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Transcript of Oral History Interview Conducted 24 December 1985
by
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b(6)

Early Career

E. My name is ~~Sigmund Eckhaus~~, born in Baltimore, MD (b)(6) educated at Baltimore Polytechnic Institute and Johns Hopkins University, where I received a Bachelor of Engineering Degree in 1949 and Masters of Engineering in 1951.

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S. What made you pick those particular careers?

E. Well, I would say probably mostly influence by an uncle of mine who was a chemical engineer and went to Hopkins and then I got a four-year Senatorial Scholarship to Hopkins, so that sort of set me in the engineering field and when I had to make a decision as to which type of engineering I picked chemical engineering. I think mainly because of my uncle's influence.

S. What did your family think about this field of work?

E. I think they were very pleased as I say it was my uncle who had been very successful in this area; I think they were generally pleased about the selection.

S. How did your education prepare you for your work, was it enough or not?

E. Oh yes, yes definitely enough. The other thing about it was Dr. Ben Harris. Dr. Harris was a professor at Johns Hopkins University in the chemical engineering department and he was also a consultant at Edgewood. After I finished my graduate work and was thinking about where to go the war in Korea had started and Dr. Harris told me they were looking for engineers at Edgewood and told me to come out and have an interview. Well I came out and had an interview and was very interested in the work that was going on. It was process development, which I was interested in, and, therefore, I accepted the offer of a job, right out of Hopkins.

S. Had you heard of the Post before you heard from Dr. Harris, like when you were going through school?

E. Well certainly, yes. Edgewood was generally well-known in the community and I was aware of the place.

S. What were your impressions of the Post then, before you had been up here?

E. I don't think I had much of an impression, I knew they were involved in chemical warfare programs, but other than that really not much more. Well, after I got here and saw what they were doing, I knew my chemical engineering background would fit right in with what was going on and I was very interested in the process development work that was going on here and I was sort of getting right in on the ground floor of a period where it was expanding because of the Korean conflict.

Prior Employment

S. Did you have any prior employment, like when you were in college?

E. Well, yes I did work at Bethlehem Steel during the summers and even after I graduated. After I got my bachelor degree I was thinking about working at Bethlehem Steel. They had a program there where they started young engineers out and moved them around the plant. It was a very interesting program, but I decided instead to go back to graduate school, get my graduate degree, and then forgot about Bethlehem Steel when Dr. Harris brought me out here.

S. That was really the first time you ever considered working for the Federal Government?

E. Yes.

S. Did you have any other career plan in mind, before Dr. Harris contacted you?

E. Well, other than possibly working at Bethlehem Steel, I don't recall going on any other job interviews, I probably had sent out some letters, but I don't recall going on any other interviews other than coming here.

Starts at Edgewood Arsenal

S. When Dr. Harris contacted you, what were your initial thoughts about the job? Was it something you were interested in, were you surprised?

E. No, you mean that he encouraged me to come out here? No, I think he probably had mentioned it in the past to some of us in the University and in fact shortly after I came out here he came out here full-time. He was just a consultant at the time and also I think he was a reserve officer and would come out on active duty during the summer, something like that.

S. When you first came to the Post, what were your initial impressions of the Post, its missions, buildings, its people?

E. Well, I was generally impressed with the number of senior scientists they had working the chemical program and generally impressed with their facilities to do chemical research. I was not impressed with their facilities to do

chemical engineering work but the man who interviewed me, a man named Gordon Jarman, who turned out to be my supervisor for the next ten years, showed me the plans of a new building that had just been designed and was about to be constructed to do process development, and I was impressed with that, and as I say, I knew that I was going to be one of the first people to work in that building.

S. Which building was that?

E. The building was known back in those days as building 2345, it was a process development facility in back of building 3330. Today the number of the building is E3640 and it has been I would say abandoned. I think the building still has some potential, but it needs a lot of rehabilitation. It is a big four-story building with five separate bays in it, has a lot of flexibility to do a lot of things in it.

S. Once you had seen the Post, you obviously accepted the position, can you describe your position, your first position here?

E. Well, I started off working in what was then the process laboratory which was located in the basement of building 3330. It was a much bigger room than any of the other chemical laboratories. It was almost like a floor and a half in height and it had big hoods in it that were perhaps 12 or 15 feet high so you could build, put in some good equipment not just like a laboratory hood, and we used that room for about a year and a half, until this new laboratory that I was talking about was ready.

S. Do you remember your particular position title when you started?

E. Well, I was called Chemical Engineer, GS-07, and I had ... well, it was essentially a training junior engineer given some projects to work on with some officers who were maybe a little senior to me by six months or so but generally the whole group was under Gordon Jarman who was the senior man, but he didn't have many chemical engineers. As I recall, he probably had one or two and they were all comparable to me, but he had a lot of GIs who had been drafted, were all graduated engineers or chemists working in the laboratory, so that the laboratory probably had about thirty people in it and was operating on shifts quite a bit, because once we got something going, we kept it going perhaps two shifts, sometimes even three shifts around the clock.

S. Particularly, do you remember any of the projects you were working on?

E. Oh yes. In the beginning we were doing process development on the manufacture of GB, the nerve agent GB and its precursors. At that point they had probably already designed the full-scale plant which was at Rocky Mountain Arsenal. Well, the key precursor was made at a place called the Phosphate Development Works down at Muscle Shoals, AL. They were having some process problems down there and we were working on other ways of making that key intermediate called dichloro and then the dichloro was shipped from the Phosphate Development Works, we called it PDW, at that time, it might also have been called Site A. It got shipped from Site A to Site B, Rocky Mountain was

Site B. I think they used the words Site A and Site B because of classification back in those days because they generally didn't want everybody knowing what was going on out at Rocky Mountain Arsenal. In fact I think the project originally was labeled that we were making incendiaries. I think it was called the Incendiary Oil Project, or something like that, but it was an alias or what was really our intent to manufacture nerve agent at the time.

S. In retrospect, what were your impressions of the working conditions at that time?

E. Well, the working conditions in this laboratory were kind of primitive for good process development and also considering the kind of materials that we were working with and the hazardous nature of these materials. In fact we got thrown out of the basement of building 3330 one day early, I think in 1952, when somebody broke open a phosgene cylinder and all the phosgene fumes went up into what is known today as the JA Wing, that wing that has been reconditioned and rehabilitated now. All the fumes went all the way up to the second floor and everyone had to abandon their office. Several people really got bad exposure to the phosgene.

S. Was safety a major factor in your work?

E. Well safety was a major factor. Sure, we were making nerve agent so they then immediately opened up that other building. At the time they were fooling around with the Corps of Engineers they were concerned about certain things that hadn't been finished in the building and they were sort of negotiating with the construction people about getting all those things fixed, but I think that the phosgene incident precipitated a settlement and we were in there within the next couple of days, I would say. We moved our whole operation down to the process laboratory, which was a building designed for our kind of work, had considerably better safety features, had intermediate areas between hazardous or toxic areas, and working area where people would stand. In other words, a clean area and a dirty area or a clean area and a hot area, so it was a very well designed building for handling hazardous materials like we were working with.

S. Although much of your work was probably classified at the time, were you able to talk about your work at all with your family or friends?

E. Never talked about my work with my family or friends, no.

S. Did that bother you or upset you that you couldn't?

E. Not really. They all knew that I worked up at Edgewood and they all just generally said, oh, he is involved in secret work and it was sort of a friendly joke but no one ever asked me exactly what I was doing and I never told them exactly what I was doing.

S. After you had worked at the Post in your first job here did your impression of the Post or the mission change at all from your initial impression when you first started?

E. No, I don't think my impression changed, I certainly understood a lot more about the mission that was much broader than just making nerve agents or doing research in that area that included many other things like thickeners for gasoline and charcoal for masks, filters, protective clothing, so there was a lot more to it than just making the agents although that is what most of my early career was involved with.

S. Once you were working a while did you develop a career plan within the munitions work as to where you wanted to go?

E. Well I probably had my sights set. I guess I started out as I said as a GS-07. My starting salary was probably \$3,600 a year. I guess my career plans were that I hoped that some day I could make \$10,000 a year and I could be a branch chief, that was, I guess, my short-range goal at that stage of my life.

Career Advancement

S. What determined your next job change, position change?

E. Well, I essentially stayed in that same area for the next ten years until I finally did become the branch chief and the scope of work was considerably more than just making nerve agents. We were involved with many other projects in the laboratory, but essentially we were making all of the chemicals and doing a lot of the chemical work for the entire post. In other words, if research needed a couple pounds of something that wasn't made in a pilot plant it was made in our place. All of the chemicals of more than a couple of grams that were required for anybody on the post were made in that facility which I ended up running. It was a very interesting place because we were doing a lot of things.

S. So your next real change in jobs came when you became the branch chief?

E. Right. I guess I became the branch chief in about 1960 and got more involved in administrative matters and management as well as the day-to-day operation in the process laboratory and I guess the next big change came in two years when my division chief, who was (b)(6), went over to what was known back in those days as Engineering Command. He became one of the directors or division chiefs. Well, he became a director of chemical weapons engineering at Engineering Command and he took me along. I got a promotion to a GS-15, so I had moved pretty rapidly. I was very pleased with my progress here, I was a GS-15, 34 years old, and went over there and became a division chief. I had a lot of respect for (b)(6) I had worked for him when he was the division chief in the previous organization which was Chemical Warfare Laboratory

b(6)

and ... I was a little disappointed because I wasn't there more than three months when he moved over to building 1, Headquarters, and left me over in the Engineering Command. There was a little bit of disappointment because I guess there was a bitter rivalry between Chemical Warfare Laboratories and the Engineering Command, and when I was left in the Engineering Command I was, sort of felt like I was left behind. There was one other man who went along with me at the same time, (b)(6). He became one of the division chiefs in the Engineering Command and I was also a division chief and as I said three months later the guy who brought us over there moved onto this other assignment and also right at that time there was a reorganization. Engineering Command went out of business completely and the new organization emerged called the Directorate of Engineering and Industrial Services. The initials were DEIS and of course we were all concerned that DEIS was going to die. But that did not happen, but it did change the kind of work I was doing. Instead of doing process development work and developing new processes over in DEIS I was working with outside production facilities in and around the country, at Pine Bluff Arsenal, Rocky Mountain Arsenal, Phosphate Development Works, so that the engineering going on in those facilities came under my responsibility. This was a very interesting, challenging assignment.

S. Did it bother you that you were moving more into the administrative aspect and less into the direct hard research?

E. No. It turned out that there were many many technical challenges going on at the same time so that I was not over-burdened with the administrative load. It's nothing like the administrative load that we have today, although at the time we probably thought it was. You know everything is relative, but nothing like the kind of administrative load that we have today I would say.

S. As you moved up the chain, they have a saying, you follow in the footsteps of someone. Who were the people that helped carry you up?

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E. For the first ten years I worked for (b)(6) and finally really took his place when he moved to another assignment and I became the branch chief which was a GS-14 job. The man who picked me for that job was (b)(6) (b)(6) who I had worked with also, probably closer to him than to (b)(6) in the last three or four years. Jarman's background was chemist and mine was engineering and (b)(6) was engineering, so I guess we worked a lot closer because we were dealing with more engineering kinds of problems and because there were plants out there that were running that we had to do some work to support. That's why of course I went with him when he moved over to the Engineering Command, so certainly I followed on the heels of (b)(6). He was probably the greatest influence on my whole technical career.

S. Were there any other interesting personalities in that time that you particularly remember as having dealt with or knew?

E. Well, the Chief Engineer at DEIS was a man named (b)(6) who was a very interesting character. He was rough and brisk, I guess brusque is the word, and a challenging man to work with. This is one of the reasons why I mentioned before that I was a little apprehensive when (b)(6) left because it left me to deal directly with (b)(6). b(6)

S. ~~Lou Garono~~ was Chief Engineer?

E. He was the Chief Engineer of DEIS and we ended up getting along all right, but he was a pretty hard-nosed type of engineer and he expected all of his engineers to be the same way. One day he called me a diplomat which I accepted as a compliment, but he didn't mean it that way. He wanted me to be a little rougher and tougher in making decisions on things and not always looking for some sort of compromise. So there was a need for both types of management there, I think depending on what the situation was.

S. Did you deal with any of the Command Group for Edgewood Arsenal?

E. Well, the commander of Engineering Command, when I came over there, was (b)(6) who went on to become, I think, the Post Commander and in a ... b(6)
A little later, I came over in 1962 and I think in 1965 he became the Post Commander.

S. Did you have dealings with him?

E. Oh yes. I had dealings with him on a regular basis. Certainly every week and probably more often than that. I also had dealings with his predecessor, General Delmore. When we had our reorganization in 1962 it was Delmore who brought (b)(6) over to the Headquarters, so I continued to have dealings with (b)(6) and Delmore, but my primary supervisor was (b)(6) and whoever was the colonel in charge of DEIS at the time. I forget who followed after (b)(6), I'm trying to think what his name was, but I can't remember what it was. b(6)

S. What was your major stumbling block in your mission or your job at that time? Was there any, like politics, spending?

E. I don't recall any stumbling blocks. We had many technical problems, we did not have money problems. It was a period (1962) when I guess Korea was perhaps over, but Vietnam was getting hot. We had money to continue our program. I think in about 1960 there was a big shot in the arm as far as money was concerned to make sure that the facilities at Pine Bluff and Rocky Mountain Arsenals and the Phosphate Development Works were kept up-to-date and maintained and that is the engineering work that we were involved with when I got there in 1962. There were many technical challenges but I don't recall any funding difficulties. We generally got what we needed. Of course, everything had to be prioritized and the low priority stuff was put on the bottom of the list and often didn't get taken care of. But there weren't any [problems] as I recall. We didn't have great concerns about personnel. We seemed to have the personnel that we needed to do the job. So I thought we were well-manned and had the money to do the job and the mission that we had.

S. Did you have the sense of it being a very important mission?

E. Oh yes, yes. I didn't expect that we were going to be using our nerve agents in Korea or Vietnam, but we also had engineering responsibility for other materials, the manufacture of CS which is a riot control agent and putting that into munitions and there were thickeners that we were still involved with for gasoline to make flamethrowers and fire bombs. There was colored smoke pyrotechnic type smoke and WP munitions that we were involved with, so there was an ample workload of high priority programs to support what was going on in Southeast Asia. These materials were being used at a high rate, CS, WP, and colored smoke.

S. How did your career continue from being the Division/Branch Chief?

E. At that point in 1962, I was over in DEIS, I guess it was, first it was a division, then it was called a branch, and in fact in reviewing my notes I found that in 1965 the name went from Chemical Plant and Processes Branch to Plants and Processes Branch and when I looked at my job description I found that it included BW, so there was a period of about a year where the engineering that was being done at Fort Detrick on BW came under me as well as the chemical, so that we had both the chemical and the biological program.

S. So in other words at that moment you were pretty much running the Army program for BW?

E. Well, I was running the engineering part of it, in other words there is a production plant and they have an engineering staff right at the plant but any programs to improve that capability, improve on the process, or enhance the process in any way were our responsibility. If they wanted to make any changes at all at the site themselves they would have to consult with us. We had the responsibility for the engineering of those facilities.

Change From Munitions to Demil Program

S. Looking at your resume, looks like you continued pretty much in the Chemical and Plants Division, but then in 1973 you jumped over to the Environmental Technology Office.

E. OK, well in 1966 we had another reorganization which brought the DEIS, that I was talking about, and the Chemical Warfare Laboratories back together in one organization. That was called the Weapons Development and Engineering Laboratory at the time. And, in fact, I think some place in that period the name went from Army Chemical Center to Edgewood Arsenal. This was about 1965 or 1966 this took place as well. In 1966 I was back doing chemical process work and process engineering work but I was back doing it essentially in the process development area and not as much in support of production out in our arsenals. I stayed in that area for a couple of years, until as you said I got involved in environment technology. The things that led up to that probably started around 1967. We had a problem with our aluminum M55 rockets

starting to leak and as a result we had to get concerned with disposal of leaking and obsolete munitions which heretofore we hadn't been faced with, of if we were, I guess we dumped them in the ocean. As we started to have large quantities of these leakers, we had to come up with some ways of disposing of them and we had proposed to continue to dump them in the ocean. Well, in 1969 there was quite an environmental concern throughout the United States - it probably was an outcome of the Vietnam era where there was a lot of reaction as to what the government was doing and how they were doing it and there was concern about the environmental issues. The public just wouldn't accept continuing to dump these kinds of materials in the ocean, so we had to come up with alternative ways of disposing of these very very hazardous materials because they had explosives in them, toxic nerve agents in them, or chemical warfare agents in them. We had to come up with some alternatives and during that period I was involved quite a bit in the program. I had to give briefings up and down the line all the way up including the National Academy of Sciences, who were brought in as consultants and this was a very interesting program. It got me involved quite a bit with EPA and looking at alternatives, pollution abatement, environmental control, this type of issue, and Dr. Harris, I think, was our technical director back then, was concerned that the whole program at Edgewood had to be more concerned with what was happening to the environment. He decided to start this environmental technology division and I was the first chief of that group. I guess maybe it was called Environmental Technology Office which grew in ... today we have an Environmental Technology Directorate. It was through my work and contacts with the EPA and the National Academy of Sciences and people at the high levels within the Army that gave me the background to know the points of contacts and he picked me to head up that office. Our concern was pollution abatement and environmental control over the activities going on at Edgewood, Pine Bluff, and Rocky Mountain Arsenals and we interfaced with other arsenals and depots as well. So there was a pooling of technology to address these various environmental issues.

S. Were you actually in on the design of the Demil program?

E. Right.

S. Were you more of a PR-type person?

E. No, I was involved starting back in I guess 1968 when we started to put together these proposals on alternatives to dumping in the ocean. We had to come up with the technology of how to handle these materials and we had to come up with ways of getting rid of rockets, getting rid of some other obsolete chemical munitions that were stored out at Rocky Mountain Arsenal. There was a cluster bomb out there so we had to come up with a process to get rid of the cluster bomb.

S. The reason I asked that is because obviously that problem is still going on today.

E. Right, well it was out of this initial effort that the whole total DEMIL program got started in about 1970. In fact I think you'll find in 1974 I became chief of the Disposal Engineering Division and that was the first formal division that we had in Disposal Engineering. We were doing disposal engineering but it was buried in out plants and process areas, and back in the early 70's we had what we called a Project Eagle. Project Eagle was headed by (b)(6), and the purpose was to get rid of the ton containers of mustard, the M55 Rockets, and some other excess cluster bombs at Rocky Mountain Arsenal. Out of that whole development of technology and study and looking at all of the alternatives came the follow-on to that, he was made a PM for disposal. (b)(6) became a general. He was a PM for disposal and then following that the organization called USATHAMA was created, which is the U.S. Army Toxic and Hazardous Materials Agency and he was the first head of that organization. The evolution was all out of this 1968-69 problem with leaking munitions and the concern of the press and the general population with environmental issues that this whole disposal program got formalized. b(6)

S. You would say your efforts were successful in establishing the ground work for the current DEMIL program?

E. Oh yes, definitely, definitely, but of course we were very naive at that time in our approach to it. Everything that we came up with, as a result of the public laws that were passed in 1969, any proposal that we came up with had to be approved by EPA and HEW, the Surgeon General of HEW, so they were looking over our shoulder all the time during all of this disposal activity and to this day they are monitoring and policing you might say, the disposal of munitions.

Returns to the Munitions Program

S. What made you leave that field to move up to the chain of command? I see that in 1978 you became Assistant Chief.

E. Well, I was chief of the Disposal Engineering Division for a period of time and then I think the decision was made to, through reorganization, put this responsibility under the PM and they were sort of made a separate group and I stayed with the Process Development Group, it must have been another reorganization in there. Around 1977, I think, that's about when we became Chemical Systems Laboratory, at that point is when probably the whole disposal program was split out by itself.

S. Did you have to remain with the munitions?

E. Well, I don't know whether I was given an option or whether I elected to do it, but frankly I don't recall what happened there. I do recall that I was replaced as the Chief of Disposal Engineering Division by someone else and what the circumstances were exactly at that time I frankly don't remember. I just don't recall what exactly happened, as I said, there was this reorganization and there were several split out of what was then, what were we called then? I guess we were ...

S. Chemical Systems Laboratory?

E. Yes, I guess we were Chemical Systems Laboratory.

S. That's pretty much when they created the Munitions Division at that time?

E. Yes, well there was Munitions Division. I was part of Munitions Division, I was made Chief of the Munitions Producibility Engineering Branch, which was a fancy title, but I think I was essentially doing the same type of process development work, but maybe getting a little more into the munitions filling and load assembly and pack-out area. In other words, previously I probably was doing most of the processed development that was involved with agents themselves or riot control agents or materials like that, whereas now, I was concerned with munitions as well in this assignment.

S. By this time had you changed your career plan in any way? Did you know where you wanted to go?

E. Well, I guess I was pretty much set where I was. Earlier in the 60's and 70's I had attempted several times to go to the Industrial College of the Armed Forces, which might have led me to higher management positions. I guess I was probably the AMC candidate for ICAF about three different times, but did not get selected. Looking in my records I was the AMC nominee for ICAF in 1965, 1970, and 1972, but didn't get selected on any of those. I was also getting involved, around 1977, in quadripartite work which was very interesting, where we were sharing technology with Canada, United Kingdom, and Australia, in the munitions area.

S. Did you do a lot of traveling with that?

E. Right, we had meetings held in Canada, or the United Kingdom, or Australia. There was a lot of correspondence among the participants, but we actually met every two years in a different country. In 1977 we met in the United States, in 1979 we met in England or Canada, I guess, and then each two years it was ... [completion of side 1, Tape 1]

Well, as I mentioned, I was involved with the Quadripartite Ammunition Conferences which were held every two years in different countries. In 1977 it was held in the United States, and in 1979 in the United Kingdom, in London, and then we toured the Royal Ordnance Factories in England. In 1981 the meeting was held in Canada, and in 1983 the meeting was held in Australia and there was a lot of work involved in writing papers and communicating with these folks.

S. What was your greatest contribution to that effort?

E. Well, I think in that area I was probably the only one really doing work in the nerve agent area, so I was a little unique in that I would present that information to those people, although they had little or no programs going in that area. They did have programs going in the colored smoke area, pyrotechnic area, and white phosphorus area and we shared that technology, but they were not working in the nerve agent or the toxic munitions area. Also, there was

continuing work relating to disposal that I got involved with. With respect to the disposal business, back originally, I guess, was the movement of munitions from Okinawa to Johnston Island which I was involved with. That whole operation was known as Red Hat. They had originally wanted to move the munitions from Okinawa out of Okinawa, because Okinawa was going to be returned to Japan and the plan was to move the chemical munitions back to the United States. Well, no governor in the United States would let the munitions come back into his state, so we had to find someplace else to put the munitions. We finally found Johnston Island, which is a little tiny island out 750 miles southwest of Hawaii, it is a ½ mile wide and about two miles long with a coral atoll around it, that is about three miles wide and seven miles long. So it is a little tiny area that we elected to move these munitions to. I went out there in 1969 looking at what the capability was there of storing these munitions on the island and also looking at the possibility of how we could propose to dispose of them on the island. I got back there in 1976 again, looking at facilities and locations for disposal of the munitions. In fact, today they are starting the design and construction of a facility to get rid of all those munitions that are on Johnston Island.

S. Were you the one responsible for selecting Johnston Island?

E. No, this was selected by someone else, I don't know who actually made the selection. Johnston Island was an interesting place, because it is where a lot of the technology was located for open air testing. After an open air shot of the Atomic Bomb, they would have an airplane fly through the cloud, take samples to access the yield to see how the nuclear weapon had functioned and they would bring that plane back to Johnston Island, decontaminate it, and take the samples and analyze them there on the island, so they had quite a capability to support this nuclear program, and in fact that capability is still out there, to my knowledge. But, of course, we are no longer testing in the air. But that capability, I'm sure, could be reactivated very quickly if we wanted to do open air testing.

Joining the Command Group

S. How did your career progress from that point?

E. Well, from that point in 1977 I was Branch Chief in the Munitions Division under Dr. Bernard Berger, then I became his assistant in 1978, then he died and I was Acting Chief of Munitions Division for about a year, I would say, until the position was finally permanently filled. It was an SES position and it took quite a long time to fill and Bill Dee was selected at that time to be Chief of Munitions Division. I was brought over to Headquarters, building E5101 as the Associate Technical Director for Engineering.

S. Did you replace someone or how did you get that position?

E. I think I replaced someone, I think (b)(6) retired. I think he had been filling that role. b(6)

S. Hadn't he been the Acting Chief of Systems Support, or Systems Development Office?

E. Well, I'm a little uncertain, (b)(6) was the Executive Assistant, he might have been the Associate Technical Director for Engineering. There was sort of a flip-flopping of positions back in those days and I forget exactly which one was which. I thought Tom Treglia was the Associate for ---, but I think at the time before he had retired he was the Technical Director for Engineering or Associate Director for Engineering. (b)(6) had been the Executive Administrator or Executive Assistant and I think they eliminated that position and he retired, so there were a couple of positions over there that needed filling and I was put in the position of Associate Technical Director for Engineering. That was under General Kastimeyer. Then (b)(6) retired, so I guess we didn't have a Technical Director. General Kastimeyer left and (b)(6) had sort of a dual role as both Commander and Director. I think his title was Commander/Director. He selected (b)(6) to be the permanent Associate Technical Director for Engineering. He made me his Assistant and I had the title for a period of six months or more of Assistant to the Commander/Director in 1982. b(6)

S. Were you disappointed that you didn't get the Associate Technical Director for Engineering?

E. Yes, I was disappointed, but in retrospect, I'm not disappointed, but at the time I was disappointed.

S. It was definitely moving further and further away from the munitions field. Was that something you wanted to do or was it more like an obligation, you were being pulled away from the munitions field?

E. Well, I guess I was willing to fill in wherever I was needed. You can see from my background I was the first in various offices that they started up at the time to get some of these programs moving like Environmental Technology and then Disposal Engineering. I had sort of broadened myself so that I wasn't just in with the munitions background, so that I could fill in on some of these other areas without too much trouble. I guess that is one of the problems we have, we don't rotate our people around enough so that they do have some broad capability and can fill in wherever they are needed.

S. Well, at your retirement party, they made a joke of your always being "acting" everything. Does that bother you?

E. No, I don't think so. I guess my mental health was so, I mean there were a couple of disappointments when I didn't get picked to be Chief of Munitions Division, I was disappointed, but there was no doubt in my mind that Bill Dee was a good selection. That didn't bother me. I was a little more disappointed I'd say when I didn't get selected Associate Technical Director for Engineering, but again I accepted that without too much of a problem. Also during that period, if you will look, I was even Chief of the Systems Development Division.

S. How did that happen?

E. Well, it happened again because the position was open, it was a key position and they needed someone to take charge of the program, to keep it moving along until they could get the right person in the slot. I wasn't even a candidate for it, but at least I kept the program moving because I had enough knowledge of the total program of the organization to keep it going. They needed somebody in there who was either Computer oriented, Operations Research, or Systems Analysis oriented to really stay with that program and make it function properly and I think that is when (b)(6) came in and took it over. I forget why he wasn't put in there originally, he must have been off doing something else, but anyway when they filled it formally he was the one who was selected. Well, then I went back to Munitions Division and I was in Munitions Division for another year, I guess as Assistant Chief with Bill Dee who I work well with, I think. Then they needed someone over here for the Associate for Producibility. b(u)

Creation of CRDC

S. Before you became Associate Technical Director for Producibility you worked with the Functional Task Group for the creation of CRDC.

E. Right.

S. How did you get involved with that? Did you volunteer again?

E. Well, I didn't volunteer, no, I guess there was a task force put together that was officially headed by Dr. Richardson who probably selected about 12 people. He brought me in and told me he wouldn't be available to function as the Chairman but he wanted me to function as the Chairman and get it rolling and whenever we came up with our recommended position on the various issues to bring them to him for approval. So we had essentially an Ad Hoc group that was called the Functional Task Group for the reorganization which is the reorganization that brought ARRADCOM and ARRCOM together as AMCCOM. That was one heck of a mess. There must have been (I'm guessing) 76 Functional Task Groups who all sort of interfaced one way or another and getting that straightened out and getting concurrence and working the whole thing out was an endeavor. But that was not a full-time job. I would say it took about 50 percent of my time and I was still functioning as the Assistant Chief of Munitions.

S. In that task group, although you had guidelines, did you have a lot of say in how the Post was organized, the new CRDC?

E. Oh right, yes, the group came up with ideas of what we would like to see CRDC look like and within the guidelines that were passed down from General Register, in other words, he specified why we were reorganizing and what he was trying to achieve and within that framework we put together a structure, we asked for certain things and we didn't get them, we asked for other things and we did get them. That was a pleasing experience.

S. Did your co-workers and friends try to influence you in any way about your decision making?

E. No, I don't recall any tough effort of any one. Each organization was represented on the Functional Task Group it seems to me. We probably had a committee of about 12 people, but like all other committees probably about four or five of us did 75 percent of the work and four or five of us did 100 percent of the dealing with the next higher level groups that we had to interface with. There were two other groups above us that worked on the reorganization. I forget what they are called, that was two years ago. It is interesting, I can remember things that happened in 1950 and I can't remember the details of that although I do know there were these two levels.

S. Was one of those the ARTIF?

E. Yes, the ARTIF. I know that (b)(6) was representing CRDC on the next higher level and then (b)(6) represented CRDC on the highest level. That was supposed to resolve programs, problems, and issues before they were presented to General Register. Of course then we had it all worked out, we thought. Then General Register left and General Burbules came in. We had, I wouldn't say we started over, but certainly he had another philosophy and we had to look up things again. But there were certain things we suggested right from the beginning, like the position of Associate Technical Director for Producibility. I proposed that we ended up getting it accepted. b(6)

S. Did you have it in the back of your mind that it might be a position that you might be interested in at that time?

E. No, I didn't. Everyone said you are creating a job for yourself, but I didn't even apply for it when it was advertised. But there were other things too, like I suggested, General Whittaker was still here and one day I suggested to him that we should have our Engineering Support Group at Rock Island. Well, he nearly fell off the table. During meetings with him he would always sit with his feet on the table and I suggested we take a bunch of engineers that were at Rock Island then and make them a part of CRDC because they were handling engineering on items that we had that had already been type classified and were in production. They were chemical items. They were the part of the criteria that was passed to us that the engineering center should have life cycle responsibility for. I suggested we take some of the engineers that were at Rock Island and make them part of CRDC. Well, he practically fell off the table when I suggested that. He thought that was the dumbest thing he had ever heard. But we finally convinced him that is the way we should do it. And, in fact, we did pick up a group of some 30 people at Rock Island who are our Engineering Support Office today.

S. Hasn't it been a problem having them out at Rock Island?

E. No, I don't think it is a problem. I think they are working the chemical commodities and they are touching base with the chemical center where the

technology is for those items, so it seems to me it is logical and sensible. Whether they should all be at Rock Island you might say that creates some sort of a problem. Now it does certainly, but we can communicate with them instantly with the VAX, they have that out there. Their business is dealing with Rock Island procurement, Rock Island management, Rock Island readiness people, and the Rock Island AMCCOM Headquarters so if they were sitting back here they would probably be traveling back there more than half of the time. They are probably sitting at the right place.

S. Were you satisfied with the creation of CRDC?

E. Oh yes, definitely, the only thing I would say that bothers me is that all of the things that are chemically-oriented are not part of CRDC, such as PAD, I think, should be. There is a chemical PAD, but they report to Hugh Luzar, who sits up in Dover and I think they should be an integral part of CRDC. I think they should report to General Klugh. There are a couple of groups that are physically located here and support us but they don't report directly to General Klugh as the Center Commander. I think that is a mistake.

S. How did that develop into several AMCCOM elements, was that part of your group?

E. No, of course we asked for them in the beginning, but as decisions were started to be made one of the earliest ones made was the one on PAD. That PAD would be, what they called central to the AMCCOM Headquarters, as opposed to being ... [At this point (b)(6) requested that the tape recorder be turned off because he couldn't think of the right word. The tape recorder was turned off for about one minute until he thought of the right word.] We were talking whether these organizations should be centralized under AMCCOM or decentralized and placed under the R&D Centers. One of the earliest decisions made was that PAD would be centralized under AMCCOM. Interestingly enough they had the Director of PAD physically located at Dover, with elements at Dover, elements at Edgewood or Aberdeen as we are called, and elements at Rock Island. Every single organization went under that kind of analysis, like Safety. Should Safety be under Edgewood, Aberdeen, or ARDC? Well they decided that Safety, even though there is a staff Safety element at AMCCOM, the Safety Offices were decentralized. So we have a Safety Office and ARDC has a Safety Office. But this type of analysis went through on everyone including the Historian, in fact that was one of the things I asked for early on, a Historian, and General Whittaker supported that. So right from the beginning we showed a Historian as part of our organization. But I thought that should have been centralized, but that was made part of the Headquarters. So I guess you actually report to AMCCOM, Rock Island.

S. Prior to moving on to the Associate Technical Director for Producibility, what would you say was your greatest contribution to the mission throughout your years? Would it be the reorganization or creation of CRDC or would it be your munitions work?

E. Well, I think it was my munitions work. As I look back on my career, I was involved in several areas, the VX process, I have the patent for the VX process which is actually the process that was used in the Production facility.

I was very proud of that effort, that was a culmination of a lot of work we did in the process development group, also the work we did on CS. Back in the early 1960's, we wanted this riot control material to be used in Vietnam and they wanted it quickly. We developed a process to manufacture it and went out and got industry interested in it and it all moved very very quickly and I was very satisfied with that effort. Also, a similar effort involved the producing of BZ. We haven't talked at all about the incapacitating agents, but I was right there in the beginning when we were concerned or interested in BZ. We wanted an incapacitating agent. We were concerned there might be a conflict in Berlin when the Russians were closing off Berlin. We had the Berlin airlift. We wanted to have an incapacitating agent so that we wouldn't kill a lot of people.

S. Were they actually considering using it at that time?

E. Well I think so, yes, I mean we weaponized it. We put it into weapon systems. The systems never left Pine Bluff, we are about to demil them today, but they are building a facility down at Pine Bluff right now to get rid of them. They were built in the early 1960's with that in mind, so I was very proud with that effort. I was also very pleased with the effort in the disposal area which really got us into the disposal business that is a billion dollar business today. They have a tremendous program and I think the new law that has been passed, which is going to provide for the production of binaries, says for every binary round we produce, we have to get rid of one of our other rounds. The disposal program is an important program, and of course these materials are obsolete, they are hazardous, so we have to get rid of them under all of the environmental and safety restrictions today.

Associate Technical Director for Producibility

S. When did you first hear about the opening for the Associate Technical Director for Producibility?

E. Well, they just detailed me over here.

S. In February 1985?

E. Yes, in other words, I said that we created that job as part of the reorganization. It was filled through formal advertising and going through the merit system, following all the proper procedures. (b)(6) was selected. Then when (b)(6) --- well, I guess a colonel was missing over in Detection Directorate, (b)(6) became Acting Director, they needed someone over there to help him out and they brought Bruce over there to help him. When (b)(6) retired they wanted (b)(6) to stay in there a while as Acting Director until the colonel came on board. So originally I was just brought over here for three months to fill in while (b)(6) was over in Detection Directorate, that grew to roughly a year. b(6)

S. Did the job meet your impressions of the job that you had created?

E. Yes, I would say it did.

S. It was what you thought you had created initially?

E. Yes, I think so, yes.

S. Did you change it much from (b)(6) concept of the position?

E. No, I probably didn't change it as much perhaps, or didn't do as much with it as I would have liked to because I thought I was only going to be here for a short time and I sort of just wanted to maintain things. As it happened, I stayed here for 11 months, but there is a lot more that can be done in this job. I think the replacement we have planned for it has the background in producibility and can pick up where I am leaving off and make it grow the way it is supposed to be. There are a lot of producibility issues that have to be dealt with.

S. What do you think are the major problems with producibility that you had to deal with?

E. Well, I guess the main thing I am concerned with is that we have enough money to see that the technical data packages for all of our items are up-to-date and current all of the time. That takes manpower and takes dollars. Now we may not have the manpower, we could do that on contract, but it does take the dollars, we don't always program enough dollars to do that.

S. What are your greatest contributions do you think, in the position?

E. Well I think I have taken care of a lot of things that are associated with the area. I've started trying to increase the number of professional engineers here which I think will help the situation. I would like to see a professional engineer sign off on all these data packages, particularly where safety or health issues are involved, which is probably practically in all of the packages. I think a professional engineer should sign them. So we have a program going increasing the number of professional engineers we have here. Also with training our producibility engineers I don't think any of the engineers get training like that in a university. It is something they have to get essentially on the job. It probably takes about four years to train an engineer to be a good producibility engineer. He has to know all of his engineering, something about development, all of the paper work, he has to know something about administration, and ILS problems that confront a project engineer to get an item out into the field. So he has to be pretty broad in all of the activities and not just in development or production. He has to know about these other issues as well in order to get the item through production or get the item ready for production is really what I am trying to say. He has to be concerned about environmental issues. He has to be concerned about the technical data package to see that it is up-to-date, that it is usable, that all of the sole source items have been eliminated, that it is a competitive package that we can go out and buy it from any source and not just one sole source. We want him to know something about what we call design to cost and that's an important issue. He has to know all about value engineering and ILS issues so he can address them. So there is a lot that our producibility engineer has to know.

S. Do you directly supervise Value Engineering and the Engineering Support Office?

E. Right.

S. Do you supervise anyone else?

E. No.

S. What are your impressions of the CRDC Command Group?

E. Well, I am very impressed with the organization that we have right now. I think our leadership is moving us ahead in the right direction. I really think CRDC is going to move up in the Lab award. You know every year all the AMC laboratories are rated by their peers, by the technical directors, and some other people that Dr. Haley, AMC, brings in to help him access the performance of the laboratories. I think last year we were #5 out of 19 or 20 on the list. This year, I think, we are going to be higher. I wouldn't be surprised if we were #1 or #2. I think that is moving in the right direction. I think certainly we have had the money in the last few years, so we can't complain about that area, but we are short on personnel. I don't think we are going to get any more personnel so we are going to have to learn to do all the tasks we have with contract support. In fact, that is one of the other things that I am working on that I think is an important contribution, a general support type contract that will provide anywhere from 10 to 50 man-years of support across the board to CRDC and the AMCCOM elements that are located here over the next year or two. I am looking for a three-year contract that would provide that level of manpower to us, on a task basis, put the manpower wherever we need to.

S. Well, obviously over the years you have seen the chemical program go up and down, where are we right now and where are we going?

E. Well, I think we are sort of leveling off. I think we reached a peak last year and I think we are kind of leveling off. Now with the production of binary munitions it will look on paper like our program is increasing significantly in dollars, but as far as the technical program, I think we are sort of leveling off. We might get some more R&D dollars, but I don't think it is going to grow significantly. It might keep just ahead of inflation. We certainly are not going to get any more people, so we have to learn to get contractors support to keep our program moving ahead.

S. How do you think the role of the Commanding General here has influenced that program?

E. Oh, that has been a tremendous bonus for us. There is no question. Having a general officer head of our organization opens doors, opens minds, opens everything. He can just cut right through and get right to the right place at the right time to effect things for us that a colonel could never do.

S. Over the years you have dealt with many generals, what are your impressions of them including General Klugh?

E. Well, we have had some pretty outstanding men associated with us in the past, General Bass, General Stoner, General Kastimeyer, and General Klugh. He rates up near the top. He is a chemical officer and has had the experience and background. He was stationed here before. I think they are the ones I would rate high. Of course, they are the ones that I have been closest to.

S. Which of the civilians would you rate the highest as contributing to the mission?

E. Well certainly, as I mentioned earlier a couple of hours ago since we got started on this thing, I think (b)(6) had a key role in the late 1960's and 1970's of keeping the organization moving along when we weren't getting the kind of funding we needed. I guess he retired in 1972. (b)(6) was the Technical Director in the 1970's and the early 1980's, but he didn't have the bucks to do anything with, so I can't comment too much on our performance during that period. I just don't think we were getting the dollars that we needed. The program was just being ignored, essentially, I think, until probably 1982 or so, when we started to get some enhancement in the budget. There is no question, you have to have money to start with to do a good job. b6

Concluding Comments

S. Looking back, which would you say has been your greatest stumbling block, politics or technology?

E. Well, I think technology is the biggest stumbling block. I think you get things done despite the politics. Sometimes we have to work around the politics. Today there are a lot of different issues, even though we have dollars and we think we have control over our programs, and certainly the user TRADOC has a big influence on what we are doing and how we are doing it, so we have to work closely with them. We just can't go off unilaterally on our own, it doesn't get us any place. We have to have a good integrated program with the Chemical School primarily, and other elements of TRADOC, and I think we do today, we recognize that, and I think we are working it that way. So we are getting our act together with TRADOC, get them together early on in every project, so that we don't go along several years and have them say "we don't want it." One of the big issues though with TRADOC is that they are primarily a military organization, every couple of years their personnel change and the new people could have a completely different point of view than the old ones. We could have problems when that happens.

S. Now that you have made it to the "top," we'll call it, what made you decide to retire?

E. Well, I just felt like it is time to leave. I don't feel the kind of fun and enthusiasm that maybe I felt or had in the past. Maybe I'm getting a

little lazy, I hope not, but I just feel like I have over 35 years service and it is time to do something else. Not that I may not even come back as a consultant. I would not be surprised if I didn't get involved some way or another in this business. I've got that background, so I probably will be involved some how or another.

S. Are you satisfied with your Federal career?

E. Oh yes, very, very satisfied, no regrets at all. It has been good to me. I've gotten myself professional recognition, enjoyment, a nice income, and done lots of traveling. The government has sent me to various places of interest, so I have no regrets about it.

S. No regrets about missing all of the money in private industry?

E. No, no, no regrets.

S. What are your future plans?

E. Well, at the moment I have several people in industry who have talked to me about doing some work with them, but I've told them all I didn't want to talk to them until I have retired, then I would start talking to them. I have been involved in the intelligence area a little bit, but we didn't discuss that at all. One of the contractors for FSTC has contacted me and wanted to know whether I wanted to do some consultant work with them and I said "yes, I would." The Arms Control and Disarmament Agency - I've been sort of a consultant with them over the last four or five years, probably longer than that, I guess, since maybe 1972 or so, when we first started trying to negotiate some kind of treaty with the Soviets - so I would expect that I am going to work with them a little bit. So if I work those areas and maybe help out some other contractor part-time I will keep myself pretty busy I think.

S. Any other final comments about your career?

E. No, no, I guess that is it.

[Completion of Side 2, Tape 1]

Korean War

S. Over the years you have been involved with many efforts, particularly a couple of special areas I wanted to ask you about. One was the Korean War effort. You were here at the Post during the Korean War. When did the Korean War actually enter your work here, when did you first hear about it, and how did it affect your work here?

E. Well, I guess the Korean War had already started when I came here and at the same time there was a gearing up of our whole chemical program in the

early 1950's so that we had money to go through and build the nerve agent plant at Rocky Mountain Arsenal and produce toxic munitions. I am trying to think, actually what I was doing that might have been directly involved with the Korean War. I guess the main thing was thickeners. The earliest part of my career, when I first came here, I was working on Process Development for GB. That probably lasted for about a year. Then I got involved, my boss gave me the whole area for my own, you might say, to do process development for thickeners for gasoline, flamethrowers, and fire bombs. (b)(2) HIGH

(b)(2) HIGH

S. Did you have any sense of a war crisis at the Post here? Like with an emergency situation?

E. Yes, there was. Well certainly in comparison, I wasn't here during World War II, but in talking to the people during WWII it wasn't anything like that. I mean, they were working around the clock and at times they would not even go home. They didn't take their leave. Around here we took our leave. There were some projects that might have gone around the clock, but there was a sense of urgency. They created the Limited Warfare Laboratory (LWL), and we had what we called "ensure" items which was probably an acronym with some significance, but I don't know what it means. There were items that we were working on that went right to the field and certainly the flame area. We were doing things, flame and incendiary, which I was involved with. During that early part of my career, those first few years, I guess I established myself as the expert on aluminum soaps. I would go around the country and help companies that were having trouble manufacturing Napalm thickener. We had a couple other newer thickeners, M3 and M4 that we were working on that were supposed to be better than Napalm. So there was quite a bit of activity and I was involved right in the center of that. I sort of established myself as an expert in that area and that led to other projects, individual projects for me, like the VX process or the CS work. We started making CS in 1959 or 1960. The CS was used extensively in Korea to dig the enemy out of tunnels. They were great tunnel builders and we used CS to get them out of the tunnels. We didn't, of course, want to use anything lethal, that to me was kind of ridiculous. We would not have used nerve agent because the world would have criticized us vehemently. But on the other hand, probably half of them that came out of the tunnels we probably shot anyway.

S. Do you remember when the war ended? Was there a celebration at the Post or anything? Was there a sense of relief or accomplishment?

E. I honestly don't remember it so it would lead me to believe that maybe it wasn't celebrated to that degree. I just don't remember it. I know, maybe because it was followed so quickly with the Vietnam War. When did Korea end and Vietnam start?

S. Korea ended in 1953 and Vietnam started in the 1960's.

E. Well, if it [the Korean War] ended then we weren't using CS in Korea. We were using CS then in Vietnam. CS came in the late 1950's.

Vietnam War

S. When did the Vietnam War become an issue? When were you made aware of the Vietnam War?

E. I guess we got hot on riot control agents and then we got into BZ about 1960. I told you we got a few weapons for BZ incapacitating agents and maybe that occurred for the Berlin Crisis. There might have been some riot control agents that we were hot on during that period, but it was CS that was developed in 1959 or 1960, in that timeframe. We went into production in the 1960's and we used millions of pounds of it in Vietnam. Later in Vietnam we got involved in the Agent Orange business which is a herbicide defoliant. They wanted the herbicide to remove the leaves from trees so that the convoys wouldn't be ambushed all the time. The Air Force came to the Army. Industry wasn't moving fast enough, wasn't making the herbicide fast enough for them, and wanted a lot of money to expand their capability, so the Air Force came to the Army and said "can you make Agent Orange for us"? They asked us where they could make it so we took a look at Rocky Mountain Arsenal, the Phosphate Development Works, and Pine Bluff Arsenal. Eventually after a series of looking around at what the Army capability was we found a plant called Weldon Springs, which was an old Army explosive plant, at one time, but had been taken over by AEC and had been used for processing Uranium Ore. It had subsequently been abandoned by AEC, they weren't using it anymore, so it was available. We took that facility and proposed making Agent Orange at that facility. The actual recommendation of the Army was that we should expand industry and not build our own facility, but this was over-ruled at DOD level. They said they didn't want to put that money into any one company and have them come out and take over the whole market. They thought the Government should do it. We were given, I think, \$19 million to start building this facility at Weldon Springs. Well, just about the time we were in the middle of construction the environmental issues started to surface concerning the use of Agent Orange and the Air Force started to lower its requirements. The cost of building this plant looked like it was going to be twice what we had predicted because of the union problems out in the St. Louis area, which were notorious. The plant was going to cost us almost twice what our original estimate was. The primary thing then was that the Air Force requirements started to go down, so we abandoned that plan. But subsequently we got involved in the litigation between the veterans and the manufacturers of Agent Orange. The manufacturers were trying to say that they had told the Government

all along the problems associated with Agent Orange. They were trying to use the information that they had given us to help build this plant, that was the basis they had released information to us and even earlier than that. So that is how we sort of got involved here at Edgewood in the litigation. The question was, when we knew that Agent Orange was a problem, that here were teratogenic problems associated with it, or chloroacne problems, things like this.

S. Did that affect the research here at the Post in any way?

E. Well, the fact is that the Post did little or no research on it at all. The Army at Fort Detrick was involved with herbicides, they had a Crops Division there, and were involved with Agent Orange. We did little or nothing ever with Agent Orange other than we were asked "can you make it for us"? We went out and designed and built the plant to make it.

S. That was only in the manufacturing aspect?

E. Right, but in the course of developing that information, developing that design for that plant, certain information was disclosed to us by industry. That is how we sort of got involved in the middle of the litigation where the veterans were suing for billions of dollars which they ended up settling for \$180 million before it actually went to trial. The depositions were being taken for like two years. I gave depositions at least three times, I know. They said the lawyers' fees were running \$10 million a year or something like that for the litigation. There was a lot of money involved.

S. When was that, that you actually testified?

E. Probably in 1982, 1983, I think the thing got settled about two years ago. It was just prior to when it was to come to trial that they settled. I mean they probably settled within a couple of months to when it was to come to trial.

S. Was Edgewood Arsenal ever the target of Vietnam protesters?

E. Very, very minor. Probably on a couple of occasions somebody was at the gate, but there weren't more than just a couple of occasions that I was aware of.

S. How would you describe, in general, Edgewood Arsenal's contributions to the war other than the few items you mentioned? Pretty minor do you think?

E. No, we were also involved in other areas, in smoke, pyrotechnics, and CS. There were a lot of munitions relating to CS, colored smoke, and WP munitions.

S. Was there a sense of a war effort or crisis at any time at the Post during the Vietnam years?

E. Well certainly there were certain things that ... We had targets that were accelerated to get things to the field, but I don't recall anything in the crisis nature that I was involved with. There were in some of the CS items early on, some of the "ensure" items that we talked about, we were working pretty hard at.

S. Did your family or outside friends in any way influence you or try to argue with you about your war effort?

E. No, I don't think so. I guess I didn't get involved, I mean even if there were comments, I just didn't debate it.

S. It didn't cause you great mental anguish or anything?

E. No, not at all.

Munitions Work

S. Another area that you concentrated on quite a bit is chemical munitions. Over the years what would you consider would be your greatest contribution to chemical munitions?

E. Well, I said the patent that was issued for the production of VX. My name was the first name on the patent. I have what they call the Blue Ribbon patent, the Blue Ribbon copy. There are other people on the patent, but I am the key author of the patent. It's that work, that process that really led to the binary program. That contribution is very satisfying to me that out of that work the binary program developed. Not that I had conceived it to be a binary munition, that isn't what I am trying to say. Others took what we had done and developed the binary concept.

S. So you really haven't had much to do with the actual binary program?

E. No, I wouldn't say that at all. I have been involved with the binary program, but I was just saying that the binary program, the process that we

(b)(2) HIGH

[Redacted]

(2)
u.c.f.w

S. What are your impressions of the current binary program?

E. I am in favor of it. I think that the binary munitions are something that are going to be in the long run just as reliable and going to be considerably safer.

(b)(2) HIGH

[Redacted]

b(2)
u.c.f.w

long run, the safety, and the environmental, and the money that is going to be saved, I think, is very important. I think that is a major contribution to the program.

S. Is it frustrating in any way to design a product that may never be used?

E. No, I think always we knew the idea was to have a strong deterrent, and if you have a strong deterrent hopefully you won't have to use it. I think everyone has known that about the program, the idea is that we want to have a strong capability and by any threat country knowing that we have this capability they will be reluctant to use it against us.

S. Do you see any future use of chemical weapons?

(b)(5)

S. Over the years are there any other interesting stories related to your work with chemical munitions?

E. Well, one of the interesting things that I remember is working closely with the United Kingdom on programs as early as the late 1950's. We had a mutual weapons defense pact with the UK where we would sponsor programs in England and we would work with our counterparts in England. I had two projects over there and would visit with my counterpart, a man who was their process development expert, and he would come over and visit our installation. We shared technology and we got a lot of payoff. They were doing some things with CS that were helpful to us in the long run. So there was a lot of interesting feedback and exchange of technology that was helpful to both countries.

S. You mentioned you worked a little bit with intelligence, did you ever get involved with what other countries were doing, particularly like the Soviet Union or Communist Countries?

E. Well, yes. I've been involved in trying to find out what they are doing.

S. Did that ever determine your research, like the current use of biological weapons in Cambodia?

E. Well, we are always concerned as to what the threat is against this country. Based on our knowledge of that threat we want to be able to protect our soldiers and we want to be able to develop a defense against whatever we would expect to be in the field. So we look, based on what we think the threat is, we develop our decon material, we develop our protective masks, protective clothing, our detectors, our whole program is really based on what we think they have and might potentially use against us. It is very definitely an important area.

S. Are there any other stories you can think of that might be of interest?

E. No, I don't think so.

S. Then I want to thank you.

E. I think I'm talked out.

[Completion of Side 3, Tape 2]

ORAL HISTORY DONOR STATEMENT

I, ~~Sigmund Eckhaus~~, have read the attached letter and understand the purpose, nature, and use of the U.S. Army Oral History Program as conducted by the U.S. Armament, Munitions and Chemical Command (AMCCOM) Historical Office at the U.S. Army Chemical Research and Development Center (CRDC), Aberdeen Proving Ground, MD, and do voluntarily participate in this program by granting an oral magnetic-taped interview with ~~Jeffery K. Smart~~ which will cover my best recollections of events and experiences which may be of historical significance to the U.S. Army. b(6)

I understand that the tape(s) and the transcribed manuscript resulting therefrom will be accessioned into the AMCCOM Historical Office to be used as the security classification permits. It is further understood and agreed that any copy or copies of this oral history interview given to me by the U.S. Army and in my possession or that of my executors, administrators, heirs, and assigns, may be used in any manner and for any purpose by me or them, subject to security classification restrictions.

Subject to the license to use reserved above, I do hereby voluntarily give, transfer, convey, and assign all right, title, and interest in the memoirs and remembrances contained in the aforementioned magnetic tapes and manuscript to the AMCCOM Historical Office, acting on behalf of the United States of America, to have and to hold the same forever, hereby relinquishing for myself, my executors, administrators, heirs, and assigns all ownership, right, title, and interest therein to the donee expressly on the condition of strict observance of the following restrictions:

NONE

~~Sigmund Eckhaus~~ Donor. b(6)

Dated 24 Dec 1985

Accepted on behalf of the
AMCCOM Historical Office by

~~Jeffery K. Smart~~
Dated 24 Dec 85 b(6)

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PROJECT DATA SHEET

- ~~CONFIDENTIAL~~
1. PROJECT TITLE: Anticrop Warfare (G)
 2. SECURITY CLASSIFICATION: Secret
 3. PROJECT NUMBER: 4-11-01-004
 4. INDEX NUMBER:
 5. REPORT DATE: 9 June 1954
 6. BASIC FIELD OR SUBJECT: Biological Warfare Agents
 7. SUB FIELD OR SUBJECT: Investigation, Authorized 7a. TECH OBJ: BW-3a
 8. COGNIZANT AGENCY: CmlC
 9. DIRECTING AGENCY: ACCmlO/BW, Camp Detrick, Md.
 10. REQUESTING AGENCY: CmlC
 11. PARTICIPATION AND/OR COORDINATION: (AR) Army
 12. CONTRACTOR AND/OR LABORATORY: C Division, CmlC Bio Labs
 13. RELATED PROJECTS: None
 15. PRIORITY: 1-3
 17. ESTIMATED COMPLETION DATES: Dev. -
Res. - Cont
Test -
 18. FISCAL ESTIMATES: FY 54 - 736M
FY 55 - 834M
FY 56 - 970M
 19. SUPERSEDED REPORTS: Project Cards for 4-11-01-002, 4-11-02-008,
4-11-02-060, 4-11-02-062, dated 31 December 1953.
 20. REQUIREMENT AND/OR JUSTIFICATION: The critical importance of food supplies and agricultural products used in industry fully justify any effort necessary to develop means of effecting a reduction in their availability to an enemy in event of hostilities. Certain plant pathogens cause losses of varying magnitude to economic crops under natural conditions. The extensive damage and rapid spread of these pathogens justifies investigations of them as agents for damaging economic crops. Certain chemicals also inhibit plant growth and can bring about a reduction in yield of foodstuffs and plant products used for industrial purposes.
 21. BRIEF OF PROJECT AND OBJECTIVE:
 - a. Brief. (Applied Research) The objects of this project are to select from the many plant pathogens known those that produce disease readily, spread naturally, and can be produced and processed to provide a durable, viable inoculum; to develop methods and equipment for producing, harvesting and processing selected fungal spores or mycelium in suitable form for use against enemy target crops; to subject chemical compounds believed to possess herbicidal activity to a series of biological tests designed to screen out those offering most promise qualitatively, for development as agents for causing injury or destruction of crops.
 - b. Approach. (1) The following steps will be taken in the development of cereal rusts as BW agents:
 - a. Determine the precise conditions required for infection and full expression of disease symptoms.

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- b. Study the physiology of spores and spore germination as it relates to the development of improved storage conditions and the improvement of procedures for processing spores to increase storage longevity.
- c. Study effect of low temperature on spore viability and infectivity.
- d. Study various parasitic races for use against specific cereal crop varieties in specific geographical regions.
- e. Improve means for the production of spores on suitable cereal hosts in greenhouse, controlled light chambers, and in the field. Select suitable host varieties as necessary to obtain a pure product.
- (2) The following steps will be involved in developing pathogens for rice, potatoes and such other crops as may be selected at a later date:
- a. Analyse environmental factors influencing establishment and spread of pathogen.
- b. Select and develop effective parasitic strains of the pathogens. Scientific and engineering approaches to pilot plant production of facultative plant pathogens will be undertaken for selected agents to establish satisfactory conditions of growth consistent with high yield and quality of product. Engineering information will be obtained in order that all necessary information on end-product production may be available.
- c. Develop suitable cultural media for the production of viable, infective inoculum.
- d. Develop reliable production and processing methods, and determine storage conditions necessary for retention of viability.
- e. Test selected plant pathogens in the greenhouse and field plots to determine factors critical for disease development, such as inoculum potential, most susceptible host stage, and the degree of injury to crop plants.
- (3) The following steps will be involved in the development of chemical anticrop agents:
- a. Screen a large number of chemical compounds by means of routine tests for the purpose of determining those which have growth-inhibitory activity.
- b. Evaluate selected compounds on various plant species at several stages of development in greenhouse and field experiments.
- c. Investigate in laboratory, greenhouse and field the minimal effective dosages, optimum volume rates and concentrations, most susceptible stages of plant development and effects of climatic conditions for potential agents when applied to the plant, soil, or irrigation water.

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- d. Evaluate chemical and biological agents to determine the operational requirements for anticrop agents, and conduct developmental tests on agents and agent-carriers to provide data needed in munition design and military operational planning.
- e. Determine the absorption and translocation of plant inhibitors by plants with particular reference to anatomical, histological, or cytological changes produced, and study the effects of plant inhibitors on chemical composition, absorption of water and nutrients, respiration, and other cellular activities of plants under various environmental conditions and stages of plant growth.
- c. Subtasks. Code results of chemical screening tests on punch cards in order to facilitate studies relating activity with particular chemical structural groupings.
- d. Other Information.

(1) Basic Research:

- (a) Determine the susceptibility or resistance of particular varieties or genotypes to plant pathogens or chemical plant inhibitors.
- (b) Determine the feasibility of differentiating strains of plant pathogens by immunological techniques.
- (c) Study the ecological factors affecting the development of specific races of rusts in epidemic intensity.
- (d) Determine response of closely similar plant genotypes to various chemical agents.
- (e) Study microbial utilization, retention by clay colloids, leaching or downward movement to provide information required in the course of the agent development investigations.
- (f) Determine the mechanism of action of plant growth regulators including the separate effects on various physiological processes within the plant.

(2) Contract Information:

Contract No. DA-18-064-CML-476	Contract No. CD4-2856
University of Wisconsin	U.S.D.A. - B.O.I.
Madison, Wisconsin	Beltsville, Maryland

Contract No. DA-18-064-CML-2334	Contract No. CD3-3545
University of West Virginia	U.S.D.A. - B.P.I.
Morgantown, West Virginia	Beltsville, Maryland

Contract No. DA-18-064-CML-2405	Contract No. CD3-4390
University of Minnesota	U.S.D.A. - B.A.I.C.
Minneapolis, Minnesota	Washington, D. C.

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Contract No. DA-18-064-CML-2306
University of Southern California
Los Angeles, California

Contract No. CD4-740
U.S.D.A. - B.P.I.
Beltsville, Maryland

Contract No. DA-18-064-CML-2388
Smithsonian Institution
Washington, D. C.

Contract No. DA-18-064-CML-1922
Iowa State College
Ames, Iowa

Contract No. DA-18-064-CML-2374
University of Rhode Island
Kingston, Rhode Island

Contract No. DA-18-064-CML-2384
Mississippi State College
State College, Mississippi

Contract No. DA-18-064-CML-2295
University of Illinois
Urbana, Illinois

Contract No. DA-18-064-CML-2387
Auburn Research Institute
Auburn, Alabama

Contract No. DA-18-064-CML-2334
University of West Virginia
Morgantown, West Virginia

Contract No. CD3-533
U.S.D.A. - B.A.I.C.
Washington, D. C.

Contract No. DA-18-064-CML-2516
Tracerlab, Inc.
Boston, Massachusetts

Contract No. CD3-4295
U.S.D.A. - B.P.I.
Beltsville, Maryland

Contract No. DA-18-064-CML-1659
University of Nebraska
Lincoln, Nebraska

Contract No. CD4-560
U.S.D.A. - B.P.I.
Beltsville, Maryland

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 Project Data Sheet

1. PROJECT TITLE: BW Antipersonnel Agent Screening & Evaluation (C)
 2. SECURITY CLASSIFICATION: Secret
 3. PROJECT NUMBER: 4-11-02-064
 5. REPORT DATE: 9 June 54
 6. BASIC FIELD OR SUBJECT: Biological Warfare Agents
 7. SUB FIELD OR SUBJECT: Agents
 7a. TECHNICAL OBJECTIVE: BW-1a 75%, BW-1b 25%
 8. COGNIZANT AGENCY: CmlC
 9. DIRECTING AGENCY: ACCmlO/BW, Camp Detrick, Md.
 10. REQUESTING AGENCY: CmlC
 11. PARTICIPATION AND/OR COORDINATION: (AR) Army; ONR (C)
 12. CONTRACTOR AND/OR LABORATORY: CmlC Bio Labs, MB, V&R, and AS Divisions (Refer to par. 21.d., Contract Information)
13. RELATED PROJECTS: None
 15. PRIORITY: 1-B
 17. ESTIMATED COMPLETION DATES: RES - Cont
 18. FY FISCAL ESTIMATES: 54 - 3177M
 55 - 3892M
 56 - 4445M
19. SUPERSEDED REPORTS: Project Cards for 4-11-02-059, 4-64-03-001, 4-11-01-001, 4-11-02-023, 4-11-02-058, 4-11-04-003, 4-64-06-002, 4-64-09-001, 4-11-04-004, 4-64-04-001, and 4-64-05-001, dtd 31 Dec 53.
20. REQUIREMENT AND/OR JUSTIFICATION: An intensive screening program must be undertaken to select potentially useful BW antipersonnel agents. The most promising candidates must receive additional intensive laboratory evaluation of those properties which govern ability to produce disease under the various conditions in which BW agents may be employed. This evaluation provides necessary supporting data for subsequent development of agents through pilot plant operation, assessment, production and standardization as a component of weapons systems. Reference is made to General Directive No. 4, "Guidance," (YF-1749).
21. BRIEF OF PROJECT AND OBJECTIVE:
- a. Brief. (Applied Research) This is a continuing project to provide a succession of candidate BW antipersonnel agents. These may be viruses, rickettsiae, fungi, bacteria, or their toxic products. Major objectives are to select and study strains of organisms which possess a high degree of infectivity and stability; to define optimum conditions for the growth, storage, and dissemination of the agent; to evaluate those factors which tend to decrease the capacity of agent to produce disease; to provide reliable diagnostic methods, therapeutic measures, and experimental vaccines for defense against potential BW agents; and to establish laboratory methods and processes which can be translated to pilot plant operation and large scale production.

b. Approach. The multiplicity of potential BW antipersoneel agents permits of widely different approaches, the nature of these depending to a great extent on the type of agent under evaluation. The following are representative avenues of research which will be explored in the course of such studies. After a literature survey and collection of strains, factors of virulence and aerosol stability will be examined under controlled environmental conditions; genetic stability and viability during laboratory manipulations and under prolonged storage will be determined; and capacity for optimum growth in media suitable for large scale production will be determined. An attempt will be made, where applicable, to select or induce, and stabilize, mutants with desirable properties such as enhanced virulence or antibiotic resistance. Reliable procedures for improving yield of agent from culture or embryos are to be devised, and better methods of assessing infectivity in animals will be developed as dictated by the particular organism under study. Means of rapid diagnosis of infection, experimental vaccines, and other prophylactic measures will be developed and evaluated. In an effort to enhance the potentiality of BW as an offensive weapon, severity of infection produced by combinations of bacteria, viruses, rickettsiae, and fungi will be assayed. In many cases basic research programs must be initiated to define underlying principles, the application of which will be necessary to carry out agent evaluation.

c. Subtasks. The following subtasks represent well defined areas of research and support effort needed to accomplish the primary mission of selecting, evaluating, and recommending potential BW agents for further development:

- (1) Stability and virulence determinations will be made on BW aerosols under controlled experimental conditions simulating natural atmospheric environments. This phase will include studies on aerosol properties of organisms and evaluation of response to infection in laboratory animals.
- (2) Chemical studies on drying, processing, and aerosolization of biological agents will be undertaken. Synthesis of chemical compounds will be provided in support of related research areas.
- (3) Physical characterization of BW agents and their derivatives will be made. This task includes research on aerosols and dry fills.
- (4) The pathology of diseases caused by BW agents will be studied. Characterization of disease in man and animals will be undertaken and assistance in development and evaluation of agents will be provided.
- (5) The feasibility of arthropod dissemination of BW agents will be studied. Such phases as production of arthropods,

infection and transmission research, and logistics and field test evaluation will be investigated.

- (6) The application of statistical principles to proper planning and analysis of laboratory and field investigations will be examined.
- (7) Determination will be made of the nutritional requirements for optimum growth and virulence of potential BW agents. Practical media for large scale production and prolonged storage of organisms will be investigated.
- (8) Fundamental research on problems relating to variation, growth, viability, virulence, therapy, immunity and other phenomena pertaining to BW agents will be carried out.
- (9) Studies on combined action of mixed agents as regards viability, infectivity, and toxicity will be accomplished. These properties of agents may be affected to the extent that infective dose is lowered, initial infection may be more severe, disability may occur over a longer period, and diagnosis and detection may be rendered more difficult. Other factors being equal, any or all of these would add to the value of a potential BW weapon.
- (10) Basic studies will be done on application of tissue culture techniques to an understanding of the infection mechanism in host cells.
- (11) Analyses will be made of epidemiological data to define factors which govern outbreak and spread of disease in populations exhibiting various degrees of resistance to infection. This study should provide more accurate criteria for predicting duration and level of response in terms of infectious dose and specific organisms.

d. Other Information. With reference to para 11, "Participation and/or Coordination," contract with the University of California, Berkeley, in support of the agent screening program is provided through Naval Biological Laboratories, Office of Naval Research, Washington 25, D. C.

(1) Contract Information.

DA-18-064-CML-2291
University of California
Berkeley, California

DA-18-064-CML-485
Duke University
Durham, North Carolina

DA-18-064-CML-2398
University of Kansas
Lawrence, Kansas

DA-18-064-CML-2449
Long Island Biological Assn.
Cold Spring Harbor, N. Y.

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DA-18-064-CML-1852
University of Texas
Austin, Texas

DA-18-064-CML-2363
University of Utah
Salt Lake City, Utah

DA-18-064-CML-2362
Wesleyan University
Middletown, Conn.

N7 ONR-29536
Univ. of California (thru ONR)
Berkeley, California

DA-18-064-CML-2512
University of Chicago
Chicago, Illinois

DA-18-064-CML-2365
Johns Hopkins University
Baltimore, Maryland

DA-18-064-CML-2395
Southern Research Institute
Birmingham, Alabama

CD4-2273
USPHS, CDC
Montgomery, Alabama

CD4-2652
USPHS, CDC
Montgomery, Alabama

CD4-65
Rocky Mountain Laboratory
Hamilton, Montana

CD4-825
USPHS, Rocky Mountain Laboratory
Hamilton, Montana

CD4-155
Bureau of Standards
US Dept of Commerce
Washington 25, D. C.

DA-18-064-CML-2550
Mellon Institute f/Industrial
Research
Pittsburgh, Pennsylvania

DA-18-064-CML-1654
Harvard University
Cambridge, Massachusetts

DA-18-064-CML-2379
Georgia Institute of Technology
Atlanta, Georgia

DA-18-064-CML-2515
Universal Match Company
Ferguson, Missouri

DA-18-064-CML-2380
University of Maryland
College Park, Maryland

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PROJECT DATA SHEET

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1. PROJECT TITLE: BW Product Engineering & Plant Design (C)
2. SECURITY CLASSIFICATION: Secret
3. PROJECT NUMBER: 4-72-06-015
5. REPORT DATE: 9 June 1954
6. BASIC FIELD OR SUBJECT: General Engineering
7. SUBFIELD OR SUBJECT: Design, Plant
- 7a. TECHNICAL OBJECTIVE: 45% - BW-1; 10% - BW-4; 45% - BW-5
8. COGNIZANT AGENCY: CmIC
9. DIRECTING AGENCY: ACCm10/BW, Camp Detrick, Md.
10. REQUESTING AGENCY: CmIC
11. PARTICIPATION AND/OR COORDINATION: (AR) Army; USAF (C)
12. CONTRACTOR AND/OR LABORATORY: Dir for Prod. Engr, Cp Detrick, Md.
13. RELATED PROJECTS: None
15. PRIORITY: 1-B
17. ESTIMATED COMPLETION DATES: Dev: Ccnt.
18. FISCAL ESTIMATES: FY 55 - 857M
FY 56 - 1600M
19. SUPERSEDED REPORTS: Project Cards 4-92-02-019 and 4-72-06-014
20. REQUIREMENT AND/OR JUSTIFICATION: It is required that optimum facility, equipment and product design criteria and designs be developed to implement an active production program whenever the need may arise. To support production of BW items, data will be developed concerning industrial capabilities and satisfactory component materials and substitutes.
21. BRIEF OF PROJECT AND OBJECTIVE:
 - a. Brief. The objective of this project is to develop complete up-to-date designs and specifications for BW plants, equipment and products. In accomplishing this objective, data will be accumulated relative to available and satisfactory construction materials and manufacturing raw materials to implement an active production program at any given time.
 - b. Approach. Upon receipt of basic designs, criteria and specifications from the Development and Assessment groups, final designs and specifications for BW facilities, equipment and products will be developed. These designs and specifications will incorporate the most recent and efficient engineering developments relative to construction and production methods and materials. Continual review and redesign will maintain these data at the optimum level of final development.
 - c. Subtasks.
 - (1) Develop designs and design modifications of BW equipment and complete Production plants for construction and/or procurement.

- (2) Develop designs and specifications (and their modifications) on all offensive and defensive BW materiel for procurement and/or production. This includes design and specifications for packaging and also the preparation of technical manuals.
- (3) Conduct continuing studies to determine methods and materials applicable to BW plants and production.
- (4) Conduct continuing studies to determine military and industrial production capabilities.
- (5) Evaluate specialized commercial equipment to determine applicability to BW requirements.

d. Other Information: None

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1. PROJECT TITLE: BW Agent Process Development (C)
2. SECURITY CLASSIFICATION: Secret
3. PROJECT NUMBER: 4-92-02-029
5. REPORT DATE: 9 June 54
6. BASIC FIELD OR SUBJECT: Processing & Manufacturing Methods & Techniques & Equipment
7. SUBFIELD OR SUBJECT: Agents, Biological
- 7a. TECHNICAL OBJECTIVE: BW-1a
8. COGNIZANT AGENCY: Cml C
9. DIRECTING AGENCY: ACCm10/BW, Camp Detrick, Md.
10. REQUESTING AGENCY: Cml C
11. PARTICIPATION AND/OR COORDINATION: (AR) Army
12. CONTRACTOR AND/OR LABORATORY: Process Development Division, Cp Detrick, Md.
13. RELATED PROJECTS: 4-92-02-026, 4-92-02-027, 4-64-06-002, 4-92-02-021, 4-64-03-001
15. PRIORITY: 1-B
17. ESTIMATED COMPLETION DATES: Res. -
Dev. - Cont.
Test -
18. FISCAL ESTIMATES: FY 54 - 654M
FY 55 - 615M
FY 56 - 1154M
19. SUPERSEDED REPORTS: Project Cards 4-11-C2-C63 & 4-92-02-C27
20. REQUIREMENT AND/OR JUSTIFICATION: The Chemical Corps has been directed to establish an offensive potential for BW agents. Current guidance recommends that practical methods for manufacture of certain BW agents for offensive weapons be investigated.
21. BRIEF OF PROJECT AND OBJECTIVE:
 - a. Brief. (Applied Research) The effective utilization of information relative to agents obtained in research laboratories necessitates that more promising leads be extended in scope and that the feasibility of developing a production process be evaluated. It is necessary to conduct certain investigations in the laboratory which do not relate specifically to a development for which there is a definite requirement. Miscellaneous information of this sort will be obtained under this project.
 - b. Approach: Laboratory studies in propagation, concentration, and stabilization of agents by means suitable for translation to production volume will be appraised in terms of the virulence and viability of the product as it will be used.
 - c. Subtasks:
 - (1) Development of methods for propagation, concentration, and stabilization of agents.

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(2) Materials handling criteria.

d. Other Information:

(1) Basic Research: None

(2) Standardization Item: None

(3) Engineering Test: Not applicable.

e. Background: This project is a consolidation of projects 4-11-02-063, 4-64-03-001 and 4-92-02-027. Under these projects general investigations were conducted on methods for the manufacture of aqueous suspensions of Brucella suis, Brucella melitensis, Bacillus anthracis, Bacterium tularensis, dry Brucella suis and Bacillus anthracis, and the virus causing Venezuelan Equine Encephalomyelitis. Based on these general investigations of production methods, and on pilot plant studies, production processes for the manufacture of aqueous suspensions of B suis and B anthracis were developed and evaluated.

f. References: 54-BL-948; projects 4-11-02-063, 4-92-02-027, and 4-64-03-001.

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PROJECT DATA SHEET

4-92-02-030

1. PROJECT TITLE: BW Agent Pilot Plant Development (C)
2. SECURITY CLASSIFICATION: Secret
3. PROJECT NUMBER: 4-92-02-030
5. REPORT DATE: 9 June 1954
6. BASIC FIELD OR SUBJECT: Processing & Manufacturing Methods & Techniques & Equipment
7. SUBFIELD OR SUBJECT SUBGROUP: Agents, Biological
- 7a. TECHNICAL OBJECTIVE: BW-1a
8. COGNIZANT AGENCY: CmlC
9. DIRECTING AGENCY: ACCmlC/BW
10. REQUESTING AGENCY: CmlC
11. PARTICIPATION AND/OR COORDINATION: (AR) Army
12. CONTRACTOR AND/OR LABORATORY: Pilot Plants Division, Cp Detrick, M
13. RELATED PROJECTS: 4-04-14-021, 4-11-02-064, 4-92-02-029
15. PRIORITY: 1-B
17. ESTIMATED COMPLETION DATES: Dev - Cont
18. FISCAL ESTIMATES:
FY 54 - 4.99M
FY 55 - 1205M
FY 56 - 1010.7M
19. SUPERSEDED REPORTS: Project Cards 4-92-02-028 and 4-92-02-021
20. REQUIREMENT AND/OR JUSTIFICATION: The Chemical Corps has been directed to establish an offensive potential for BW agents. Current guidance for conduct of the R&D program for BW directs that practical methods for manufacture of certain BW agents for offensive use be developed. Pilot plant development of these agents is necessary to determine methods and equipment required for large scale production and to evaluate the agent.
21. BRIEF OF PROJECT AND OBJECTIVE:
 - a. Brief. (Applied Research) This project is established to conduct general pilot plant investigations not necessarily related to a specific development for which there is a requirement. Methods, techniques, materials and equipment will be evaluated to determine the feasibility of entering into a program to develop a process for production of specific BW agents.
 - b. Approach. The pilot plant and engineering phases of the development will supplement the data obtained in the laboratory, so that there is available the information necessary to design equipment in which to pilot recommended processes. Emphasis will be placed on the development of design and operating criteria for equipment for piloting processes for the manufacture of viral and rickettsial agents propagated in embryonated eggs and bacterial and fungal agents propagated in deep tank culture. Other methods of production, such as continuous

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culture, tissue culture, etc., will be investigated. Information available from research and development laboratories will be adapted to practical production methods and equipment in preparation for piloting by: (1) Selection of those portions of the process which must be piloted or further evaluated; (2) Selection of those portions of the process for which equipment must be developed; (3) Development of new or improvement of existing equipment, including the evaluation of materials and methods of construction; and (4) Evaluation of those portions of the process for which equipment was developed.

c. Subtasks.

- (1) The production of newly-developed agents and simulants for evaluation and test by Chemical Corps and other agencies.
- (2) The development of equipment and techniques required to evaluate unit of operations, products, and processes.
- (3) Cooperation with munition development groups in the development of disseminating devices for BW agents.
- (4) Cooperation with process development laboratory groups in the development of new or unique production methods.

d. Other Information.

- (1) Basic Research - None
- (2) Equipment and techniques required to produce certain BW agents have been developed and evaluated.

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