do it and I take a couple of slides. So I went out and talked to them about how to integrate the chemical defense program. This is really a five sided program of individual protection, collective protection, medical aspects/treatment, detection/warning, etc. and we had a diagram that showed this kind of a way in which to look at the total defense program as a program as opposed to individual pieces. That is, after you have detected then you can avoid contamination, to mold the concept of contamination avoidance. If you can't do that then you have individual protection if you can handle individual protection, then you have to provide collective

protection for vans, vehicles, shelters and of course if all else fails you've got a medical treatment program. That was my little dinner talk at the meeting.

The president of Battelle ask me, who was the host, at the meeting ask me what I was doing. I told him I was just talking to companies and he said have you talked to us and I said no, he asked why and I said I didn't want to move to Columbus and I didn't want to work full-time. All he said was why haven't you talked to us, then it ended up with my going to work for Battelle as a part-timer out of my house because they were getting into the chemical defense business. They made the corporate decision to get more involved than they had been, although interestingly enough, the first project that Edgewood ever had with Battelle was in 1949 when I was developing the equipment to sample the atomic bomb cloud, they had a expert in how to design isokinetic sampling nozzles. So I went to them with a small program under contract to design the nozzles that we use on the B17s for sampling into the cascade impact or I'd almost forgotten it, but suddenly here I became associated with them working part-time out of my house.

Three years later they called me up and said when are you going to take a physical. Why do I need to take a physical, and they said because you are going full-time the 1st of August in '83. Then in '85 we opened an office, here I am I'm still in the chemical program; in June it will be my 50th year. So that's a quick summary.

JS: Well, that was very good.

EE: I don't know whether I've adding anything to your archives, but I had a lot of fun.

JS: OK! Well I want to thank you for the oral history interview.

EE: I probably overlooked some things or a date or two that's wrong, but I'll confirm those when I work on it.

JS: OK! Thank You.