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Los Angeles Department of Water and Power

POWER SYSTEM ORAL HISTORY PROJECT

GROWTH AND DEVELOPMENT OF THE POWER SYSTEM:

AN INTERVIEW WITH LYALL STINSON

Interviewed by Thomas Connors

The Bancroft Group

Dates: March 10, March 24, March 31,

and May 12, 1992

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BIOGRAPHICAL SUMMARY

PERSONAL HISTORY:

Born:	September 30, 1912 Alhambra, California
Education:	San Pedro, California, public schools University of Southern California BSEE 1935 MIT Advanced Electronics School, U. S. Navy 1944
Married:	1932, to Alice E. Trefethen, San Pedro
Children:	James Robert, Employed by Technicolor Corp. Alice Elizabeth, Employed by LAPD

CAREER:

1935	Hired by LADWP, Powerhouse and Substation Operator, Power Operating and Maintenance Division
1936	Electrical Tester, Meter Test Section, Power Design and Construction Division
1937-1939	Electrical Tester, Station Test Section, Power Design and Construction Division
1940-1942	Electrical Tester, Research Lab, Power Design and Construction Division
1943-1946	U. S. Navy
1946-1948	Electrical Engineering Associate, Station Design Section, Power Design and Construction Division
1948-1954	Electrical Engineer, Station Design Section, Power Design and Construction Division
1954-1959	Electrical Engineer, Research Lab Director, Test Lab, Power Design and Construction Division
1959-1963	Senior Electrical Engineer, Test Lab Supervisor, Power Design and Construction Division
1963-1964	Principal Engineer, Engineer of Transmission, Power Operating and Maintenance Division

1964-1966	Principal Engineer, Engineer of Generation, Power Operating and Maintenance Division
1966-1969	Assistant Division Head, Power Operating and Maintenance Division
1969-1973	Division Head, Power Operating and Maintenance Division
1973	Retired

MEMBERSHIPS

IEEE
Los Angeles Electric Club
Los Angeles Breakfast Club
Railway and Locomotive Historical Society
Masonic Lodge
Eta Kappa Nu, National Honor Society for Electrical Engineers
Sigma Phi Delta, National Engineering Fraternity
Water & Power Men's Speakers Club

TAPE NUMBER: 1, Side A

March 10, 1992

TC: Why don't we start this set of interviews with personal history and family background, like where and when you were born, for openers.

LS: All right. I'm a native Californian. I was born in Alhambra and the family moved around a little bit, to Huntington Park and Garvanza [district]. But by the time I was four we went to San Pedro and I spent all of my early life down there, and went to school in San Pedro.

TC: What year were you born?

LS: I was born in 1912. My parents had come out from Kansas, and I don't really know much of their history before that. My dad never seemed to want to talk about Kansas very much, although we did make a lot of trips back there to visit his mother, who was living up until 1940.

TC: Were they a farming family?

LS: No, not entirely. My grandfather on my father's side was a carpenter, but on my mother's side they were a farming family. They had come to Kansas in the early days--I think it was right after the Civil War--and went out to western Kansas and dug one of those sod huts, they called them, and hunted buffalo, took the skins back to Wichita and traded them in for a farm near Wichita. But my folks came out to California before I was born. My father was a teacher, and worked for

different school districts until he finally wound up in San Pedro.

TC: What kind of a teacher, public school?

LS: Yes, he was a high school teacher. He had a general certificate and he could teach most anything, including Latin and English, and, of course, Latin was pretty common in those days. But then he started teaching drafting, because he had taken an architectural course in college, and had been an architect before he came to California. In San Pedro he was head of the Smith Hughes Project, which I guess is long gone, but it was sort of a trade school concept where certain high schools were given state money to start industrial training, the boys went to school half-day and then worked in industry the other half. They organized one of those in San Pedro and he was director of it for many years.

TC: Well, very interesting. What was it like growing up in San Pedro? When I go down there I realize it's not Los Angeles. It seems like a very different world.

LS: It was really rather primitive. There were very few paved streets and the city was a waterfront town. It was clustered around mainly Sixth Street and Front Street, that was the business district. But there were big stables along Pacific Avenue and Gaffey Street, which is now the main street where you enter town. It was just a little dirt road that ran along a barbed wire fence and there was nothing above Gaffey Street on the Palos Verdes hill. It was just ranches and farms up

there. Toward the ocean it was dry farming, mostly by Japanese gardeners, and toward the top of the hill was grazing land and cattle. Three little streams came down the hill in those days and emptied into the harbor. There was water in them almost the year round.

The main street of town was Sixth Street, and then Pacific Avenue, which ran out to Point Fermin, it was just a dirt road with a railroad line down the center, which had started out as [Henry] Huntington's drive to get a railroad to the ocean. The Southern Pacific had the waterfront on one side of the channel and the Union Pacific had the waterfront on the other side, so Huntington came through town with his line and up Sixth Street and out Pacific Avenue to Fourteenth Street, sort of circled the town, and then down Fourteenth to the bluff at Timms Point, which was the point where [Richard Henry] Dana landed when he came to the coast and where they threw the hides over the cliff to the ships. Huntington started a little harbor down there, which is now the outer harbor and the yacht basin. We kids would go up in the hills and camp out along one of those little streams.

TC: Did the Los Angeles streetcars come up there?

LS: Yes, there were four railroads. The first was a railroad that was built by [Gen. Phineas] Banning, who owned a big rancho in the Wilmington area which he'd purchased from Spanish people. He lived in Wilmington and his place is now a museum. He built a railroad from Los Angeles to San Pedro which was

called the Los Angeles and Wilmington or maybe the Los Angeles to San Pedro, although it terminated in Wilmington right on what's now the Harbor Steam Plant property. There was a big old brick building there, which was the station and warehouse, then he dredged a canal to bring in barges.

It was all mud flats out as far as Timms Point. Originally, the ships would come in and anchor out about where the lighthouse is on the breakwater, then they'd lighter things in by barge and hides back out. That was the main trade. The ships couldn't come in, even with small boats, further than Timms Point, it was just mud flats.

So Banning dredged a little channel that went from Timms Point back up along where the main channel is now to his warehouse and railroad station at B Street right on the Harbor Steam Plant property, and he ran barges. The barges would be brought in by steam-driven tugs to the channel, up the channel as far as they could, and then he'd hire people to drag them up the channel by rope. My wife's family went to San Pedro in the 1870's and her father used to tell me when he was still alive about working as a kid on weekends dragging those barges.

The old Banning warehouse became a kind of a storage room at Harbor Steam Plant and DWP stored a lot of parts there for the steam plant. When I was the Generation Engineer, I found this out and was very interested in it. I took my father-in-law over there one day, and he was thrilled to see the old

place. We went in, and you could see a place in the flooring where the canal had come up right through the middle of the building, and they pulled the barges right inside the building and loaded the stuff onto the freight cars that ran along the side. Previously, Banning had operated a horse teaming business between Los Angeles and Wilmington.

When the Southern Pacific came to Los Angeles, the county had some bonds that Banning had issued to help pay for his railroad. They bought out Banning's interest and then gave the whole thing to the Southern Pacific in order to get them to route their railroad to Los Angeles. They were going to go across on the other side of the mountains through Palmdale to Yuma. So that's how the Southern Pacific got to Wilmington. Then they built a piling wharf out through the mud flats to Fifth Street in San Pedro, and that was the terminal of the Southern Pacific.

The Union Pacific, which was then called the Terminal Railway, started in Los Angeles, went to Pasadena and Glendale, from a station around the county hospital and then down the east bank of the Los Angeles River. They wanted to go down to the harbor, so they built a line down through Long Beach. It went right through the main part of Long Beach and out on a sand spit that was called Rattlesnake Island, which was part of the delta of the Los Angeles River. It was all pilings from Long Beach out to the end of this sand spit where they built some wharfs. They ran Terminal Railroad trains

down there for several years and then they were bought out by the Los Angeles-Salt Lake Railway, which eventually became the Union Pacific.

So the Union Pacific got in on the east side of the channel, Southern Pacific on the west side. Then there was a steam railroad that started in Los Angeles and which was called the Los Angeles Central. It was a narrow-gauge steam line to San Pedro that went through Gardena and Torrance and came in through some of the hills at the north end of San Pedro. It never got out to a wharf, it stopped about two blocks short of the center of town because there was a hill they couldn't get through or get around, and in the early days that was the end of the line.

Then, after Henry Huntington started the Pacific Electric [PE], it started building extensions all over southern California. There were four partners in that and three of them sold out one dark night to the Southern Pacific, and they left Huntington holding the bag with only a 50 percent interest. The Southern Pacific then stopped this expansion of the Pacific Electric because it competed with their local lines. They were running passenger trains to San Pedro and they had branch lines into Long Beach and Pasadena. Lots of towns had a Southern Pacific commuter line that ran passenger trains, two cars maybe or one car, several times a day. Huntington couldn't get permission to extend his Pacific Electric anymore, so he started another company called the Los

Angeles Inter Urban [LAIU]. He'd go to a place along one of his these old PE lines and built another railroad out from that under this LAIU name. He built one that went from Dominguez down to San Pedro, he built to Whittier, to Santa Ana, and to Watts. All of these started from the PE line at some location. So we had that line coming into San Pedro, one of his LAIU lines, which started near the Long Beach Pacific Electric at Dominguez, but they didn't actually tie together there. Then we had the Los Angeles Central which Huntington bought and the Union Pacific and Southern Pacific, the Santa Fe ran a line from Torrance in the 1920's and connected to the Harbor Belt Line in Wilmington, and they were all running passenger trains. In 1911 they all merged together and then the PE took them all over. Under his LAIU, Huntington also built five local trolley lines in San Pedro.

TC: Well, when was the harbor itself built?

LS: That was about 1906, and I have a lot of information from my father-in-law about this because he was a kid then and lived right there at the waterfront. There was a big fight with Santa Monica. The Southern Pacific had bought an old railroad that ran from Santa Monica to Los Angeles called Los Angeles and Independence. They were going to build it to Independence up in the Owens Valley. They built from Santa Monica to Los Angeles along what's now Exposition Boulevard, and then they started on a big tunnel through Cajon Pass. Then the Southern Pacific, not wanting competition, bought them out.

The wharf at Santa Monica wasn't very good and it was too close to this little residential village which was a sort of a resort area with a couple of big hotels. So the Southern Pacific went about a mile up the beach to Temecula Canyon and built a huge wharf a mile long out in the ocean. They connected that to the Los Angeles and Independence and then made a connection with their line over on Alameda Street, the old Los Angeles and Wilmington. So that gave the Southern Pacific access to the ocean at both Los Angeles Harbor points, which were the Santa Monica area and San Pedro. Then a big fight began: which one was going to be the major harbor? About that time, the Santa Fe also got into Playa Del Rey and they wanted Redondo to be the harbor. This battle was tied up in congress for years and it's quite a story, but by 1906 they had straightened it out and decided it was going to be San Pedro.

They started work and the Southern Pacific built a branch line from Burbank out to Chatsworth. Another railroad was built that went up into the hills back of Chatsworth to a big quarry, and they started quarrying material up there. They also started quarrying material at Catalina Island and bringing it over by barge; that was going to be the major source. They got the first two barge loads, and then a big celebration was planned where they were going to dump these barges, but they wouldn't work. (chuckling) They couldn't get the rock out of the barges, so the whole breakwater

stopped for about a year. The quarry in Chatsworth wasn't the quality of stone they wanted for the top surface of the breakwater, so they opened a big quarry in Riverside. So rock came in from Riverside, and it came in from Chatsworth. The Chatsworth stuff was spread on the bottom as foundation and then the harder granite from Riverside was put up at the top where the wave action caught it.

So, about 1907 or 1908, the breakwater was finally finished. They left a gap of 1,500 feet next to the shore. Well, after about two years they realized that the big waves were coming through that gap and tearing their harbor up, so they filled in that 1,500 feet. The breakwater is about two and a half miles long. The first 1,500 feet is just loose rubble and then it's cut, smooth blocks. My folks went there in 1916, so by the time I was junior high age they were just getting the harbor really going.

TC: Oh, they took that long?

LS: New wharfs were going in, but it was a very narrow channel. It wasn't much more than that original Banning channel over to Wilmington, but they kept deepening it and widening it a little bit at a time. They'd pump that silt into various places. Rattlesnake Island, which had been very narrow, maybe 100 yards wide, was one place. They pumped a lot of stuff over there. They widened it so it had room for a couple rows of houses, big beach front mansions along what was called Brighton Beach. Passenger trains came down every day from Los

Angeles and came out along that spit and dropped people off right at their homes. My mother taught school over there for a couple of years on the island and had to go back and forth by ferry. It was a beautiful place until it finally became industrialized.

One thing that held up the harbor was a big island called Dead Man's Island on one side of the channel and Timms Point on the other. They just boxed the channel in to where it was very narrow. As a kid, I had gone out to the island. We kids used to go down and borrow boats and row around in there, even swam about halfway across there once. I guess it was in the thirties, they really got busy and completely eliminated that island. They found some graves on it, which had given it its name. They widened the channel to about three times what it had been. The island would be right in the middle of that present channel along about where Ports O'Call is now. So I really saw the harbor develop.

TC: An eyewitness to the whole thing. So you went to public schools?

LS: I went to schools there. Then I went to USC [University of Southern California].

TC: Your father was teaching drafting and that sort of thing?

LS: He was still teaching, yes.

TC: That's sort of pre-engineering. Did he inspire you to go into engineering?

LS: Well, maybe so, but I was just always interested in electricity. I decided when I was about ten years old that I wanted to be in the electrical business. We kids would get together every once in awhile and make radio sets. Radio was just getting going then, so that got me interested and I decided I wanted to be an electrical engineer. So, after high school, I started USC and got a degree in electrical engineering.

TC: Now, why did you pick USC? I guess UCLA [University of California, Los Angeles] didn't have an engineering program then.

LS: That is true. UCLA didn't have an engineering school at all. They had just a year before that moved out to Westwood from the old Normal School, a teachers college on Vermont, which is now L.A. City College. Stanford [University] was a long way off and [University of California] Berkeley was a long way off. I went out to Cal Tech [California Institute of Technology] for an interview and thought about that, but at that time, and I think still today, they were more physics oriented than the kind of engineering that I was really interested in.

TC: So SC had a solid program in engineering?

LS: They had a good engineering program with a laboratory made up mostly of donations from different places, such as L. A. Gas and Electric and from buildings that had been torn down that had their own generators, which was very common in the early

days. They had about five or six professors and an electrical laboratory. I felt afterwards that probably Stanford or Cal [Berkeley] might have been a little more comprehensive, but I got along all right.

TC: Well, you must have started just as the Depression was setting in.

LS: Yes, I started in 1930, and it was a bad year. In 1932, when the banks all folded up, why, I had to drop out for a year and a half. Living down there in the harbor, the big industry was the Union Oil Company and the lumber business. I got a job at the Union Oil Company as a chemist because I had had a year and a half of college chemistry. I worked there for a year and a half. Living at home I could save up my money, and I got a little pocket money then to head back to school and finished up.

TC: What did you do as a chemist, work in a lab?

LS: I worked in the chemical lab, testing oil and analyzing it. All the shipments that came in by pipeline or tankers would send hundreds of tin cans full of oil samples to the refinery, and in the laboratory we'd analyze it. Then we did production runs in the refinery. From all of the different refinery equipment they'd bring down samples every two or three hours.

TC: This was local oil?

LS: No. Union had two big fields; one was the Kettleman Field, which has been developed, up by Bakersfield. They had one pipeline then, and I think later they added another pipeline

to Kettleman. They had also developed the Athens Field, which is down around 116th and Broadway, and Santa Fe Springs. So, between those fields, they had a pretty good supply of their own. They had a dock down at the harbor right by where the Harbor Steam Plant is now and had tankers coming in probably a couple times a week. They'd have maybe eight or ten compartments on the tanker, all loaded with different things. Crude was coming from various places; much of it was interchange with other companies. They'd have a big tanker coming in maybe from San Francisco from Standard. They'd unload it at the Union dock and it would become Union oil from then on. (chuckling) Then they shipped out some quantities of finished product here and there, but mostly the finished product went to southern California and Arizona as gasoline and oil, road oil and so forth.

TC: So you were able, after a time of that work, to re-enroll?

LS: Yes, to go back, re-enroll and finish up school. I think there were ten of us in the electrical engineering class, not a very big class.

TC: Now, did you have any association with DWP [Department of Water and Power] engineers at USC?

LS: A little bit. One of the things that the Dean of Engineering had established was a series of industrial luncheons. Once a month, the senior electrical engineering students would have a luncheon with somebody from industry, such as DWP, and get a little talk and we could ask questions. Then, with DWP, we

always had a field trip around the DWP system, down to Station B usually, and then once a year the senior class went up to Powerhouse 1 [Power Plant 1]. The Station Test engineers would be up there and they'd turn one of the generators over to us and we'd run what they call a retardation test, which is an efficiency test on the machine and on the hydraulics, and then write a report. We'd spend about twelve or fourteen hours up there. We got acquainted with the fellows from Station Test, who I later worked with.

TC: I have a couple of questions about your early association with the Department, and I'm not sure which one to start out with. Maybe just to get this out of the way, you must have heard about the St. Francis Dam disaster when it occurred. It was major news for quite a while.

LS: Yes, I was up there just before the disaster. I was taking electric shop in high school, and the electric shop students took a field trip to San Francisquito Canyon two weeks before the dam went out. It was just brand-new and they were still working on it and installing a new machine in Powerhouse 2 and a new machine in Powerhouse 1 to make use of the extra water they were going to get. We went up to the construction camp at Powerhouse 1 and had lunch and spent the whole day up there, and two weeks later that dam went out. Of course, it was a big thing on the news, and having been up there, I just knew exactly what it was like. But I didn't get up there again until I went up on the retardation run with USC. Then

I could see the terrible scarring, and pieces of the dam which hadn't been removed. When you got up above Powerhouse 2, there were these great chunks of cement the size of a house just scattered all over the place. They started getting rid of those. They dynamited them into rubble, scraped them away and buried them right away. You could hardly find the place now.

TC: Yes, you can hardly find it now, that's true. You would have been a kid, of course, but did you follow the inquest and that kind of . . .

LS: Not closely, no. There were a lot of pictures in the paper, of course, but there was no radio news in those days, but I'd read the paper and look at the pictures about it and realized the magnitude of the event. At the time of the Santa Barbara earthquake, we had some relatives out here from the East visiting. My dad took two carloads of us up to Santa Barbara to see the earthquake damage--that was in 1928--and we came back down through Fillmore and the Santa Clarita Valley. Nothing had been covered up or overgrown or anything then; it was just utter disaster.

TC: Yes, that would have been where Route 126 is now, I think.

LS: Yes.

TC: There was talk, and Mr. [William] Mulholland at the time believed that the dam was dynamited. There was never any follow-up on that, but he did believe that.

LS: Well, there were people at Powerhouse 1 with whom I got acquainted later that had worked there at the time. There were two lives saved at Powerhouse 2. One fellow named Marine lived at PP-1 and passed up going home from Los Angeles just a few minutes before the failure.

TC: Everett Marine, sure.

LS: He said that when he passed the dam about dark there was water coming around the abutment. But he's the only person I know who had ever been close to it just before the failure. One of the men in PP-2, I can't remember his name now, but I guess he got out of the power plant and he was running for the camp maybe, and he and a woman from the camp got washed up on the side of the hill. They spent all the night and half the next day up there till finally somebody came down from Powerhouse 1 and found them. Really, I think probably the abutment failed. When you go up there and go back up on that hill, it's just decomposed granite. Maybe that became that way from the flood, I don't know.

TC: Yes, I've seen pictures of it and it was just horrible, horrible devastation. I can understand the Department's wanting to settle it as quickly as possible.

LS: Yes, I talked to people that went up there and worked on the rebuild. In fact, my wife had two uncles in that crew, one had just graduated from Cal and the other from [University of California] Davis, both engineers, and they got jobs up there on the rebuild of Powerhouse 2.

TAPE NUMBER: 1, Side B

March 10, 1992

TC: Obviously you knew about the Department of Water and Power as a kid. When did you first think you might want to work there?

LS: Well, there were no jobs anyplace when I got out of school, bread lines on Main Street downtown. The school sent out letters to anybody we could think of, and a lot of people on their own list. They had an advisory council for the engineering college and they sent letters out to all those people. I got a response from DWP within about a week or so, because I lived in San Pedro, I think, mainly. They wanted a substation operator in San Pedro for vacation relief. I went in and saw Mr. [Herbert] Cox and he put me to work the next day. I started as a substation operator on the graveyard shift in San Pedro.

TC: That was Herbert Cox?

LS: Herb Cox, yes. Sub[station] 3 in San Pedro, and I worked from June up until November and was laid off. But the station chief told me to go up and see Cox the day after I got laid off. In fact, he told me a couple of days ahead. He said, "You go see him and he's going to have a job for you for sure someplace." So I went up and talked to Cox and he said, yes, they needed a few men down in the Test Lab and he was going to arrange for me to go to the Test Lab.

TC: What were your duties there in the substation?

LS: Substation operator? Well, it was a two-man station and they had a big condenser, which made it one of their major stations. With rotating equipment in a station, it required a lot of maintenance. The second man did switching on the low voltage side, but mainly cleaning up, polishing everything, including the floors, from twelve o'clock midnight to seven o'clock in the morning.

TC: So it was the night shift, it was graveyard.

LS: And then keep the log books up. We'd work together, the board operator and I. They were very nice there, they did a lot to help me. Some of them would sit back and just let me take over the station for a while sometimes and sit there and watch me all the time. I learned an awful lot there.

TC: I can imagine, yes.

LS: But it was basically a glorified janitor job.

TC: So you went to see Cox and . . . ?

LS: He sent me down to the Test Lab and they got the paperwork kind of mixed-up down there and didn't call me for a couple of weeks. I had taken Civil Service exams for draftsman and mechanic helper and I don't know what all else during the time I was working in the substation. So, about two weeks after I got laid off at the substation, I got a call for electrical tester. I went down there and they put me to work the next day. They were really hiring hard and fast because they were getting ready for the frequency change.

TC: The frequency change, okay. So this is 1935?

LS: This was 1935, yes, November of 1935.

TC: Okay. Well, let's see, we could talk about the frequency change, but maybe first, had you heard of Ezra [F.] Scattergood, say, growing up or as a young engineering student? Did he have a reputation beyond DWP?

LS: Oh, yes, everybody new about him. Of course, the whole DWP Power System was based around Scattergood. For a while they had the Power and the Water System merged, as it is at the present time. It wasn't always that way, they were two separate departments. He started as an engineer in the Power System, and then pretty soon they put the systems together and he became the General Manager of the Power System and everybody in the city knew him. There were fights going on then with the private utilities, and the Owens Valley problems were going on, so everybody knew Scattergood and knew who he was, but I never met him personally. I met his daughter once.

TC: A remarkable man, anyway.

LS: Yes.

TC: Well, what was the frequency change all about? I know that it had to do with the hook-up with Hoover Power.

LS: Well, I guess that there had always been talk in Los Angeles of going to 60 cycles. All over the country there were different frequencies. New England was running on 77 cycles and some places were 25 or 50 and some were 60. The 50 was, I guess, inherited from Europe pretty much. But a man named Lowe, who had built the Mount Lowe Railway and had been a

balloonist in the Civil War, started a gas company which eventually became the Los Angeles Gas and Electric [LAG&E]. It also gathered up a couple of little electric systems. I don't know how many electric systems there were in Los Angeles, but I have personally worked in probably ten of them. They were just all over town, some of them, two or three little generators. Some of them were big systems, like the Biltmore Hotel and the *L. A. Times* had several good-sized generators.

TC: When you say you worked in them, you worked . . . ?

LS: As a Department tester.

TC: For ones that had been taken in by the Department.

LS: No, they hadn't been taken over, but they reached a point where they couldn't handle the load or keep up on maintenance. I think the failure of those little private generating plants is that they never realized what the maintenance would do to them. They had them built and the contractor walked off and left them. Maybe fifteen years later the maintenance became just exorbitant. And when they tried to do maintenance, they had no source of manpower. So eventually they all got tied into the Department or to the gas company [LAG&E]. The gas company was really one of those that had grown from that kind of a start, when Lowe started a streetlight distribution system. Then they had the Pacific Power and Light, which was started by Huntington to provide his streetcars with power.

So the small systems gradually came to the point where in many the Department was going in and doing their maintenance work for them. In most of them they had installed standby power, which required a lot of automatic switching equipment. When I got into the Station Test, we were going out and doing test work on their generators and the transfer equipment and their switch gear. They just didn't have the test equipment or the trained men to do this kind of work. I got into a lot of these old plants, which I guess are all gone now. The gas company did the same thing. They had several of the big downtown buildings that had small power plants, and the gas company served them with standby feeders. Their prize was the Biltmore. They had, I think, three feeders going into the Biltmore at 4100 volts.

There was an anti-municipal-ownership faction under the surface here in Los Angeles. Most of these places were served by the gas company. But then when the Department took over the gas company it was all one, so we were working in these stations. The old Seventh Street Development Company had a big power plant down on Seventh Street and there was one that's now a parking lot across the street from the City Hall on First and Spring I guess it would be. There was a pretty big plant there. The building is gone now, it's just a big parking lot. They had great big steam-driven engines, mostly Corlis type.

TC: What kind of fuel did they use? Was it oil at that time or coal?

LS: I think it was mostly oil, but there was some coal, and the Los Angeles Gas and Electric brought in enormous amounts of coal. Because over by the County Hospital they had a great big gasworks where they made producer gas. A byproduct was briquettes, and there was a giant pile of briquettes over there. I used to go over there with my dad and get a couple of washtubs full of briquettes to burn in our fireplace. Then gas came in. I can remember when they cut the gas system over from producer gas to natural gas coming from Kettleman Hills. They came to each house and put new burners in the stove, and the old gas plant sort of disappeared and the briquette pile disappeared.

TC: Would that have been in the twenties?

LS: The late teens and the early twenties.

TC: So, with the frequency change . . .

LS: Well, the gas company ran on 60 cycles, and finally everybody realized this was just wasting money the way they were fighting. My dad worked for about six months for the gas company on summer vacations when he was teaching. His job was to go down the street and try to talk people into changing from DWP over to the gas company. I don't think that many of them realized the frequency problem, but in those days you didn't have too much. There weren't too many washing machines, there were no refrigerators, and it was really just

the lighting, which did not matter, but where there were motors they could get into trouble. There were quite a few times they got mixed-up when they'd tie somebody's service into the wrong system and they'd have the wrong frequency. Finally, they came to the agreement that they'd do it every other block. So one block they'd have 50-cycle lines, the next block would be 60, and that was through the middle twenties and up through the thirties.

Just as a sideline, the Department even had 50-cycle on their system out here in the Valley for a while. After the frequency change, the Water System had put in a diesel plant and started their own power system to run the Van Owen pumps. They have about 100 pumps down Van Owen Street that are still operational and they ran these pumps on 50 cycles. On Van Owen Street we had a 60-cycle feeder and a 50-cycle feeder that ran on the same poles feeding these pumps. Finally, during the war they gave up and converted everything to 60. That difference in frequencies was always a big headache, so everyone knew it was going to have to change.

Then Edison began to tie to other utilities. They tied into San Diego Gas and Electric and into PG&E and they had to put big frequency changers in. They were very expensive and needed a lot of maintenance. So it was in the cards for the Department. And when Boulder came along the government leaned toward 60 because the independent agencies, Nevada and Arizona and the Metropolitan Water District [MWD] definitely wanted 60

cycles. It was decided that they would build a plant with some of the machines designed to run either 50 or 60, and the [Southern California] Edison machines ran on 50, and then the Department, Pasadena, Burbank and Glendale, cut their systems over to 60 cycles.

TC: So that entailed changing all the meters, right?

LS: Well, there were three separate projects. One was changing the meters. Every meter had to be modified and recalibrated for 60 cycles. The second was changing all the clocks. They tried to make that easy by buying about a dozen different varieties of clocks in large quantities and giving people a free trade: You bring in the old clock, we'll send it to South America or someplace and just give you a new clock. When people had some old heirloom or a clock built into a masterpiece vase or something like that, it was taken down to the Test Lab Instrument Shop. It had originally been just a couple of fellows that repaired electric meters. I don't mean house meters but the instrument meters that were used in testing. But they expanded that to about seven or eight people and they'd rebuild these clocks and streetlight time switches, et cetera. They had real watchmakers who could make new gears for them if necessary.

Then, the third item was the industrial problem. The General Plant [Division] took over the rebuilding or changing of machines where they had to. They had an enormous frequency changer mounted on a truck-trailer combination, which they

took around to these industrial places and ran to supply 60 cycles to see how the equipment operated. They then decided what to do. Should they change gears or pulleys or get new motors, or how to best correct the problem. General Plant would get it all engineered and ready. And just a couple of days before the frequency change they'd go in and make changes, such as put new pulleys on equipment. Things like washing machines, which were becoming fairly common then, were just allowed to run faster. Refrigerators turned out to be satisfactory; with a very few exceptions, they could just be allowed to run faster. So they had it all laid out ahead. As they cut the feeders over, maybe a dozen feeders at a time, General Plant had crews who would go out and get the equipment cut over.

TC: So the whole thing was staggered, the whole cut-over?

LS: That's right. They started at the harbor end and they installed a big frequency changer at Station C, connected to Edison.

TC: Okay, that's in Wilmington, right?

LS: Wilmington, yes. Edison had a generator over at Long Beach that could run on either 50 or 60 cycles, so they built three transmission lines from the Long Beach plant to Station C. They ran that generator on 60 cycles as they needed it when the load began to build up. Each weekend they'd cut an area over, usually everything out of one distributing station. By

that time, I'd gone out to the desert and was no longer in the Meter Test business.

TC: Yes, that's what I wanted to know. In the course of all of this, where were you, if this is, say, 1935 or 1936?

LS: It's early 1936. There were so many meters they couldn't do too many of them at once. So they'd do them ahead of time in each area. After they were cut to run on 60 cycles, there'd be some losses but it wouldn't be significant. Most of the household meters were done first. They saved the industrial loads to the last minute. But the household connections were mostly lighting; in those days you didn't have anything except the refrigerator, probably, and a washing machine. So it wasn't a bad program.

They established a little field laboratory up in Garvanza real close to the North Main Street Meter Lab where they could work back and forth. The people that were designing this and going to make it run could go out to the Garvanza lab and come back and make new equipment or modify their equipment. They built a large number of test panels where they could just plug the meters in real quickly and test them. When I first went into the Test Lab, I went into the Meter Lab, and I worked there for a month.

TC: Now, what street is this on?

LS: That's 1630 North Main Street, where Station A is and all the shop buildings, and the Test Lab is still there, a big new building. I learned all about meters and I learned about

these temporary test boards they were building. One interesting thing is that the week I left Ed [Edgar L.] Kanouse came in there and took over my job. I broke him in on testing meters. (laughter) So Ed and I started on the same job, we didn't finish there.

TC: You probably had a few jokes about that later.

LS: Yes, but we were always very close friends after that. Then I went down to San Pedro. They opened a big lab down in San Pedro, which covered the south part of the system where they were going to start the frequency cut-over. They had three groups in the lab. There was a shop where they brought the meters in and disassembled, overhauled, and painted them. Then they put whatever new gearing was needed, and new coils, or whatever had to go into making them operate on 60 cycles. They were then rolled into the test area, of which I was in charge. I think I had about twenty-five testers.

Then there was the field group. They would go out and put jumpers around the meters and then take them out of service and bring them into the lab. Then they would go to the repair shop, then the test shop. There was about a three-day schedule and then the field fellows would take them back out. Usually mornings they'd install meters that had been overhauled, and then in the afternoons they'd pick out another bunch, bring them in in the evening, and they'd be ready to start to do the repair and test the next day.

TC: It seems like there was a real schedule that you had to follow, that you had to keep to.

LS: Oh, yes, we didn't want to keep them out of service too long. We went all through San Pedro, Wilmington, and Harbor City out of that lab. An interesting thing, I think, was after we finished the last thing the tester did when it was all calibrated for 60-cycle was to stamp the dial down in the corner with a rubber stamp that said "60 cycles." That's so they'd know that meter had been converted. Well, these meters hadn't been back in service for more than a couple of billing periods when the trouble started. (chuckling) That was in February, March, April, May, I guess, of 1936, and they didn't cut over to 60-cycle power actually until maybe October or November. So all that time these meters were out there running with a little stamp in the corner that said "60 cycles." Everything that went wrong in the house resulted in a complaint right away: "My washing machine is broken down because it says 60-cycle power."

Well, when they abandoned the lab in San Pedro, they opened another big one up on Main Street and Vernon Avenue. In fact, it was larger than the San Pedro lab. But they asked me to stay in San Pedro for three weeks and take over the complaint job. In every area of town they had a complaint man who usually worked out of some substation and he took care of all the complaints from customers. Sometimes they were meter problems, sometimes they weren't, but he was supposed to kind

of make an analysis. If it was a meter problem he fixed it, if it wasn't, he found out the right people to take care of it. So I worked a week breaking in with the complaint man down there and then I took over for two weeks. It just about destroyed my faith in humanity. (chuckling) Because right at that time we were getting all these complaints about broken-down equipment that was all attributed to the 60 cycles, which didn't exist at that time. Anyhow, after my little stint at that, I went back up to the Main Street lab and took over the testing crew there.

TC: I just wanted to see if we were covering the various things that I wanted to get at, locations and how long it took. I think we've covered those things. So the customers didn't have to bring the meters in?

LS: No.

TC: They were taken out and reinstalled.

LS: They had to bring the clocks in.

TC: Okay.

LS: At San Pedro our Test Lab was next door to a saloon. (chuckling) It was a pretty good-sized building. When I was a little kid, it had been the office and yard for an electrical contractor. It was a two-story building and he opened a radio station upstairs there, McWhinney Electric Radio Station. Gee, that must have been in the real early twenties. But he had left there, and one-half of the downstairs was vacant. I have no idea what was in the

upstairs by then--it might have been made into apartments--and the other half of the downstairs was the saloon. They made a pretty good lunch there. A lot of us that were working in the lab went next door to eat lunch.

One of the fascinating and very educational things was they had a whole row of slot machines, which were absolutely illegal in Los Angeles at that time, and had been for a long time. And they ran wide-open. A man came in every day to take the money out of the slot machines and adjust them and repair them. I got kind of acquainted with him. I was interested in a machine like that, so I'd take my sandwich and go over there and watch him and talk to him. He was willing to talk and explain them, so he taught me all about the insides of slot machines. I was fascinated with the way he could set the odds. I remember one day the bartender coming over and he said, "These aren't paying out enough." He said, "People aren't too interested." The fellow said, "All right, I'll set them up a couple more percent," and so he did. There were little pins they could stick in holes and he'd change the pins and that would make the things pay out more or less as desired.

TC: Change the odds. Incredible.

LS: (chuckling) And all this time they were running them and the police never bothered. Things were pretty bad in the police department then. After I had worked in the Main Street Lab a while, I guess it was July they asked me if I'd go into the

Station Test and go out to the desert to the Boulder Transmission Line camp, which I did.

TC: Okay, we've got a little bit more time on this tape, tell me about that. So you went out to Silver Lake?

LS: Yes, I went down with my suitcase on a Monday morning. There were six of us heading out: there were two for Boulder [City, Nevada], two for Silver Lake, and two for Victorville. At Victorville they could hike up to town once in awhile, I guess, and at Boulder there was an enormous big old camp that had been abandoned by the Six Companies. They were still doing some finishing up on the plant, but I'd say 75 percent of the crew were gone.

TC: This is the construction of the dam?

LS: That was the construction of the dam and the installation of the equipment. The Department, of course, was going to take over the maintenance and the operation. Our crew up there got involved very deeply right away because the government was way behind, and all the dates were set for the cutting over of the various systems to 60 cycles. They pitched in right away learning about the plant. It was so far behind I got sent up there for awhile from Silver Lake and worked with them getting ready to hot up the lines and get the first two machines going.

Well, Silver Lake was a big old dry lake. It hasn't always been dry, there have been two or three times since then when terrible floods have hit the desert and it's had six or

seven feet of water in it. The camp was just a little bit up the shore from the old dry lake bed. A railroad line called the Tidewater-Tonopah branched off the Union Pacific and came up right along the edge of the camp, and they had a little dock with a station with a telegraph operator in it, Silver Lake Station. I don't know why. One train a week, and then there was a passenger motorcar which ran out to Death Valley, one freight train a week, the operator in the station with a telegraph key, and our tent camp. It was rows and rows of tents, and a big mess hall, a sick bay, and then a big building with showers and toilets in it. Four men to a tent, and the tents were about five feet apart, dry sand blowing, and hot. They drilled a well about 1,500 feet down under the lake bed and got water, but it was terribly alkalized. The taste was awful and most everybody got sick from that water. On the table they had big pitchers of blackberry juice, and you were supposed to drink at least a glass of blackberry juice every meal to try to offset the alkali. (chuckling) I don't know what the theory was, but that was the orders anyhow. And, oh, dirty! And everybody was sick and the heat was just awful.

You'd go into the mess hall and they had a big old wooden barrel right by the door. One day it would be filled with iced tea and the next day with lemonade--they'd get lemon juice in huge, big cans--and the top surface was covered with

flies. With one hand you'd swipe the flies off and dip your cup in. (chuckling)

You were supposed to go to the mess hall right away when you checked in. You'd get four of these big commercial-size juice cans and take them to your tent. You sat one of these under each foot of your cot--they had iron cots with iron feet--and you set these in the cans. Then each tent had two or three extra cans and you'd go over to the wash house, and you'd fill them up with water and carry them back and pour about eight inches of water into each of the cans where the feet of your bed were. Well, you did that about twice a day; if you didn't the water would evaporate in that heat and dry up. And if you let them dry up, your bed was full of crawlies. In the middle of the night, you'd wake up and you'd have scorpions and centipedes and everything under the sun crawling all over you. Oh, what an experience!

TC: So you were building the switching station at the time?

LS: Yes, the switching station. They had built the lines the year before and they were all strung.

TC: Okay, so the towers were up there for the lines.

LS: The towers for the transmission line were all there. They'd used that camp for those line crews, but they were all gone. Then they moved in the station construction people, electrical, industrial construction people and building construction people to put in foundations and build this building and install the electrical equipment. One of the

first things I remember after I got there was the Monday morning bus that would come in from L.A. They'd go up and down Main Street and offer jobs to the folks standing in the bread lines. Of course, this was still pretty bad Depression time.

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LS: The bus would come in from downtown L. A. and would have maybe thirty or thirty-five people . . . I hate to say derelicts, they were people just out of jobs who thought they could work, although they warned them it was hard work. They'd unload that bus and kind of get them settled in the camp and then they'd take them up to the station, which was about a quarter of a mile up the hill from where the camp was.

When I arrived they had poured the foundation for the basement and they were just forming up the walls for the upper story. It was a one-story building but with a full basement under it. It was a bad job and they were pressed for laborers. The good mechanics, like the carpenters and the cement finishers, would stick with it because they got pretty good pay, but these fellows they brought up were just for labor. For the sewage system, they were making a spreading field down toward the lake; and it was big because eventually they were going to build maybe eight houses there and a dormitory and a repair shop for future maintenance of the transmission lines. The ditch had to go down below the level of the basement floor, which was maybe fifteen feet or something like that, and then it had to stay that level until it got far enough down the hill to where it was maybe four feet below the surface and then it started to spread out.

Well, these poor devils would work in that ditch in the hot sun, and it was over 100 [degrees] all the time, you know. We'd go to work about 4:00 in the morning and work until, oh, 10:30 or 11:00, knock off till about 4:00 in the afternoon, and go back and work till after dark. After the first day, these guys would start disappearing. The train would come through and it would stop at Silver Lake for orders or something. A lot of them would disappear on train day, and then a bunch of them would hitchhike down to Baker and either catch a bus or hitchhike probably--they didn't have any money--back to Los Angeles. By the end of the week, their gang of thirty was gone, and the next Monday another bus load would come out.

TC: What did you do in that spare . . . whatever it was, four or five hours?

LS: Oh, well, sleep mostly--at least the Test Group, and the mechanics did, too. Because as soon as they got the station up and got some lighting in it, then we were installing equipment and tried to work at night as much as possible.

TC: Okay, what's in the station?

LS: Well, those stations were pretty unique. I don't know what's become of the one at Victorville. The one at Silver Lake was just wiped off the ground. The houses that they had built were sold and people moved them down to Baker.

Starting in the basement, they had one big room that had six or seven large Kohler generator sets in it. There was no

power available in the area. Think of all this power coming from Boulder and no power available to that station. They had six or seven big Kohlers that each generated . . . oh, 75 kw or something like that, quite a bit. They had complicated switching equipment. They could be used for power supply to the camp and the station, and two of them were always set aside for charging the battery, a giant 250-volt battery used to operate the circuit breakers and MG sets to supply DC power to the supervisory control and the communication systems and so on. They probably only needed one or two Kohlers at a time, especially at night. The people in the camp would go to sleep and they weren't using any power, and in the building they didn't use much at night, so they'd shut down all but one Kohler at night. But the two battery-charging Kohlers had to go all the time. There was the battery down there and all these big Kohlers--they were in separate rooms--and then there was another room that was just generators for generating power for the telephone and a lot of equipment like that.

On one end, there was a room about fifteen by twenty-five, and a room immediately above it on the first floor which made use of a giant swamp cooler. That was their first air conditioning and it was very primitive. They had water that ran down through grids and down to the bottom and then pumps to circulate it while big fans blew air up through it, just like the swamp coolers you see around here now on people's roofs. But it was a big one! (chuckling) They used that to

keep the station cool because they had to keep the batteries cool especially, and all of this equipment like the motor generator sets and the Kohlers generated an enormous amount of heat.

To supply heating in the winter and to run the Kohlers, they had big butane tanks buried out in the yard. It was an interesting system. They had an ordinary household water heater. Liquid butane would go through the water heater and be heated by a burner using the butane itself and be turned into gas, and then it was distributed in a gas distributing system to the houses, the dormitory, up to the station. The biggest part of it drove the Kohlers. A big butane truck would come out from Los Angeles and unload a whole tank truck of butane. Years later, after they built the Third [Boulder] Line, they decided to put a transformer in and tap into the transmission lines. That way they got power and they eliminated the butane system.

The mechanics were working both day and night. Days they'd work out in the yards and nights they'd work in the building. Everybody was on at least a twelve-hour shift. The Test people were of course following right along behind the mechanics with the testing. The stuff they'd work on during the day we'd test at night and the stuff they'd work on at night we'd test out in the day.

TC: This is new equipment for you, right?

LS: Yes, that's right.

TC: How did you learn?

LS: It was new for everybody. I was the only one that hadn't worked in Station Test before, and most of them hadn't had too much time there. The lead man, Bowser, down at Victorville had quite a few years. The lead man at Silver Lake, Zabaro, had about four or five months in Station Test, and the two men at Boulder had each had three or four months in Station Test. So nobody except Bowser had had too much experience. We spent a lot of hours just going over instructions books and prints and ferreting out how things worked and then doing our testing. Then once in awhile they'd send an extra crew out from downtown. We had to change the oil in all the breakers. They had been sitting there in the desert for months and they'd done some breathing and the oil had become wet. So, at the last minute, they had to send out crews to change the oil, dry it, and test it.

TC: Just a technical point, what happens at a switching station? I mean, you've got Boulder Power Plant and you've got two switching stations between there and Los Angeles.

LS: There are physical characteristics of a transmission line which makes switching pieces in and out very difficult, and usually a long transmission line has to have special circuit breakers to handle what's called the charging current, and the line can reach a point where it's impossible. Also, as you go along a transmission line the voltage tends to rise, so that at the receiving terminal, if you had to switch one long line,

you'd have a terribly high voltage. By cutting it up in sections, you could switch a small section at a time. They even designed a new type of breaker that had never been used before to switch these lines, because no breaker built at that time could switch much more than those ninety-mile sections at full voltage.

TC: So it's a regulation kind of mechanism?

LS: Well, mainly it's to be able to break the line up into sections and take a short piece out to work on it. If they wanted to go out and change insulators or clean them, they could get that section out and get grounds on it. You just couldn't switch a longer section in those days so it was broken up into short pieces. Eventually, when the line was rebuilt to 500 kv and new breakers available, it became possible to switch longer sections. They eliminated Silver Lake at that time and Victorville at a later date, although they have a station at Victorville now where other lines come in from other points.

TC: I see. You said that on one occasion you were sent over to Boulder to the power plant.

LS: Yes.

TC: What did you have to do there and what was the set-up?

LS: Well, there I did the same thing I was doing at Silver Lake: testing the equipment out in the rack. The relay system on those lines to trip them out in case of trouble was all done by radio signal that passed over the lines. You coupled the

radio to the line, then you uncoupled it at the other end. The radio signal is called carrier current. When I went up to Boulder they were just getting the carrier in service. I spent practically all of my time up on the hill in the switch rack, getting the carrier current adjusted and getting it all tuned-up and in service for the relay protection. I did some work down in the power plant and I got somewhat acquainted with Boulder, so that later I went out there and worked vacation relief Test man.

TC: So, in this period, you were there for just a short stint?

LS: I think about two weeks.

TC: Two weeks?

LS: Yes, this was just before the line came hot. I went back to Silver Lake and I was there the day they hotted-up the line the first time. We had trouble, things that we couldn't anticipate, you know. One of them was up at Boulder. There were only two machines available, which was the minimum you could use to pick up one line section, even a short ninety-mile section. They got up to normal voltage in the morning and were going to have the big celebration and parade down in Los Angeles in the evening. After about two hours the bearings started to heat up in one of the machines, and they thought for awhile they might have to take the whole thing down and bring the power from Edison or something. (laughter) But they slowed the machines down to a very low speed and kept

the line energized, and it ran like that all day long and they finally got the bearing cooled off.

I was in the control room at Silver Lake and it was hard to find out anything. We had no telephone system working. We had a radio in the camp and a radio operator. He was supposed to communicate down to Wright Street in L.A. The Communication [Section] used to have a building on Wright Street down near Twenty-first or something like that. Sometimes you got through and sometimes you didn't. If you had to take a line section out or get a clearance, you'd try the radio first because it was all within the Department, you could do it very fast. If that didn't work, you'd go down to the railroad station and get the telegraph operator to telegraph the Union Pacific operator down at Cicorro and he'd telegraph the Union Pacific operators downtown. They had a deal where they'd call the Department and give them the message. Maybe two or three hours later it would come back. So, when it came to switching and energizing the line, it was a bad deal.

Anyhow, we finally got the word that at a certain time they were going to go ahead. About five minutes before they were going to light the giant arc light they speeded up the generators at Boulder and got them up to 60 cycles. We could tell what was happening there at Silver Lake. We had meters and we could see what was going on and when it got to normal voltage. As soon as the giant arc light ceremony was over,

they stopped the machines and Boulder didn't move for several days after that. (laughter)

TC: I've read about the big inaugural where all the dignitaries were there, and Mr. Scattergood and I think his daughter flipped the switch.

LS: Yes, they made it. (chuckling)

TC: Well, at the Boulder Powerhouse, maybe this has more to do with when you went back there the second time, I just want to get a handle on how work was divided. Edison had a portion of it and the Department had a portion of it?

LS: Yes, the Department in 1937 bought the Los Angeles Gas and Electric Company electric properties, and that included one of the machines at Boulder and a transmission line to Boulder. They sold the transmission line to the California Electric Power System, I guess it was, which was then called the Southern Sierra and/or Sierra Pacific--it had a lot of names. Anyway, that transmission system finally was taken over by Edison. The Seal Beach Steam Plant of the Gas Company had supplied power out over that line for construction power and to take care of the camp at Boulder, because there was no electricity except small Nevada Power Company generators around Las Vegas at that time. That's how the Department got that extra generator out there which they connected into the Department system.

The Department then had a contract with the Metropolitan Water District to operate their machines. Edison had two

machines. The Department operated all the common things in the plant, all the plant utilities, including two house generators. They did maintenance on all those machines except the Edison machines.

The DWP maintained a Test crew there of two men for awhile, then they made it three men. After I came back to town and was in the regular Station Test crew, they sent a man up there for vacation relief, which I did for one year. After I came back from Silver Lake, I went into the regular Station Test crew. They were rebuilding the whole 34.5 [kv] system because of the high short circuit duty imposed on the circuit breakers by Boulder and the Edison connection at Wilmington. Every 34.5 kv circuit breaker had to be rebuilt or replaced. I got in on that project and worked on it for a year or so. In late 1957, they decided that Design and Construction would test the relays on the Boulder lines, as there had been several faulty relay operations. The line would trip out or sections would trip out from time to time when they shouldn't have, and sometimes when they'd take a line out and put it back it would trip immediately. They would close it in and it would trip right out again, and that was beginning to happen more frequently all the time.

Bowser, who had been the lead man at Victorville and who was a real old-timer, and I were picked. He was the lead man and I was his helper, and we were to go over all the relays on the Boulder system. We spent about a week organizing this and

getting a lot of test equipment built and studying the relays, all the books on them and so on. We started down at Station B, and the first day down there we took one line section out of service. They had a switch that you could turn on the relay board that disconnected a whole set of relays and then you could work on them. That would leave other relays on the other line section in service. We got all the okays and paperwork and took one set of relays out on that first Boulder line between Los Angeles and Victorville.

Now, the other line was still in service with the other set of relays. It was our first test on these and we were feeling our way along. Pretty soon another Test man came in who was responsible for checking the metering at the same time we were doing the relays. One thing he needed to do to be sure his meters were all right was to make a test on the potential transformers to determine their error. The transformers supply voltage to the meters in proportion to what's actually on the line. They can't build a transformer that has zero errors in it, so they test and determine the errors and then compensate the meters to make up for the errors and give you a final zero error in the meter.

We were down in a vault underneath the transformers on the Boulder line, and the meter tester said, "I've got to put those potential transformers back in service in order to make my Silsbee test on these transformers." Bowser and I kind of looked at each other, and he was running the job, and so

they started trying to put the lines back. Well, they worked two and a half hours before they got the system back. Everything was happening, and the relay problem showed up again. They tried to put a line back and it would trip out, put the line back and trip out. They opened all the sections out to Boulder and then they started building back from Boulder with low voltage on the machines, when they'd close this last section into the Los Angeles transformer bank and it would trip. For awhile they thought we'd blown up a transformer, but both lines were acting the same. They finally got the lines back in. As I say, it was about two and a half hours. Everything, the whole system had been black. (chuckling) The boss came down to Station B and he walked into the control room while it was still blacked-out. He wanted to know what happened and we told him and he said, "Well, you guys go home." (chuckling) We never knew whether we were going to come back or not! (laughter)

TC: Who was the boss then?

LS: Joe Cunning, he's been long dead. So we went home. My wife's family was having a birthday party and we were supposed to have dinner in San Pedro. We came back about eleven o'clock, and here's a note on my door from Bowser that said, "We're going to Victorville tonight. Call me at Station B." We didn't have a telephone and I had to drive down to a drugstore to call him at Station B. He said, "I'm picking up the test equipment and I'll come by and pick you up in about twenty

minutes." He said, "We're going to Victorville and you'd better be ready to stay a long time." So we went to Victorville and started testing these darned relays, and we tested and tested and we could find no problems in them. They needed only minor adjusting. We got them adjusted, and I think after we did this there were fewer of these faulty operations. We worked in Victorville for about two weeks and then we went out to Silver Lake for a couple of weeks, and then to Boulder, and then back to Victorville again. Then we got back to "B" and we finished up the job we'd left in the middle of the uproar.

TC: Was there any sort of disciplinary action for that?

LS: No. I guess there was a kind of a feeling you're allowed one mistake. (chuckling) I think you're a better Test Man. Well, meanwhile [Edgar L.] Kanouse had gone from meter testing into the research lab. I don't know if he had a scholarship or what it was, but, anyhow, he wanted to take a leave of absence and go up to Stanford and get a doctor's degree. The DWP let him do this and he said he'd work on some Department project. So they gave him the project to find out why these relays didn't work. I read his thesis--many times--and he did a lot of research. He'd send down all kinds of instructions. He wanted tests, and Bowser and I went out to Victorville one day and did a lot of testing out there for Kanouse in connection with his thesis, and he figured out the problem.

TC: He figured it out?

LS: Yes, and General Electric came in and modified the relays or sent new parts for them, and they were rebuilt and it solved the problems.

TC: I know it's probably more technical than I could possibly understand, but, in brief, was it a matter that the equipment just couldn't handle the power or something?

LS: It was in the relays. They were a new design that had never been built before and they were very susceptible to negative phase sequence voltages. When you energized this line, it created negative phase sequence voltages in the line itself, and the relays couldn't distinguish between that and a fault on the line. So they modified the relays. I don't know how, I was out of that business by the time they got it done and I don't know exactly what they did.

TC: Well, did Kanouse work with the lab up there, with Dr. [Joseph S.] Carroll and . . .

LS: I believe he did.

TC: Was it the [Harris J.] Ryan Lab?

LS: Yes, the high voltage lab. I think Bradley Cozzens also did some work up there.

TC: Bradley Cozzens was the other, yes. Now, they had a lot to do with the testing of the transmission line, I know, just before, even before the equipment was bought, I think.

LS: Yes. They developed new types of clamps, and that HH conductor which proved to be a problem later on. Then Floyd Goss got in on it, although I don't think he went up to

Stanford. But he was doing a lot of work in the Test Lab on things that they were going to use for the line, such as clamps and connectors. He designed a vibration damper, which in connection with the problems they had with the HH conductor, they had to discard later.

TC: What were the problems with the HH conductor? I haven't heard anything about that.

LS: Well, it was a tube, about an inch and a quarter, composed of segments of copper that were locked together with tongue-and-groove running along the segment. The tube was twisted into a spiral which kept the segments from coming apart. It worked just fine for about . . . I'd say about fifteen years. There was a graphite impregnation in the tongue-and-groove that locked these segments together and it began to dry up or harden. It got so the segments couldn't move with respect to each other.

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LS: And it made it one stiff bar instead of a flexible conductor. The vibration was just terrible. It couldn't be taken care of because these segments had to slip and we began to have conductor breakage. The HH conductor would just break in two. Sometimes the patrolmen going along the line would see a place where one segment had broken out of the ten or twelve segments--I don't remember how many there were--and the ends were sticking up in the air; one segment would have broken and others would be cracked. With the binding of the segments, the vibration wasn't properly transferred to the dampers. In fact, they finally decided that these dampers were aggravating the thing. The solution was to replace the HH with aluminum and use a different type of damper.

TC: So that would have been into the fifties by then? You said it was good for fifteen years or so . . .

LS: They were having all this problem after the war, I think about 1950. By the time I got back in the transmission line business in 1963, they had no more Goss dampers on the line.

TC: Just to finish up some of this story of life in the desert and that experience, did you ever run into . . . Well, did [William S.] Peterson come out periodically, and Miles Bolser, the people that designed it?

LS: I never saw Peterson or Bolser out there on the line. The transmission line was finished when I went out there and they had nothing to do with the stations. A fellow named Jim [James D.] Laughlin was in charge of the station work and he showed up pretty regularly. But no, the transmission line was all strung and finished and I never saw Peterson or Bolser out there.

TC: Did you ever have any dealings with him, personal dealings with him?

LS: I knew him very well, yes, in later years. When Kanouse moved into his office, why, I was still very close friends with Kanouse and I used to drop in there to see him. Peterson would be there and we'd sit and visit. I was Superintendent of the Test Lab when he retired and he came around. I remember the last visit I had with him. He dropped in at the Test Lab down there and we had a nice talk one day. Yes, we knew each other very well.

TC: How about Bolser? Did you have any dealings with Bolser? Again, was that strictly transmission?

LS: No, he was in charge of the Test Lab, above the Superintendent. The Department's organization in those days didn't follow too much logic at times. Bolser had several groups in his organization, including the Test Lab and Relay Design. They'd had the big problem about Carl Heinze. See, Carl Heinze started to compete with Scattergood, as I understand it. I was just a peon then, I didn't know the

inner workings at that level, and Heinze left and started his own consulting company. I got acquainted with him afterwards when he was a consultant. Scattergood then was in complete control and they went through the organization. Apparently people had taken sides during the fight and there was a big reorganization.

TC: Well, where was Heinze in the organization? Was he one of Scattergood's assistants? [Thomas A.] Panter was one of the people he brought, and [Charles P.] Garman, I think.

LS: I can't exactly tell you that, because Heinze was gone when I got there.

TC: He'd been long gone, okay. But I have heard of that story.

LS: I just got it then from other people that I worked with that had been there at that time. The Test Lab had a wonderful spirit and I think they got fine people in there, and they tackled jobs that were just unbelievable. But they didn't seem to get too much help from above.

TC: Yes, they sound unbelievable. It's incredible.

LS: It was sure interesting, and it was an education. And I don't think there was anyplace in the Department a young engineer could have had a better place to learn the ropes.

TC: It was like a trial by fire, literally. (chuckling)

LS: It was. Yes, I guess it was.

TC: Trial by heat.

LS: They'd tell you, if you needed something for a job, build it yourself or forget it.

TC: How long did Bolser stay on after Boulder?

LS: Well, he was there after I left the Test Lab, which was in 1941. Yes, I'm sure he was still in charge of the Test Lab when I left there.

TC: Maybe we can finish this up. We've been almost . . .

LS: Well, we haven't gotten out of the Test Lab yet. (chuckling)

TC: Yes, we haven't gotten out of the Test Lab. Well, maybe we should finish that. Do you want to finish that?

LS: Well, all right, we'll try it. Anyway, after all the Boulder start-up, I came back to town. They had been supplying Burbank, Glendale and Pasadena on 34.5 lines out of Station A, but they were getting more and more power as time went by. They were building up their systems and they needed more intertie capacity. They were entitled to it but the Department was limited by the line capacity between the systems. They finally decided to build Station E as a tie point to supply Burbank and Glendale. When they started work at Station E, the first thing they did was to go out in this great big open field and drill a bunch of ground wells for the grounding of the station. I was sent out there as the first Test Man to go to Station E to test these wells. They'd drill awhile and then I'd come in with my equipment, run tests on the wells and determine whether they were adequate grounds for a big station. If they weren't, I'd tell the driller to go ahead and drill some more. So I was the first Test Man at

Station E, and I was there with Station E all the way through until I got out of the Test Lab.

TC: Where is Station E? I can't picture it.

LS: It's right on the city line on Whitnall [Street] between North Hollywood and Burbank, so that the switch racks backed up to the city line on one side and Burbank on the other. On one side they had lines going to the Valley, on the other side the lines went over to Burbank and Glendale. They could just cross the street and they were on Burbank property.

At that time, the transmission to the Valley came out of a 34.5 line out of Station A, went clear out to North Hollywood, Van Nuys, Canoga Park, Power Plant 3, back down along San Fernando Road, and eventually back into Station A. And that loop supplied the whole Valley. Substations were small. The Valley had nothing but farmland in those days. Then they began to build lines out from E. Of course, now they've got six or seven receiving stations in the Valley alone. But E was everything. Because it was so far out on the system, they put in a big synchronous 60,000 kva condenser. The station was built right alongside the right-of-way of the lines to San Francisquito. They tapped those lines and brought the taps down temporarily into the station. That made lines with three points on them: PP 1 and 2 and RSE and RSA.

Well, I took a course in relay about that time. Every semester I took a night school course of some kind, and this

course was given by the head relay engineer of Edison. Somebody asked him in this class how do they go about coordinating the relaying with the construction of the system in Edison. He said, "Oh, we've got a great system. They write to the relay engineer and they send him a map of what they're going to do with all the lines, and down at the bottom in a hand-scribbled note it says, 'There, you son of a bitch. See if you can put protection on that!'" (laughter)

Well, one of the things nobody could do was to put good protection on was a three-point line such as we had coming into E, two three-point lines. And I'll tell you, we spent a lot of time on those lines trying to get those relays working at E. Finally, they got E along to the point where they moved in some circuit breakers. They were in such a rush to get this going that they had not even put in circuit breakers. When they got circuit breakers they cut the lines and had them come through circuit breakers. Things improved after that. I worked at E for maybe four years on and off, right from the beginning to the end. About the time E was finished, we had to rebuild all the stations in the Valley for a higher short circuit duty. So I worked on all the stations in the Valley replacing circuit breakers and getting ready for the higher duty. Once in awhile in between times I'd get a three- or four-week assignment in the downtown area. We had taken over the gas company about the same time we built Station E, and all the stations on that system had to have the breakers

replaced, because they were going to be cut over to the A and B systems. There was a high short circuit duty on those systems.

When all of that cut-over work was finished, they asked me if I'd come into the Research Lab in the Test Section. So I worked at the Research Lab from about the middle of 1940 up until after the war started, and to the time of the PAS Survey, when I got an appointment to the Design Section downtown. In the Research Lab, I worked on a lot of real interesting problems.

TC: Okay, well, we can continue talking about that if you want.

LS: Oh, people would bring in all sorts of odd things. They'd say, "Well, we've got a problem somewhere in the system. Go and analyze it and see what you can find."

TC: Who did you work with?

LS: Well, Ted [Theodore M.] Blakeslee was in charge of the Research Section then. He later became Superintendent of the Test Lab, Operating Engineer, and then Assistant System Head and System Head. One of the things I did there was Fault Analysis. They had a couple of oscillographs installed; now they've got oscillographs everywhere. We would go out after each fault and bring the records in to the Lab and develop them and process the film and then analyze the film and write up a report on what happened and why the lines relayed the way they did. You had to have a good knowledge of all the relays, which I had from my Station Test work, and then you'd decide

whether you had a faulty relay operation or what had happened on the lines or if a circuit breaker had partially failed, that sort of thing.

I think one of the interesting things there was work for the General Sales Group. They were out selling power to everyplace they could, and they dreamed up some of the wildest things. They brought them into the research lab and we were supposed to figure out what they were and what we could do. One day a pickup truck showed up completely piled full of old washing machine wringer-rollers. Those were from the days when washing machines had open, exposed wringers. These were steel rods with rubber rollers cemented onto them. A man from General Sales came along and said, "I want you to figure out some cheap, easy way to get the rubber rollers off of these steel rods." Then he said, "The police department is arranging someplace they're going to have wooden rods with a handle made for them, and they're going to be batons for beating people." In about two days we figured out a method of heating these rods to a red heat in about twenty seconds.

TC: And then that would burn off the . . .

LS: That would loosen up the rubber and start it to melting, then we'd slip them off. In about a week we had this whole truck full finished and the police came and picked them up. They drove off with their truck loaded with rubber rollers, and I don't know whatever became of it, but I really don't believe

that they were ever made into police batons. But it was an idea and we did just all kinds of things like that.

TC: So sometimes these wouldn't be particularly related to the Power System?

LS: No, only to sell power. However, we got a lot of real research projects. One was to see why certain fuses weren't working right and if they scattered sparks which could start a fire. We set up a system down at river powerhouse. They used to have a powerhouse, a hydro station down on the corner of Coldwater and Ventura Boulevard. They had so much water then they didn't know what to do with it. They had a powerhouse in Franklin Canyon where it went down the other side of this hill, but this was at the low point, right alongside the river. If they didn't need the water in Franklin Canyon they'd run it through this turbine and dump it in the riverbed, and then they'd catch it down at Griffith Park and pump it back out of the river and put it into the line that runs over to the Silver Lake Reservoir. So we set up a big test outfit down there, and we were testing fuses. Nobody seemed to really know whether or not they scattered sparks. We had this all set up with the generator running wide-open, and then put a short circuit on the generator through the fuse. It didn't affect the system. We weren't tied to the system. When the fuse would blow, we'd take high-speed pictures of it. We were doing that right when the 1938 flood came. We had to stop that job for about two months till the

Valley got back together again. Pieces were washed out of that pipeline that came down by the powerhouse. They had to get that replaced before we could start testing again.

TC: Was it just after that that the [Army] Corps of Engineers redesigned the river, as it were?

LS: Yes. Right after that they started building these two big dams, Hanson and Sepulveda.

TC: Well, where was the Research Lab?

LS: It was in the Test Lab building down at 1630 North Main Street. That building had been the transformer repair shop in the early days. Then it became the Test Lab and they built another building for the transformer repair shop. The Test Lab never got anything new, other people got the new ones. We had a big area that was the Research Lab. It was about a thirty-by-thirty or forty-by-forty room, something like that. The building had a lot of offices, such as the Meter Department and the clerical office. The Relay Test, which was part of the Operating Division, not D & C, had a room where they brought relays in from the field. But they also had crews going out and testing them in the field.

TC: Yes, right. I think Pete [Peter G.] Lowery came in doing that. This was after the war.

LS: He may have, yes. Then we had a big Meter Test Lab where they tested new meters and brought meters in from the field that were damaged and rebuilt them. There was an instrument repair shop, which had grown to a pretty good size by that time,

overhauling all kinds of instruments, and they also built a lot of equipment there for the Research Lab. Then they had a big bay with a big crane and railroad tracks came in; and it wasn't being used for anything by the Test Lab, but it had been when they brought transformers in there. During the Boulder line tests they got a high-voltage transformer. That's where Kanouse went after he left the Meter Lab. He went down to the Research Lab and he got in charge of the new high-voltage transformer. That's because he had a master's degree--I don't know where from, back East someplace, I think--in high voltage. So he took over the high voltage lab. He had been doing fault calculations when I went into the Research Lab. When he went into the Transmission Design, I took over his job in the Research Lab doing the fault calculations but not the high voltage work. Then we had a Transformer Test Lab, which was over in an old warehouse across the street.

TC: What would the fault calculations that you . . .

LS: Well, these oscillographs would measure voltages and currents at different receiving stations during the fault. Then I'd collect the records from the different stations and start the mathematical calculations, which could be very involved, to determine where the fault originated. Sometimes we didn't know where it actually happened and how severe it was, whether any secondary actions took place, whether it might have been during the operation of the breaker, whether there was extra

arcing in the breaker that you wouldn't have expected, and write a report.

TC: Would you recommend something to be done, or it was that you just wanted to know what happened?

LS: No, the detailed report might just say: "This breaker shows signs of arcing or stress. From my looking at the oscillograms, I determined this." And that was the only recommendation that I made.

TC: So it was an after-the-fact summary?

LS: Yes.

TC: And the report would go where?

LS: We sent out several copies of the report. It went to Design Engineers, Relay Test, Station Maintenance.

TC: Well, we're still in the Research Lab. How long did you stay there?

LS: I stayed there till the PAS Survey, when the Civil Service was overhauled and all new Civil Service classifications were set up. Everybody had to take an exam to hold their job, or were allowed to take one exam above it for a promotion. At that time, the job I was holding would have been classified as an Associate Engineer, and I was working as an Electrical Tester. We had Electrical Testers working at jobs which are now Senior Engineer. They got better pay but they had no classification. Draftsmen were doing many types of work. They had Draftsmen working as Senior Engineers. But nobody ever took an exam for a promotion, they just got higher pay and would go do the

work. I passed the Associate exam pretty well and I got an Associate job as a Power Plant Receiving Station Design Engineer.

TC: Okay, that PAS Survey, now that came in about 1939 or so, 1940, by this time?

LS: Yes, exams were given, I think, in probably about the beginning of 1941, because I can remember Pearl Harbor Day I was still in the Research Lab, but I left maybe a month or so after that. So those lists came out just about 1942.

TC: And this was Civil Service-wide?

LS: Yes, it was a result of the [Frank] Shaw recall. When Shaw was recalled and [Fletcher] Bowron was elected the new mayor, he started cleaning up the city.

TC: One of the reasons why Shaw was recalled, it was some sort of a . . . was it laxness or . . .

LS: It was mostly the police department, but it existed everywhere to some extent.

TC: So you had people just not paying any attention to Civil Service, in other words?

LS: That's right, and they had people with very low ratings that were holding down high-level jobs and taking money on the side. Oh, it was a very corrupt situation.

TC: Would you say that the Department was apart from that, or not as tainted?

LS: The Department was probably the least major department involved in the problem. The airport wasn't too big then, but

the Harbor Department was a big one, and I think it was pretty clean because there were people in the Harbor Department who I'd known from my life in San Pedro. They were people that I would have trusted. In DWP I just don't believe there was much of a problem. I never ran into any of it.

TC: I wonder, because it was a proprietary department, it was responsible for its own conduct?

LS: It was Scattergood.

TC: Scattergood?

LS: Yes, Scattergood. He wasn't going to let anybody monkey with his Water and Power. And after they split it up into two departments, I think it was [Harvey] Van Norman who was running the Water Department, he was the same way: nobody was going to mess around in his department.

TC: So then, by that time, by the time of this PAS Survey, it became a requirement and people had to follow that?

LS: Yes. I think the Department has been absolutely lily-pure since. I never saw any problems anywhere.

TC: So your move from Station Test to Research Lab was not a promotion as such?

LS: I got more money.

TC: You got more money?

LS: Yes.

TC: Okay, but you kept the same title?

LS: The same, Electrical Tester, which I had as a Meter Tester. In those years a Meter Tester got the bottom pay, $115, I

think it was. When I went out to the desert, I got a pay raise. That's when I went into Station Test. Then, when I went to the Research Lab, I got a raise. So in pay it wasn't too bad. It was more like the present ladder. Of course, pay wasn't as high then as it is now. It was really a good promotion when I went downtown to Station Design. What I was getting in the Research wasn't too far from that in pay, but it was a better job and by then they'd established these Civil Service ratings. I had an Associate rating, and then right after the war I got the Engineer rating.

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March 24, 1992

TC: Last time we had some discussion of Receiving Station E and your association with that, and as we were just talking prior to turning on the tape, there are a couple of other elements of that period that we want to cover. So I think the first one we could start with would be the [Southern California] Edison tie-in. I think that's the correct phrase.

LS: Along toward the last of my tenure at Station E, where I worked from the original ground breaking, about the last big feature was the bringing of the Third Boulder Line into Station E. It also involved the installation of a large synchronous condenser, because Station E was at that time going to be the only receiving station in the Valley and it was to be the control point for all of the Valley voltage regulation and also supervisory control center of the various stations. The synchronous condenser was installed before the line actually came in, and it's purpose was to mainly regulate voltage on the 34.5 kv system, and also help maintain the power factor on the Third Line at its most efficient point.

An interesting thing happened when the condenser was in service and had been operating for two or three weeks. When my partner Nick Wenzel and I went into a relay vault one day, mechanics were drilling holes in the relay panel in preparation for the Boulder Line relays to be mounted. We

stood and watched them for a few minutes, and all of a sudden all the relays on the board started to trip and we realized from the relay targets that the whole station had gone black. The high-voltage line relays had all tripped out from the vibration of the drilling. The voltage started to go down very slowly, which was kind of a puzzle for a minute. Then I think Nick [Wenzel] and I both began to realize that the condenser, which is just a giant motor on the system, had an enormous amount of energy stored in it and it was maintaining the voltage on the 34.5 kv system but it was slowing down. We could see there was going to be a lot of trouble, so we started running for the control house, which was maybe a hundred yards away. About the time we got there, the operator decided to close the high side breakers back in. This would energize the banks that fed the E system, which at that time was the whole Valley, but the condenser was still hanging on. It had tripped off only on the high side, and nothing had relayed it from the 34.5 system. It slowed down and finally came to a complete stop. When the operator closed the high side breakers it was like starting a giant motor right across the high-voltage line without any starting preparation at all. We hadn't gotten into the control room, we were just going up the steps when we heard this loud bang and the whole yard started to pulse. The machine started very slowly, and over a period of about fifteen or twenty seconds it got up to speed. But it slipped poles at first about every two seconds,

and then gradually slipped a little faster. As each pole slipped, the whole yard would shake and the control house would vibrate and all the windows would rattle. Actually, no damage was done, but it was no time at all till they had people designing a new relay system for that condenser. In fact, all the condensers on the system had that same possibility, and they were all equipped with protection then to keep that from happening.

TC: You mentioned your partner there Nick.

LS: Nick Wenzel was my partner during the whole building at Station E. He'd worn out two helpers, I was the third one, but he'd been there all along. Although I worked there off and on from the beginning, later I became a full-time Station E Test man.

We got the Third Boulder Line in and everybody was very happy, and the top brass came out to watch it be energized. I can remember somebody making the comment that, "Now we have no more problems because we've got a third line on a different right-of-way." It had been thought in the early days that the original two Boulder lines were fail-safe. They hadn't been, and in the first few months the first outage occurred. They'd had about seven or eight outages since where they dropped both of those Boulder lines, and as they were carrying the whole city there wasn't enough generation left to keep anything going. We'd had several big blackouts in the first two years of the operation of the Boulder lines, but the third line was

supposed to cure it all. I'm afraid it didn't, because while I was still at E we had two outages of all three lines, so we still had big problems.

An interesting project that came up while we were still working at Station E was that the Department took over the remnants of the Edison system in the city, which hadn't been included in the purchase in 1922. That included the area all around Venice and part of the San Fernando Valley, mostly the North Hollywood area, in the east end of the Valley, and Tujunga and Sunland. Because we were at E and very handy, Nick and I took over the test work for the cutover. It started first in the Sunland-Tujunga area.

It was an interesting procedure because the Edison system was a four-wire, 4100-volt distribution system and the Department system was a three-wire Delta 4800- or 5000-volt system. The procedure was that before the day of the cutover, linemen would get out in the field and replace all the transformers on a feeder with transformers that had taps so that they could be quickly changed from 2300 to 4800 volts. They'd also changed the regulators in the DWP station so that everything could be quickly cut over. On the day of the cutover, in the morning they'd cut the feeder loose where it left the station, and then the line crews would swarm all along the feeder changing the taps in the transformers, and cutting out the fourth wire, the ground wire of the 4100-volt system, so that they could go to a Delta system. The

construction mechanics would be in the station cutting over the regulators and some of the meter and relay wiring. It went very well up at Tujunga with no problems. The feeders were out for two or three hours, which meant the customers had no service, but they'd been warned that they'd be out of power for three or four hours on that date.

Then we moved down to North Hollywood to Station 35, which was going to finish up the rest of the Valley. We went through the same procedure, and this is the one time in all my career when I really thought I'd had it in Station 35 that day. They had taken all the insulation off the connections on top of the regulator so they could change the connections. The mechanic in the station had a clearance, and also the linemen had a clearance. The line foreman went over to McNeil Substation in Burbank, which was the Edison station, and cut the feeder clear from Edison. When they got all the transformer taps changed, he came into DS-35 and turned in his clearance.

Well, only DS-21 in the Valley had operators in those days. They were supervisor-controlled out of Van Nuys, and the operators didn't get too much experience in switching. Anyway, the poor operator that was at 35 that day was slow in getting his switching done, and meanwhile another operator came in who was senior to him and took over. I can remember hearing him say, "We can't leave these customers out any longer. Let's get this back." I was up on top of the

regulator, and all the bare connections were around my feet, and all of a sudden I felt the regulator start to vibrate. The mechanics in the station doing the work had never turned in their clearance, but the operator decided to energize it. I stood there and screamed bloody murder for ten or fifteen seconds until people began to find out what was the matter. Nick went over to the board and he tripped the whole station out. (chuckling) That was my worst experience working for DWP, but it all turned out all right.

TC: What was the frequency of that kind of accident or even fatality?

LS: There have been a few. I've worked in two stations where there were people killed due to erroneous switching.

TC: How about linemen, that kind of . . .

LS: Once in awhile linemen would get on the wrong side of the pole, or they'll even get on the wrong line where there are two on the same street. I heard a rumor not too long ago of a line crew getting a line on a street a block away from the work site. Several adjacent streets had lines going down them and they got a block off and threw a ground over. The linemen don't usually have problems because they throw a ground over the line before they do any work; then, if anything is going to blow up, it does right then. Although on the 34.5 we've had a couple of line injuries that I've worked on afterwards doing testing to determine what actually happened. But it does happen. Every power system has that problem.

TC: Yes, and I can imagine there's the usual reporting that has to go on afterwards.

LS: Oh, there's always an investigation, and usually by what used to be called the Division of Industrial Safety, which has been taken over by [Cal-] OSHA since OSHA was organized. But everybody gets into it. There's a lot of investigation and a change if needed in the procedures, but those things sneak in.

TC: Well, I think dealing with electricity in that quantity is inherently dangerous.

LS: Yes, when you're working on the high voltage you learn to watch every move you make and it just becomes second nature; although on the test crew we didn't do enough of that hot line work to really get into the rhythm of it. I've worked quite a bit on energized equipment wearing gloves, but it isn't like the linemen where they just . . . live with it all the time, but they make mistakes occasionally.

That kind of wound up the cutover of Station E System. I think about that same time, or maybe the year before, the Department purchased the electric properties of the old Los Angeles Gas and Electric Company. There was a rush to get that system tied into our system because they had two old steam plants which were very inefficient and costly to operate, which were their only source of power. This was right after the first two Boulder lines came in, and we had Boulder power and lots of it because we were getting a great deal of the secondary power from the Metropolitan Water

District that wasn't needed to run their pumps. When the cutover started, one of the first jobs I had was to go down to our Station 5 and check out two 34.5 kv cables from DS-5 about a block down the street to LAGC Station 16. We started delivering power on this tie. The gas company's standards were different, and they used color-coded wire instead of numbering systems, so we had to get in there and in just one day learn the whole procedure and how their relay and meter systems were put together. It was very interesting.

After that first tie, they started cutting the 34.5 system over all over town and picking up these gas stations and including them in our various systems and loops. A lot of them went onto the A System or the B System. Their circuit breakers were very underrated and we had to replace or rebuild all the circuit breakers. They had a very unique sort of switching system in their stations. They only had half the number of breakers we had, which involved switching lines lots of times with disconnect switches instead of breakers, which is all right if you were very careful and knew what you were doing. But the gas company stations mostly were remote-controlled, so they didn't have operators that were in there all the time and real familiar with the station. I worked on several of those cutover jobs and most of them went pretty well. But there was one crew that did the major part of the test work on those, and there were, I think in one year, seven big blow-ups where there were switching errors, and they blew

up a 34.5 bus. It was a real hazardous project, you might say, in getting the two systems tied together.

On the low voltage, the gas company was the same as Edison had been, a four-wire "Y" system, 4100 volts. That had to all be cut over a feeder at a time. Usually they'd split the substation in two and they'd make one transformer bank 4800 and leave the other transformer 4100, and then the feeders, one at a time, were transferred just like we had done at North Hollywood and Tujunga. All the transformers were made dual voltage transformers and then on one day they'd cut a feeder over.

TC: Well, who devised that dual system to begin with? Would that have been somewhere in [Power] Design and Construction or Station Design?

LS: The dual system was not designed by the local utilities. It had just grown up from the first utilities about the turn of the century. At first, each power system was a single generator in a station and a few feeders leading out to the load areas. They picked some low voltage for safety and economical insulation costs. The limit to the length of a feeder was about one mile per hundred volts of EMF. Twenty-three hundred volts [2300 v] seemed like a good compromise value. The systems were three-phase and so the transformers were connected in delta for a three-phase load. As the load increased and got to be too large for a 2300 volt service, the

transformers were reconnected in star and gave 4160 volts, which could provide service to more load over the same system.

Some utilities had purchased transformers with 2300 volt windings that were operated in parallel. To increase the voltage the windings were connected in series, thus giving a 4600 volt system which could still be operated as a delta system. Some of the power systems wanted a delta system because the system could continue to operate if a ground occurred on one conductor. The star system required a neutral wire from the center point of the star and thus was more expensive. Four wires per feeder versus three wires for a delta system, and in case of a ground on one of the other wires the feeder would trip out.

Just after the war started, they finally finished the PAS Survey where all the jobs were given new Civil Service classifications. At that time, I went into the Power Plant and Station Design Section of the PD&C [Power Design and Construction]. They were just getting going on Harbor 1 and 2 Units, which they were really rushing because of all the outages on the Boulder line, and they needed a lot of steam power here for backup. Those first two Harbor units were specially constructed for quick start-up and for emergency use. I think the idea at that time was that they were going to be emergency backup to the Boulder lines, because they didn't really need the generating capacity. When they took over the gas company, they had the two old gas company steam

plants, which also gave additional capacity if needed. And only once did they really need all that capacity, and that was in the 1938 flood when the Boulder lines and the Aqueduct lines were washed out and everything was down and all we had was the old gas company plants and the frequency changer at Station C. After a few days, they got the Aqueduct plants back in service. I think it took about that time, or longer, to get the Boulder lines back. There were maybe two or three towers down on the Boulder lines and four or five towers down on the Aqueduct lines.

TC: Not to divert your train of thought, but you mentioned the flood last week. I guess the result of the 1938 flood was the [Los Angeles] River management system that we have now.

LS: Yes, there wasn't really any system before the 1938 flood. (chuckling)

TC: There wasn't any? Was it a situation like the one we've been facing for the last couple of months where it just rained all the time?

LS: Yes, it was like the one two months ago when the Sepulveda Basin flooded. It was considered, I guess, a 100-year flood. The few small dams in the upper canyon couldn't handle it. The Sepulveda Dam and Hanson Dam were built immediately after that and a lot of the channels were lined. There was just terrible damage everyplace. You couldn't find a place in southern California, including the desert areas, that wasn't badly damaged. Right here in my neighborhood--I didn't live

here then, I came two years later--but there were fifty houses washed out just about four blocks from here that went down the river. The river was out of its banks, it spread over blocks and blocks of the North Hollywood-Studio City area, and carved a new channel where it went by Universal Studios. Later on, when the Flood Control lined the channels, they used the new channel and took dirt out of there to fill in the old channel and saved about a half a mile of river channel. But it was just a terrible flood everyplace, and highways and roads were closed for weeks. But the two dams were built here, and lots of other projects. Besides the Army Engineer projects, which those were, the L. A. County Flood Control District has done a great deal of work on small retarding basins and small dams. We haven't had really a water problem but we haven't had a real flood either.

When I first built this house, the Tujunga Wash had three channels. It split up about where Valley Steam Plant is and came down in three separate routes. One of them was right where the Hollywood Freeway is now, one was about a mile west, and the third one came about through the area where Disney Studio is, and then they all ran into the L. A. River. After the dams were built, the Hanson Dam then intercepted the Tujunga Wash, and the channel that's west of here was made into the permanent channel to spill water. The other two channels were abandoned and they're all grown over now with industry and the Hollywood Freeway.

The Sepulveda Basin blocked off a lot of bad channels, including the Los Angeles River. This flood we had two weeks or three weeks ago, whenever it was, it didn't even fill that thing a third full, so there's enormous amount of capacity available. It does require, however, that they run the Los Angeles River Channel at maximum flow, or they could have filled up, I think, in this last flood. So it discourages me to see them put all this construction, like the Tillman Sewage Plant [Filtration Plant] and all these recreational areas down in the bottom of that basin. Because in any flood like this one, which is about fifty years from the last one, that thing is going to have twenty-five feet of water in it.

TC: Well, that was an aside, but topical, I think. Now, the L. A. G&E [Gas and Electric] plants, the two plants, one was the Alameda Plant, right?

LS: One was the Alameda Plant, which was the old original plant, I guess built by Lowe, the fellow that built Mount Lowe Railway System. He had built a big gas plant up in Pasadena and then he started Los Angeles Gas and Electric as a gas system. It wasn't Los Angeles Gas and Electric, it was a gas manufacturing plant. Then he built a little electric system, mainly for street lighting and to serve the downtown elevators and that sort of thing. But it gradually expanded to where they had about 30,000 kw in the Alameda Plant and about 70,000 kw in the Seal Beach Plant.

The Seal Beach Plant had been built about 1924 and was badly damaged in the earthquake of 1933. In fact, all the gas company properties were badly damaged. They were not structurally sound. They were built of brick without much reinforcing, and every substation when we took them over was in real bad physical shape structurally. The Department had to do a great deal of work in going in and reinforcing those stations, besides all the electrical work we did to boost up the ratings on the breakers.

TC: What was the LAG&E's service area? Was it all over?

LS: Well, they served some county. Of course, they weren't prohibited like the Department was from going outside the city limits. So, when we picked them up, mainly it consisted of Hollywood, the area down around La Brea and Jefferson--they had a lot of load in there--and then all the downtown area. They had a lot of big stations downtown. I think there was a feeling on the part of business and industry to look to the gas company as being a private utility rather than the Department. So their biggest stations were all the big downtown stations, and they had a lot of direct current [DC] distribution. Three or maybe four of those stations had several big motor generator sets in them where they generated DC. Of course, the Department had two DC systems downtown, too.

TC: Oh, they did?

LS: Yes, they'd inherited these from the Edison Company in 1922. We had a 500-volt DC system and a 250-volt DC system. The 250 was a favorite of everybody for elevators. It was wonderful for operating elevators in the larger buildings. The gas company also had a very extensive 250-volt system. Those were tied together immediately and we got a lot of the old DC machinery out of service, which was duplication. We didn't need all the generators for the combined system. At the same time, the Department started getting rid of the 500-volt system. One big feeder ran out on San Fernando Road almost to the Glendale city limits and served two or three big flour mills at 500 volts DC. They had another feeder that ran the other way and ran down to and served everything in Exposition Park at one time. That was all DC back in the early days. They got rid of all the feeder that went north, but the one south they tied onto the streetcar line, which ran down Exposition Boulevard. It was just to run some elevators in a couple of those buildings--that's all that was left on it--so they fed it off the streetcar trolley till they finally junked it after the war.

But the Gas Company system was adjacent to the Department system. In some areas, every other street would be DWP and every other street Gas Company. There were some streets where Gas went on a pole line down one side of the street and DWP the other side of the street. It was a mess. Of course, as soon as they got the two systems on the same voltage, they

began eliminating all that duplication. For three or four years, there was an awful lot of work going on.

TC: Now, did Edison compete at all with LAG&E during that time?

LS: They did in the early days, yes. In fact, there was another one, Pacific Light and Power, which Edison took over, that had been built by the Huntington Street Railway interest from power plants along the Kern River. That was one, and then it combined with Edison, and then the gas company stayed pretty independent because of the difference in frequency and we took over the original Edison property inside what was then the city in 1922. Then in 1928, I guess it was, we took over the gas company. They went out of business. They sold their gas interest to Southern California Gas [Company] at the same time.

TC: So they were parceling themselves off?

LS: That's right.

TC: In fairly lucrative amounts for themselves, I think.

LS: I don't know.

TC: The negotiations went on for quite awhile.

LS: Oh, yes.

TC: Now, did Edison pick up what LAG&E had in the county?

LS: Yes. For a time we served them through tie points. I worked on a couple of these jobs where we'd have feeders that would start in the city and then go to county. All but one of the old gas company stations were inside the city. There was one in West Los Angeles which served mostly the Hollywood area,

but we had a lot of feeders that went out into the county areas. They'd be in the city for awhile and then they'd go through a piece of county and then back into the city. What we did at first was to install a meter at the pole where they crossed the line. We'd measure the power into this little piece of feeder and then back out again. I worked on two or three of those meter jobs, especially down around Station B where we had a couple of feeders out of gas company stations that ran over into Huntington Park and the Florence area. So we put meters in those. It was not long before Edison took those over. It was easy for them because they had the 4100-volt system, and so maybe after a month we would discontinue the tie points.

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TC: Anyway, we were talking about Harbor [Steam] Plants, Units 1 and 2.

LS: Yes, Harbor 1 and 2 were being rushed because they wanted backup for the Boulder lines. Then, when the war came along, the government decided to build a big aluminum plant down in Torrance and they needed all the power they could get, they insisted that it be 60 cycles, which meant it had to come off the Department system then because Edison was still on 50-cycles until after the war. There was one Edison unit that could run on either frequency, and we had the frequency changer at Station C, and then we built Harbor Unit 1. I guess 1 was running before I went into the service and 2 was pretty well along, but my first jobs were to work on the frequency changer, which was just getting the bugs worked out of it. Then I did design work on the electrical wiring and control systems and relay systems for 1 and 2 at the Harbor.

TC: The frequency changer was a fairly large apparatus, I know.

LS: It was a large piece of machinery, maybe fifteen to twenty feet in diameter. It consisted of a giant motor on one end of a huge shaft and a generator on the other end. The motor was started up--it could be started on either end--start it on low voltage, and then when it got up to speed, switch it to the high voltage, just like we did the condensers in Stations B

and E, which were very similar. Whatever end it was started on then would be locked in, and then they would synchronize the other end to the other system, either the 50-cycle system or the 60-cycle. It was interesting that after Edison went to 60 cycles there was no need for the frequency changer, and we broke it apart and moved the 50-cycle end out to Receiving Station D and installed it as a condenser. Because a condenser is just a large motor. That was all I did in Station Design until I left to go into the service.

TC: Well, let's talk about that, going into the service. What year was that, first of all, that you went in?

LS: I went in actually about January of 1943, and I was in the navy and expecting to go within a week when I had a fall and broke an arm. It was a pretty bad break, so they wouldn't take me in for several months. They just kept giving me examinations. Well, I was in the hospital for awhile, but when I got out and around I went back to work in Station Design, still working on Harbor 2 till August. In August 1943 I actually got my orders to New York and went in the service.

TC: So you were within the Department during those early war years, at a time when a lot of men were going off, enlisting, or leaving.

LS: Yes, that's right.

TC: Was there a significant drop in manpower and change of working and scheduling?

LS: Yes, almost everything stopped in the Department because of the priorities required to obtain material, and everything went to war production. Any work that was done required that you arrange a priority from the government to get your material and there was a lot of red tape. So, really, the work dropped off, and to the point where they were encouraging engineers to go away. Quite a few that I knew did. They got a leave of absence from the Department and then they got picked up under some kind of a war manpower act where they were guaranteed their jobs back when the war ended and they came back. They went to work at places like Lockheed [Aircraft] and quite a few went to the aluminum plant. It was a big booming thing and there were several of our Station Test men that went down there.

TC: Was that Alcoa?

LS: I can't tell you who was in charge of it, but we built two transmission lines from Station C over there to supply power to it. They had the old Alameda Steam Plant going and the Seal Beach Steam Plant and the frequency changer and Unit 1, and later on Unit 2. They were just kept on the line all the time, in addition to everything they could get from Boulder, in order to keep the aluminum plant going. Then a little later, the government built a big magnesium plant out at Henderson, [Nevada], and they picked up most of the surplus Boulder power for that, so that we really needed all the power we could get.

So, at the time I left, actually the engineering force had kind of dwindled. The jobs that were still going, for which they had priorities, were the steam plant and, I guess, Station D and to rebuild Station C. Station C had just been a little switching station, actually, where some 50-cycle lines from Edison came over and interchanged with the Department--I think they had three lines. When all of this big load started going through Station C, then they built the 138-kv lines up to the aluminum plant and RSC was built into a big station, and I worked on that some, too.

TC: Was there in your age group a sort of peer pressure to enlist or to join up? I know some men did, some didn't.

LS: Well, I don't think so. I don't know why different people did. I know in the younger fellows there was a lot of pressure from the draft. All the group that I was with that came from USC in my graduating class went. I was in the army reserve but resigned and went to the navy because they promised me a promotion and a chance to get into radar training. We were thirty at that time. All of us had kids, too. But no, I don't feel that there was ever any pressure from anybody.

TC: Those who stayed, did they get deferments as being somehow necessary for war production?

LS: Well, about all that stayed at the Department were older fellows that were maybe in their forties. There were quite a few fellows that were my age that took these war manpower

leaves to go work someplace else. Some of them may have had draft pressure and some may not, I don't know.

TC: There was--as there was everywhere--quite a bit of Civil Defense activity here, and I read somewhere that the Department had a concerted kind of Civil Defense effort.

LS: (chuckling) Yes. I was still in the Test Lab when Pearl Harbor came. One of the first things they wanted to do within the first month was to be able to turn out all the streetlights. That project was assigned to the Research Lab of the Test Lab--I was in the Research Lab then--and we developed a system of being able to turn out the streetlights by a switch up about fifteen feet up on the poles where the time switches were mounted. We made these switches out of the headlight beam switches they used to have for automobiles. You'd have a switch by the throttle that you could press and raise the headlight beams. I remember going down to Western Auto, which was the predecessor of Pep Boys, sort of, and coming back with about 1,000 of those one day, and we worked each one into a little box. We built the boxes in the Test Lab and then we did all the wiring for this. They'd mount up on the pole where the streetlight time clock was. Each streetlight circuit in those days was run by a time clock that fed off of the 5-kv circuit. Then it would have a string of maybe forty or fifty streetlights, and then there'd be another time clock. We wired these things up and took them out and the linemen were instructed how to install them. Then, near

each of these switches we found a Department employee and gave him a fifteen-foot fishing pole, and when the blackout alarm sounded he would run out and punch this button that was in this box and turn the streetlights off. I guess it happened several times. I do remember the first time this happened. There were quite a few that somehow had been missed and the lights kept on going, but we got those corrected finally. That was one. And then, of course, they had classes in first aid and lots of the people became air raid wardens and so on.

TC: Was there a real fear that Japan would attack the mainland, particularly L. A.?

LS: Well, I think there was after that shelling up in Santa Barbara when the submarine came up alongside the oil field and shot at a couple of oil wells. It didn't amount to anything and they couldn't have done very much damage. That really stirred people up and there was a lot of excitement after that. Then, at two different times we had big blackouts, when I guess they finally decided there were planes being moved from one field to another and all the Civil Defense people hadn't been notified.

I remember one night there was a blackout and I went out in the backyard and I was talking to the next-door neighbor. Pretty soon a great big flight of planes went over--pitch-dark and they had no lights on, but we could hear them coming from the north and going south. I had no idea where they were going, and pretty soon the blackout was lifted. Now, whether

they wanted to black things out so people couldn't see the planes or follow them, I don't know.

Then we had another blackout that gets written up in the paper repeatedly over and over, or the whole story comes back sometimes on the anniversary when they thought there was an airplane and all the anti-aircraft guns started shooting away and shrapnel fell around and did a little bit of damage. But those two episodes are the only ones I know of, but they got people real excited.

TC: There was also another thing that the Department had a connection to somewhat indirectly, and that was the relocation of Japanese-Americans. I know that this is not exactly germane to this particular story, but as somebody who lived in that time, and you have good recollections . . .

LS: Well, I remember the streetcars picking them up. Most of them here in Los Angeles from the Little Tokyo area they loaded on the PE, the big red cars, and took them out to the Santa Anita racetrack. It was made into a transit camp and they stayed there maybe two or three weeks and then they took them out to the camps that had been constructed. That camp up in Owens Valley on DWP land was one of them.

TC: Manzanar.

LS: Manzanar, yes. But I didn't know very much about that.

TC: Well, the Department wouldn't have had, I suppose, very many Japanese-American employees?

LS: They had a few.

TC: They had a few?

LS: They had some that I knew that were just fine people; one fellow I worked very closely with in the Test Lab for several years. I don't know where he was sent, I think it was up in Dakota or someplace. Then we had the fellow that later became General Manager, Tamaki.

TC: Sure, Carl Tamaki. That's right.

LS: Yes, he was sent to a camp.

TC: Was he working in the Department at that time?

LS: No, and he hadn't graduated. He was still going to school, I think he was going to Berkeley. But his family was moved back to Missouri or somewhere and he was sent with them. Finally, he got some kind of arrangement to go to college, and I think he graduated from the University of Missouri. Then he joined the army in that Japanese unit [442nd].

TC: That's right, the Japanese-American battalion.

LS: Yes, and he hadn't been in that very long until he was transferred into counterintelligence, because he spoke Japanese fluently, and Spanish. Spanish was his native tongue. He was born down in El Centro, and then when he went to school he started to learn English, but at home he'd been taught Japanese. His parents didn't speak any English at all. Carl and I became very close friends. In fact, when I left my job as Generation Engineer later . . . No, while I was Generation Engineer, the job of Steam Generation Engineer became vacant. There were two engineers under me, one steam

and one hydro, and Tamaki asked for that job and I took him on gladly as Steam Generation Engineer. Then, when I left the overall Generation Engineering job, he followed me into that. Then, when I left the Assistant Division Head job and became Division Head, he became my Assistant Division Head. We were very close friends.

TC: Now, he's still around?

LS: No, he died about two years ago.

TC: Oh, I didn't realize that. I was thinking that he should definitely be an interviewee for this program. That's too bad. Well, when you joined the Navy, you were shipped out?

LS: Well, I went back to New York to an old abandoned fort that had been maintained by the New York Park Department as a historical monument. They had the old gun emplacements there and it was a nice big park called Fort Schuyler. There were two of these forts, one where Long Island Sound runs into the East River. They were built on the opposite sides of Long Island Sound and they could each one fire about halfway across. That was during the War of 1812, and it was to keep the British from coming into New York up Long Island Sound. So the one on the . . . well, I'm not sure whether it would be north and south or east and west--I guess it's the north side--was Fort Schuyler. The Navy took that over and they built barracks there and they made it into a boot camp for engineers. Then the one on the other side the Maritime Commission took over and made that into a school for maritime

engineers to go on the Merchant Marine ships. There was a lot of rivalry and fellows would go back and forth to visit.

The physical training consisted of going out and learning navigation by rowing a whale boat up and down Long Island Sound for about four hours about three times a week. (chuckling) They'd come out and we'd have whale boat races with the Merchant Marine fellows. They had a big old Merchant Marine ship that they used to go out on for training cruises. They couldn't dock it over on their side, so they'd dock it on our side and then they'd take small boats to go back across. Every once in awhile, we'd wake up in the morning and here was this beat-up old ship tied up to our dock. I spent two months there in what would be boot camp, a very specialized boot camp for future engineers in the Navy.

TC: Well, was it the same sort of regimen that you get in boot camp of physical fitness and making a man out of you?

LS: The same miserable life! (chuckling) We had a lot of class work. We took navigation. For the whole two months, we were taking a long, drawn-out navigation course, and a gunnery course. I'd been in the Army Artillery Reserve, so I knew about gunnery. So I could take my gunnery studying time and put it into navigation, which I enjoyed. At the end of two months, we just split up and everybody went different directions and I never saw most of those fellows again.

TC: Just quickly, you were in the Army Reserves?

LS: I had been in the Army Reserve from . . . I guess about 1937 I went in. I had two or three friends that were in and they seemed to like it, and especially the artillery. To an engineer the artillery was kind of appealing, so I went in and I was assigned to the Third Coast Artillery, which was at the harbor manning those big harbor guns down there. I made one trip on a two-week duty tour up to Santa Barbara when they took one of the railway guns and we fired it at a target on a raft going up and down the channel. Then I had another tour with anti-aircraft, the old three-inch anti-aircraft guns, and so I'd really had quite a bit of experience with artillery. So I liked the artillery in the Navy. It was real easy, I never had to crack a book or listen to a lecture, I already knew all this stuff about guns. But we had to drill a lot. They had two or three what they called dummy drill guns, where you could pass the ammunition and you could load the ammunition. It just went into a big metal frame made out of angle iron, and you jammed it in and rammed it just like you were loading a regular gun, and then it slid back out. So you could spend a half an hour on one of these dummy loaders just practicing loading a five-inch gun. But it was mostly just PT and getting shots, shots for everything in the world. Once a week we'd have shot day and all go line up and we'd get a different kind of a shot. Gee, we had yellow fever and weird things that you'd get in the tropics--I don't know what all they were.

TC: Probably typhoid.

LS: Oh, yes, typhoid, paratyphoid, smallpox, tetanus, and on and on and on.

TC: Well, wouldn't the obvious choice have been to go into the army, having been in the reserves then?

LS: Oh, well, I wanted to. Just about three months before the war started I had heard about radar and I was real interested in that. I got to talking to some fellows that had seen some and had a little experience with it, so I wrote to the army and asked to be transferred to the Signal Corps and get in their radar school. I was a second lieutenant in the army. And about a week and a half later I got orders to report up to Oakland to a radar school as a sergeant. The pay would have been much less . . . I couldn't have afforded it with my family. I couldn't have made my house payments on what the pay was, so I got real ticked-off about that. The more I thought it over the madder I got, so I sat down and wrote a letter back and resigned from the army.

Then, two or three months later, along comes Pearl Harbor. So I decided, well, I ought to do something. So that is when I started trying to get into the Navy. And for a few months they wouldn't take me because of my eyes. Then I had to go register for the draft when I couldn't get into the Navy. So I registered for the draft, but at my age and with a family, why, I doubt if I'd ever have been drafted. Anyhow, pretty soon the Navy sent me a letter that said they were

lowering their vision standards and I could come down and sign up any minute I wanted. So I went down and signed up and a week later broke my arm. (chuckling)

TC: Okay, so we jumped back there for a little detail, but, okay, leaving boot camp, now where did you go?

LS: Well, I was sent up to Bowdoin College in Maine, just as the snows were starting, and I'd never been out of southern California before. They had what was called a radio school, but it was a classified radio school, and actually they were teaching the basics of radar. But it was only classified as confidential, which is the lowest level of classification. I went to school there for three months and then they announced that I was going to be held over as an instructor. So I stayed there for another month and I finally went to the commander and I really howled, because I already had orders. They just said, "When released by the commander you will report to MIT for further training," and I wanted to go to MIT. (chuckling) So he finally said, "Okay, you can go."

So, after four months up there, one month as an instructor, I went down to Boston to MIT and had a four-month course, which was a tough one. It was taught entirely by civilian, regular MIT professors, and it was in effect their master's course in electronics. They really poured it on. We went ten or twelve hours a day. They had rented a huge, big old warehouse down on the waterfront. They had antennas up on the roof, about twenty or thirty radar antennas up there, and

then three or four floors of laboratory below that, and then classrooms below that, and then the prize was a big gymnasium below that. (chuckling) Never going to let up on that stuff. So every day was late, especially days when we would have lab work and we'd be there till 10:30 or 11:00 at night.

After the four months there, most of the fellows went out to the fleet. Every ship, even destroyers, had a radar-trained officer on it by that time. About a dozen of us got orders to go down to New York to the Western Electric Bell Telephone Labs, to get a special course in a new type of radar equipment that was coming out that tied directly into the fire control computers on the big ships. Western Electric had designed this and built it, and they had a crash course trying to get people that they could send out either to the repair ships or the Navy yards. Not very many went to the fleet for awhile. Later on, they did go actually out into the fleet, where they were trying to get people in places where they could train others for this fire-control radar. Up to that time, the information from the older radar had to be read out of the range finders and the direction finders and actually set into the computers by hand. The computers were all mechanical with cams and gears in them, but this newer equipment was all electronic and the information from the radar went directly into the computer, which was part of the same box, and made a nice setup. They could just turn it

loose and it would pick up a plane or ship and send the output to point the guns.

TC: Now, this is pre-transistor.

LS: You could open the doors and in one of these sets you'd see dozens of vacuum tubes. Some of them were big giant tubes. So I went for six weeks to that class.

TC: Well, going back to Boston for a minute, did you live in some sort of Navy housing?

LS: No, at Boston I lived in several places. I lived in a couple of rooming houses and then I guess about half the time I lived in a dormitory over at MIT, which is on the other side of the river. The school I was going to was out on the waterfront by South Station, but they had people from several schools in that dormitory. They had a group of Chinese that couldn't speak English that were a riot. You see, we were real friendly with the Chinese then.

TC: Nationalists, yes.

LS: I don't know what they were studying, I never did find out, but they were all screaming at each other. There must have been two or three different tongs because they'd get into fights. One night they got in a big brawl and they got the fire hoses out and they were hosing each other down with the fire hoses and yelling and screaming. Finally, we called the police. (laughter) The campus cops came over and got them under control. That was an interesting place. It was just the regular dormitories at MIT. They didn't have any students

left. They had a lot of research projects going on there, and a branch of the Navy Electronics Laboratory which was doing some sort of work--I never knew what it was.

My wife came back the last week I was at MIT. We stayed in a hotel in Boston for a week and then we went down to New York and got an apartment. The day we got to New York, we went down to the railroad station and signed her up for space to come home. It took over a month to be able to get a seat on a train if you were a civilian and didn't have military priorities. So she stayed there a month with me. There were three of us that had come from Water and Power and gone through this same thing, so the three of us wound up in the Bell Labs at the same time, and two of us had our wives. During the day they'd go around together, so it was kind of enjoyable, although it was hectic living. But we had a little one-room place with a hot plate in it so we'd get some of our own meals.

But as soon as she left, I moved in with one of the fellows I had known up at MIT. He was living in this beautiful, big apartment. I don't know what the New Yorkers call it. It was like a giant apartment with about eight bedrooms, and way up in a skyscraper. This lady had taken this place and she was renting out these rooms to military people, two to a room, and then she had two rooms of her own. That was pretty nice. We had to get all of our meals out and

that was a lousy business; that's while I was there at Bell Labs the last two weeks.

I got my orders the last day I was there, didn't know where I was going, and I got orders that said I was going back to Boston. (chuckling) Boy, the guys were sure ribbing me, going back to Boston after all that time we'd been up there. But I had fourteen days' leave. I had ten days' leave and four days travel time to Boston. So that afternoon I went down and showed my furlough pass and bought a furlough ticket for half price and got on a train and sat up in the coach, and I went all the way to California. It took four days coming, four days going, and left me six days at home. I went back to Boston and I lived in a rooming house I had lived in for awhile the year before.

TC: What was the duty in Boston?

LS: Well, I was in charge of installing radar on ships. About the time I got there, they had just completed the D-Day landings, I was assigned to the RMO, Radio Material Officer group, and he had about six officers under him on permanent assignment, and one was in charge of ECM, that's the coding machines, and one was in charge of radio communications. I don't know what else they did, and then there were two of us that were ordnance officers in charge of the gunnery and fire control equipment. The ships were pouring in for dry-docking and new radars and other work as needed, some battle damage work.

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LS: The various officers that were in there included two WAVEs who had gone through MIT in the same class that I had, and one from a previous class. They ran a laboratory where the highly confidential equipment was brought off of ships for service when they came in. If a ship came in for a major overhaul or repairs, and it was going to be in for, we'll say a month, they took all the crew off, and they were lodged in big barracks there, which was just like home to them, and then the ship was turned over to the yard people. Well, the equipment that was highly confidential was taken off the ship, and especially the IFF equipment, which enabled you to tell whether a radar target was a friend or a foe. That was the terminology: Identification of a Friend or Foe. When you picked up an airplane or another ship on your radar, the way the signals appeared on your scope, you'd know who it belonged to, and they just didn't let that equipment ever be seen by a civilian. Even most of the Navy personnel didn't even know it existed, except the officers who had qualified for that level of confidentiality. They'd take those things off and cart them under guard up to this laboratory and these WAVEs would overhaul them. Then they had another place where they took the ECM machine, which was the coding machine. That was in our electronics RMO group, too, but I never saw any of that.

We were doing an awful lot of radar replacement. They had a lot of old ships that hadn't had the newer fire-controlled radar and were putting that on them. Then lots of them had radars that needed to be modified and improved. I did an awful lot of anti-aircraft radar work that was tied in with the fire-controlled systems. I'd go down and I'd get a couple of their better electricians mates assigned from the ship to help me and we'd take the radar all apart and rebuild it and put a lot of modifications in it and bring it up to the new standards. That was the sort of thing I was doing in the yard.

We had some experimental work that would come down from MIT, where they had a branch of the Navy electronics lab, and they'd bring down experimental antennas or the modifications which we'd install in the sets, and ships would go out and try them out. So that was also part of my work there. (chuckling)

One interesting thing was all these ships have devices on the hull of the ship to measure things in the water, fathometers and depth indicators and submarine listening devices and so on. When a ship came in and had the hull worked on they were always given a plastic coating on the bottom of the hull. They never could keep the yard fellows from coating right over all these detectors. They tried all kinds of things to stop that, and finally the commander of all the RMD electronics business in the whole yard over at the

Boston Navy Yard, which was on the other side of the harbor, issued an order. He said a confidential officer is to inspect each one of these individually before the ship leaves the dry dock.

Well, about that time, I was put in command of the night shift for the whole yard. There were three of us, one for machinery and one for hulls and one for all the electronics. I worked for about five or six months as the night commander and would go to work about six o'clock. Well, a ship in the dock would finish up all its coating, and they always wanted to undock it at daylight the next morning. So it wasn't turned over as completed until about sunset, and so every ship that went out of the dock, I'd go down and crawl underneath the hull. They'd be about, depending on the size of the ship, maybe about four or five feet off the bottom, propped up on blocks, and it was a filthy, dirty place down there. The docks would accumulate everything in the world, you know. I crawled down there and had to take the drawings and locate every one of these sound devices and check off that it was all safe and not coated over. That was a mean job. Finally I got off that night shift and somebody else got to do that.

We usually had a bunch of ensigns that were assigned to ships who would come in and stay at the receiving station across the street, and they'd be sent to the yard just to hang around and see if they could learn something and look busy until they could get to their ship. If they were on a fleet

ship and it came in from convoy duty, then they could go aboard. So each of us had two or three ensigns, and especially on night shift at one time I had, I think, about five of them. I didn't know what to do with them. We had a bunkhouse, and on the night shift it was allowed, as part of the job, that we could go up and snatch a little sleep in this bunkhouse. The telephone operator knew where we were all the time.

I sent one of these ensigns down to look at the electronics on a destroyer escort that was going out the next day. I said, "You have the communications officer, turn everything on and ask him if he's happy with the way it's working." So pretty soon the ensign called me up and he said, "Well, this fellow is not happy. He found out that I wasn't regularly assigned here and he wants some regularly assigned person." Going down on those ships, and especially crawling under them at night, I'd wear an old uniform without any insignia on it, just old dirty khakis, you know. So I went down to the dock and I went to see this communication officer. He looked at me and he said, "I didn't want a chief coming down here." I looked like a chief with a billed hat, you know, but no bars or anything. He said, "You get out of here. I want an officer to come down." So I went back and then I found a JG and sent him down there to talk to the guy. I was a lieutenant. (chuckling)

TC: But yet, you were a lieutenant?

LS: I was a lieutenant, yes. I wasn't about to tell him that I came down there undressed. I got off that night shift and things got more peaceful it wasn't half bad.

But as soon as we cleaned up all those D-Day ships, the whole effort moved to the West Coast. So I asked for a transfer to the West Coast and I got it, assigned to San Francisco. I came home, spent a few days, and then I took my car and drove up and kept the car up there then. I got there on the Fourth of July and the wife went up with me. We had a little apartment that belonged to a girlfriend of hers that she'd gone to school with and whose husband was on the *Indianapolis*, and it was supposed to have gone out a week before. She'd left the apartment, but she still had a month's rent paid up, so she asked us if we wanted it. So we went up and took it over, it was real nice. There again the train was a problem. The day I got there we went down and tried to get Alice a reservation on the train, and it was four weeks before she could get on the train to come home.

But I was assigned to the south branch of the Navy yard there, the main Navy yard was Mare Island and this one down south was called Hunter's Point. It had a couple of big docks and then a bunch of submarine docks, and they didn't keep anything in very long. They took in battle damage and mostly that sort of thing or ships that had had real trouble of some kind and they were all filled up at Hawaii. When they didn't have available docks out there, they'd bring them to the

coast. They'd come into Mare Island and Puget Sound and so on, so we had quite a few. We were always full. I got acquainted with a couple of docking officers and learned some of their big problems.

I should have mentioned it, previously in Boston they had the largest dry dock in the world and it was owned by the state, the Commonwealth of Massachusetts, and the Navy had taken it over. They didn't want to dock any big ships in Europe because they'd be too close to the bombing, so the *Queen Mary* and the *Queen Elizabeth* and the *Ile de France* and the *America* and all sorts of big battleships came to Boston to this big dock, so I got to work on all those big ships. The *Queen Mary* and the *Queen Elizabeth* were in about every two months for yard work. So then I got out here and they had another big dock like that.

TC: For those big ships, they had been passenger cruise ships.

LS: Yes, they had.

TC: But during the war didn't they become troop ships?

LS: They became troop ships and they were taken over by the Army Maritime Group or something, I don't know what the name was exactly, but basically I think the army was running them. But they had to use Navy facilities all the time, of course. They'd had one experience in Boston that made me very interested in this docking; I got well acquainted with some of the docking officers. This giant dock had no big ships

scheduled for about a week, and they put two big destroyers, 2,500-ton class in it, and a giant oil barge in behind them.

The docking officer, he's never more than a lieutenant--I could hardly believe this--but he goes down in there with the surveyor's equipment, he surveys the dock, and then from the ship's plans he finds out the points where pressure can be exerted on the hull and he mounts a pedestal, like railroad ties criss-crossed, under each of these pressure points. There may be, oh, 100 to 200 of them under a big ship, and they're scattered all over the bottom of the dock and exactly in a certain position. Then they float the ship in, and he's up there with his transit, waving his arms and screaming, and he has it moved from side to side. They have ropes going to winches and it's all maneuvered in till he decides it's exactly over these pressure points, and then they let the water out and it comes down on them.

Well, just before I left Boston they'd had the two big destroyers in this dock and this giant barge, and they let it down and the barge wasn't in the right place and it came down and the pylons or piers just crushed the hull in and broke it up. And it trapped these destroyers in there. They got every welder on the Atlantic coast, I guess, and they came in there with about 1,000 welders. They cut it up into little pieces and hauled all the pieces out. (chuckling) I was just fascinated with that. I stood out there quite a bit on the

dock watching all this going on, because my office was just about fifty feet from the dock.

Well, things proved a little calmer in San Francisco. The ships that came in, a couple carriers and a lot of submarines, but they came in for big projects and it wasn't rush, rush, rush. By the first of July, they were beginning to assemble the fleet for the invasion of Japan, so the pressure began to build, and they wanted them out--and they wanted them out fast. They had two docking problems that were just outrageous. One of them was a carrier where the crew shifted all the fuel in the carrier from one side to another when the ship was down in the dock. When they started to bring it up, the carrier tipped and wedged in the dock, and they thought they were going to cut up one carrier there for awhile, but they finally shifted the load, twisted it and finally got it loose. They sank a huge, big oceangoing tug right there at the dock. These things made interesting things to watch. Then the atom bomb day came along and everything just stopped. Boy, the yard just went dead. No hurry, no pressure, we sat around and talked a lot and got out a few ships that were still around. It was a different life after that while you waited for points to get out of the service.

TC: Was there any sort of indication that something big was happening before the bombs were dropped?

LS: (chuckling) Well, the only thing, and I didn't know it till afterwards, was the *Indianapolis*, which is a big, heavy

cruiser, and was in to have its guns repaired. The gunnery officer of the yard told me at dinner one night, "They're crazy. I've been out on that ship six times firing those guns." He said, "There's nothing wrong with those guns, but they come back and they want to work on them some more." Well, the *Indianapolis* was going to carry the atom bomb to Tinian, wherever it was. Finally, it got out, and this friend of my wife's, whose husband was on the *Indianapolis*, showed up one day, and her husband had called her and said, "We're just lying here in the stream, going in and out every day and coming home at night. You might as well come back up." She said, "Well, I loaned the apartment out." He said, "Well, you come up here." So she showed up, and then Alice and I moved out of the apartment and went to a hotel. But it got sunk the day after it delivered the atom bomb. Gee!

TC: Where did it get sunk?

LS: Well, it left Tinian and it was heading for the Philippines to join the fleet there, which was going to be the invasion fleet, and a Jap sub got it. They were running silent and nobody knew it. It was just going to leave Tinian and show up about six days later in the Philippines, and pretty soon it was overdue. They finally got a lot of ships out looking for it and they found wreckage and a few men still on life rafts. But I think over 1,000 had gone into the water and the sharks got them.

TC: Oh, horrible, horrible.

LS: Every once in awhile you read an article about it. It still is a big argument as to what happened and why. But this fellow that we knew, he was lost there.

TC: He was on board?

LS: Yes. There wasn't much doing after that until one day I was having lunch with one of the hull officers and he said, "How'd you like to go out in a submarine?" I said, "Well, all right." He said, "We're going to test a submarine. Just finished yesterday, and this afternoon we're going out on a run, a test run." He said, "Come on down to the dock." So after lunch I went down to the dock. They check you on, take your life history, who to call, and you went aboard. He hadn't explained this exactly to me that this ship had been in dock and everything had been fixed and repaired and something done to it. Well, this was my ship. I was the radar officer assigned to that ship and I'd been aboard it a couple of times. He said, "Now you hang around the radar. If anybody asks you why you're here you say you're checking out the radar." Okay.

So we started out, we went up and down the bay, and then they decided to take a couple of low runs, just down a little bit, the conning tower still out of the water. Then they were going to really dive. They went out to the center of the bay where it was about the deepest and they made a crash dive and we started down, down, down, right into the mud, and stuck. Well, the propellers were still sticking out and the aft

torpedo tubes. The word was that we could crawl out through a torpedo tube if we had to. But there were two tugs that were with us all the time. We never got twenty feet away from those tugs. So the tugs right away got to work and a couple more tugs came out. But meanwhile, we were down to where there was pressure on this thing, and there must be 1,000 packing joints on the hull of a submarine carrying electrical cables and pipes and air and all sorts of things through the hull. Every one of them leaked. There was water getting inside, and the pressure built up and it became a fog, you couldn't see two feet in front of you, and water just pouring in everywhere through these packing joints. And the submariners didn't seem to care; this happens to them all the time, apparently. (chuckling)

But they monkeyed around there for about an hour and they'd keep wiggling the sub back and forth. For awhile the props were out of the water and they couldn't do anything with them. But then they finally lowered their rear end and that loosened up the front a little bit and they got out. So we got out of that, but that was a fascinating thing. My first experience on a submarine and then to turn out like that! (chuckling) But then the war was over and I came home, came right back to the Department.

TC: What was the separation procedure? Did they just send you home?

LS: Every week they posted on the bulletin board how many points you had to have to get out. Everybody had a chart and they were all figuring their points. The point system was complicated as all get out, so you really had to learn it and understand it. You'd work it out to find your score and they would post the magic number. And everybody with so many points will get out next Wednesday, everybody with so many more points will get out on Saturday, and so on. So I saw this coming about a week ahead.

TC: Did points have to do with days in, or. . .

LS: Oh, it had everything. It had to do with your age and days of active service, days overseas, any medals and the quality of the medal, whether it was Purple Heart or whether it was just for nothing, you know. All these things had different point values assigned and you'd add up all your points. And then they'd change. For awhile they'd give you maybe a point for every ten days on active duty, and then pretty soon it would be a point for every twenty days on active duty, so you were constantly rebuilding your pyramid.

Well, I saw it coming, so I called the wife and said, "Bring the boy along, he's old enough to enjoy this. Take the train up and I'll meet you at the station." It was easy to get hotel rooms then. The war was over in August and this was in April.

TC: So August of 1945 it was over.

LS: Yes, this was April of 1946 when I knew I was going to get out. She came up and we had about three days, and then when I hit it I just went down and picked up a paper from the duty officer. I'd been picking up stuff that was hard to get at the ship store. I had about twenty pounds of butter and I had a lot of canned hams and that sort of thing. They had a commissary there where you could buy it with no problem. It was stuff that wasn't appearing yet in the stores.

TC: Stuff that was rationed still?

LS: No, no rationing. It was starting to come back, but most of it was surplus army goods. If you worked at the Navy yard, you'd just go down to the commissary and show your card and you could buy anything you wanted. So I had a pretty good supply of stuff. It had no labels on the cans and was a big surprise when we opened it. I loaded the car full, and my sea chest, and home we came. When I got down here, I had to report to the Navy Reserve Armory over by Dodger Stadium, and they spent a day and a half processing me out, physical exam and writing up a lot of papers. I think I had two months' leave coming. But I went down to the Department and I said, "I'm going to take a month's leave and then I'll come back to work," so that's what I did.

TC: Did anybody in the Navy try to convince you to stay in, because you had proven yourself so valuable during the war?

LS: They really put the pressure on, yes: "Yes, we'll give you a promotion. Sign up for four years, get a spot promotion right

away, and get your choice of assignments." I found out that was a bunch of malarkey afterwards, but a lot of fellows did it. But I went into the reserves, though, stayed for five years, and I got promoted to lieutenant commander and went on three active duties with the same fellows that I'd gone through MIT with. I went back to MIT one year for two weeks. The other two years I went down to Point Loma to a naval electronics laboratory that's down there--still there, I guess.

Well, I kind of enjoyed it, but it got to where I just couldn't do both Navy and DWP. The Department was getting too much for me and they expected an awful lot in the reserve. Beside these active duty trips, I had to do a lot of schoolwork, and I was always taking more classes. I wanted to take classes that would help me in my work with the Department, which was good, but finally I asked for retirement. So I got retired from the reserves. I'm still a retired reservist although over age for any duty.

TC: Well, when you came back to the Department then, that's in May or so, June perhaps, of 1946.

LS: Yes.

TC: Did you just pick up where you left off?

LS: (chuckling) I went to exactly the same job, and they were building Harbor Units 3, 4, and 5 then.

TC: Units 3, 4, and 5 at Harbor [Steam Plant].

LS: Yes, they were just getting started. I'd been back about a year, I guess, and I got promoted to Engineer. I took over a pretty large squad, doing all the electrical wiring and controls on 3, 4, and 5, and the conduit. Then they weren't far enough along to have a lot of conduit and wire yet, they were still doing cement work, and so my group got assigned to Stations G, H, and J, which were just being built then. We were kind of getting ready to start on H and K, but by then Harbor picked up enough so we went back on to Harbor. This was just the same work I had done on 1 and 2, except I was in charge of the crew now.

TC: You're talking about four new receiving stations. That's quite a jump.

LS: Yes, G, H, J, K . . .

TC: That suggests that the system is growing pretty quickly.

LS: Yes, there was one in Hollywood, one out in Sawtelle, one in Northridge, and one over by Elysian Park. My crew did all of the wiring design for that, and we were just kind of getting finished up when they started Valley Steam Plant.

Well, Valley Steam Plant was a very interesting project. We had all that Seal Beach Steam Plant property, and the gas company [LAG&E] had intended to put in two new units. They had actually put in the foundations for those two units. So the first idea was the Department would just take over and get similar units and use what was there. But it became apparent right away the Department needed larger units. Those were

going to be about 50,000 kw units and at Harbor we were putting in 75's. So the Department went ahead and had bought the larger equipment, the turbines and the generators and the boilers and the condensers, things you have to have a lot of lead time with, and then they got into a fight with Seal Beach. Seal Beach was going to tax them, really stick it to them, because they were out of Los Angeles County. So here was all this stuff coming in and no place to put it.

There was a lot of kidding around. They talked about moving these units over to Harbor and maybe other places, and so this big drawing came out from some joker in the Drafting Room and they made a lot of prints of it and sent it around all the offices. It showed a great big barge with a steam plant on the barge and a tugboat pulling it. It was called the Seal Beach Steam Plant and here was a plant that could be towed around all over the place. (chuckling)

Well, finally they decided on Valley. That had a couple of good things going for it. They did need some power source out on the north end of the system, and property was cheap then, and this was right below the Hanson Dam where there was a lot of area that they wanted to keep clear for spreading basins so the water from Hanson Dam could be spread out. They bought this property and it had a gravel pit on it. (chuckling) The word went around that the gravel pit was going to be for an ash disposal if they ever burned coal, but no one was ever going to burn coal. So they then moved the

plant out there. These units were designed for ocean water cooling, and their efficiencies weren't so good when we wound up with cooling towers.

TC: So the original units for Valley had been planned for the Seal Beach upgrade?

LS: Yes, the first two units, that's right, and they were actually under construction. In fact, construction was well along on them, and there wasn't anything else they could figure out to do. They couldn't find any seacoast property. They were able to make some changes in them so that they could use cooling towers out there. So my crew all went over to designing the Valley Steam Plant.

TC: Most of the work was done then downtown?

LS: Yes, we were in the old Wright & Callendar Building down on Fourth and Hill Street.

TC: So you wouldn't have to go out to the site to inspect them?

LS: Oh, after they got to the point where it was actually being built and equipment installed, the engineers were expected to go out there once a week or so and look over their portion of it to be sure everything was going right and see if they could anticipate problems coming up and make any changes. That's part of the design work, to follow it up with field inspections regularly.

TC: And that's how it was done? You had conduit and wiring and somebody else had some other aspect?

LS: That's right, somebody else had the big machinery. Then in the Steam Plant Design Group they had a man in charge of a piping squad and a man in charge of a boiler squad. What was the other one they had? Oh, then one in charge of the fans and blowers and pumps and that sort of thing.

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LS: The work at Valley [Steam Plant] was uninterrupted and went along very smoothly. We got the plant in and it worked well.

TC: Well, there were certain features of Valley Steam Plant that were innovative, like its being an outdoor steam plant for the most part.

LS: Well, it was outdoor because it wasn't near the coast. You didn't have the salt air problem such as we had later at Scattergood, where we went to an enclosed plant. Yes, it was an open plant because the atmospheric conditions were very good. It had these big wooden cooling towers out there because they didn't have the ocean water for cooling. Then there was no way to get oil in. There were no pipelines and the oil had to all be hauled in by rail or truck. We had a big railway yard with lots of tracks coming into it, where they could run long trains in with oil cars and unload them right into the big storage tanks. However, the oil contracts were with local people so the oil came by truck. The tank farm was right there adjacent to the plant. We had a little bit of gas in those days but not much. Mainly the gas was used for firing off, if we could get it. If they had to fire off on oil it was a horrible situation, but it could be done.

TC: You mentioned that there was a field or an area that some people said would be for ash in the event of coal burning.

LS: (chuckling) Well, this was this hole in the ground that had been a huge gravel pit. Nobody knew what to do with it. People would come out there and look at this thing and say, "Well, what are you going to do with it?" We had to buy it to get the property, you see. I guess they even marked on the drawings "Future Ash Disposal Pit."

TC: But it was never thought to be coal-fired?

LS: Well, the Water Department stopped anything like that because this pit was so deep that there was always water in it, and it went right into the aquifers. It was right near these big spreading basins where they spread the Tujunga Wash water. So there was never any question of using that for anything. Later, the Valley Steam Plant picked up some gas from a huge, big old landfill where they'd used one of these gravel pits adjacent to the steam plant for trash disposal and which began to generate gas. They put some little generators in at first, and the maintenance was too high on those, so now I think they've got a little pumping plant and they pump it over to Valley Steam Plant. It goes into the boilers.

TC: So that's still in operation? That's the [Sheldon-] Arleta landfill?

LS: Yes, that's what it would be, but that was after my time.

TC: Yes, that was more recently.

LS: So that was about the substance of Valley. It was a very interesting plant but not much different than Harbor. When Valley got pretty well finished up, they decided to start the

Owens Gorge [Project]. Owens Gorge was really going to be something different. It was going to be three entirely automatic, remote-controlled hydro plants in series, where water that went through one had to go right through the next. There wasn't any storage in between them and this meant that the control system had to be very complex. So the boss called me in and he said he was going to put my group onto that. I said, "Well, I'd like to make a couple of changes if you're going to do that." I said, "With all this complicated remote-controlled stuff, I'd like to get a couple of my old Test buddies in there," which he let me do. I also got one of the Navy fellows who'd gone through MIT with me.

TC: Who was that?

LS: Vollum, Ed Vollum. He got multiple sclerosis, and just about the time we finished the Gorge he began limping and having trouble, and about a year later he was dead. Terrible. He had two little kids, just babies almost, one about two years old and one about four. Well, anyhow, he was in my group. Then I had these two fellows from the old Station Test gang that had become engineers. I also had two or three fellows that had been writing specifications to purchase equipment. I kind of eased them over into a new group that was going to do nothing but write specifications. They hadn't had much field experience and I wanted fellows that had worked on equipment. This automatic control, I realized, was going to be like having a bear by the tail.

TC: Well, with the automatic control there, did you have to jump into the available literature and the technical materials to find out what was . . .

LS: We designed it ourselves. We worked out the logic for it, exactly what we wanted, and we found relays that would do these things and we even designed a couple of relays. We made up the circuitry to perform the logic that we wanted. We had a combination of supervisory control to control the main electrical parts, the circuit breakers and that sort of thing, and that was purchased ready-made from GE [General Electric]. We wrote the specs as to what we wanted it to do, and it was about what the supervisory control of a substation would do, and controlled the transmission line breakers and voltage regulators and so on. Then we had the generator start-up, which was a very complex thing, and each of these things had to be tied in with the water controls. I worked with [Kenneth O.] Cartwright on that. He was a mechanical engineer from the Hydraulics Section. We had some real interesting problems to work out to be sure this water all got flowing through the three plants at the same time.

TC: Well, you must have had to take a crash course yourself in hydro power generation.

LS: Well, I'd worked in the power plants a lot. I'd worked at Boulder and PP1 and PP2.

TC: At Boulder, true.

LS: And one of my engineers had, too. He was Walt Bowser who was down at B the day we dropped the Boulder lines. He and I had been through a lot together.

TC: What was his name?

LS: Bowser. He's long gone. He'd been with the Department a long, long time, he was an old-timer when I came there. We got this thing designed and decided we had what we wanted. Then we went through the circuitry just like we would as if we were old-time Test men, as though somebody else had designed it, and got it installed up there, and I really don't think it ever had a problem.

TC: What comes first in a project like that? There are so many things that have to be done. You have to gather the crew, you have to start building the actual plants themselves, and you have to start designing the machinery . . .

LS: Well, each of the sections must coordinate with the others. We had two squads in the Electrical Section: one was handling these automatic controls and the wiring and the other one was handling the heavy equipment. Then there was the Mechanical Section. They had two or three squads and one was handling the hydraulics and then another one the big valves. Then the Structural Section had a squad taking care of penstock and concrete work and foundations and that sort of thing. So it just starts as a general idea that we want to plan a certain capacity. So the Electrical fellows say, "Well, here's about what you'd want electrically." The Structural fellows say,

"Well, if you do that, here's what we would want structurally." And about that time, maybe you're ready to go out for bids. So you write up your specs for a generator and a transformer, and the other pieces of equipment, and the different manufacturers come in with their bids. You sit down and analyze those, and then when you've decided which bid you're going to take, the sections get back in it and the squads really go to work. They get the drawings of the generator and decide how it's shaped and where the wires come out, and then the instruments and relays that have to go with it. Then we just start laying out our switchboards and purchasing the instruments we're going to want and lay out the wiring. The Equipment people are doing the same thing, and they're working with the Structural people then on the foundations and the way the pipes are coming in and the valves and so on. Gradually it just sort of builds up and the squads all have to keep working together back and forth.

TC: So you're aware of what other squads are doing and what progress they're making?

LS: Oh, yes. A fellow named Ernie [Ernest W.] Werk, who died a good many years ago, was in charge of the electric equipment, transformers and so on. I was in charge of the wiring and the controls. Cartwright was in charge of the Mechanical and the Hydraulics squads. We three did a lot of work together. We were very close, because the hydraulic controls had to intertie with the electrical controls and coordinate with our

automatic starting and stopping procedure. Also, the hydraulic equipment had to tie in with the electrical equipment. Here you had the Hydraulics people dealing with the turbine and the Electrical people doing the generator, which is part of it. So the three of us were really close; we tied it together.

TC: Did you have to work with the Transmission Design people at all?

LS: No, we didn't have to do much with them, except that our Electrical Equipment people had to design the switchrack and get the circuit breakers in and the disconnect switches and a place to tie the end of the transmission line in.

TC: They take it from there?

LS: Yes.

TC: Because I remember reading and also hearing--Larry [Lawrence] Schneider was telling me about it--where part of it was put out on contract and there was a beef about the contract.

LS: Well, he was transmission line construction engineer. I knew Larry quite well but there was never anyplace where our work had to tie together except for where that last wire tied onto the end of our rack.

TC: You probably had to go up to the Gorge plants at some point in time?

LS: Oh, during the early days I went up several times just to look over the field, and then in the early days of the construction I got up there, and each of my engineers got up there, I'd

say, at least once every month for a four- or five-day trip. We were building three plants all at the same time. Then, along toward the end when they had made the first test runs and put each unit in service, they sequenced from the top unit first and on down. I went up and I took one of my engineers with me and we stayed there a week on the start-up of each unit.

TC: Did you end up staying in Bishop, or there was a camp, I know.

LS: Yes, they had a camp but we avoided that. That was just like the old camp out at Silver Lake. (chuckling) In fact, a couple of the fellows just refused to stay at it. Anyhow, when the engineers would go up there it wasn't worth moving into the camp for three or four days; we'd stay at a motel down in Bishop.

TC: Well, here again you're a younger engineer so you're not privy to some of these decisions, but maybe from a vantage point of years later and what you learned along the way, you might have some insight into, for instance, why the Gorge plants anyway. You're developing steam generation in the Basin. Why do you need new hydro?

LS: Well, economics was the main thing. It was realized before the war when all of our steam plants were burning oil, which is very labor-intensive, and there's a lot of equipment to maintain and it's inefficient, and here was all this water. Because in 1940, you see, the Gorge began to have a good water supply when they built that extension to Mono Basin.

TC: That's right.

LS: So the Power System looked into that and it looked good. The California Electric Power System had two little plants in the Gorge, which ran off of the stream flow in there, so DWP bought those. That gave them all the rights to the Gorge. The Water System was going to run a lot of water down there and the Power System actually started work before the war. There were going to be four plants then, and they were going to all be different, but each plant was to be the most efficient for its location. In one of them they'd done quite a bit of tunneling. That was all stopped by the war, but the basis of those surveys showed that if the price of oil went to $2.30--I think it was $2.30 a barrel--then that Owens Gorge Project would pay out. So after the war they did more studies. Of course, when the war was over we had plenty of generation. We had all these Harbor units, and until the whole area began to pick up in load we had several years of grace period. And Valley was coming along then, too.

So, when they went back after the war and started more studies, they decided it would be more economical to build three plants absolutely identical, and that meant the spacing was different because now you had to get exactly the same hydraulic drop between each one in order to get the same amount of power out of it. So they did that and their studies showed it would work out all right. There was not much question about it, the oil did get a little above $2.30 there

at one time for awhile, but meanwhile the plants were built or on their way. But then when the price went up to $7 or $8, the plants were just little gems running twenty-four hours a day the year round, and the only time they shut down was for inspection of the tunnels or something of that sort. So they really paid out. The fact that the water is being cut off now is a sad situation, but they've paid for themselves.

TC: So the Gorge plants will be shut down?

LS: Oh, it's my understanding they're going to have to run water down that gorge now for the fishermen, under some of these new agreements.

TC: That's right, this is all the new agreements between Mono County and Los Angeles.

LS: I only know what I read in the paper. But every drop of water that comes down the gorge in a stream doesn't go through the plants, so that's a loss, a big power loss.

TC: Well, when you would go up into the [Owens] Valley, what would be the attitude of the Valley people? You hear a lot, I think sometimes exaggerated as to the animosity of the Valley people.

LS: I never had too much contact with them, except a few that I ran into here and there that worked for the Department, or had worked, or their parents had worked for the Department. I think they were coming to realize at that time that most of their troubles had come from that big bank failure up there, the Watterson Bank.

TC: The Wattersons.

LS: The Valley people had lost their money in that bank. And when the Department first began buying up property, there hadn't been, I think, too much objection. There were a few die-hards, but I was told by one fellow who said, "You know, all this talk about agriculture is a farce. They put in all these orchards and my parents did that. If they got a crop once in three years they were lucky." He said, "The weather is just horrible up here and it costs money to haul produce out," and he said, "I don't think they lost a lot when they sold that property." The Department paid pretty well for it to get the water rights.

TC: Yes, they paid well.

LS: So that's the impression I got, but I never lived there and I never knew the people.

TC: And at the time when you would go up there, that would be an over-the-road trip? I mean, you'd drive as opposed to . . . They may have had a train that went up.

LS: Yes, there was no train. I think people were glad to see us come up there because the valley boomed from that big camp. While building the Owens Gorge plants, they'd hired a lot of local people, big crews, and I think it made a boom to all those towns, which I think a lot of them liked and appreciated. But once that stopped, then they had nothing but their tourism, I guess, to go on and things kind of died down, that's when the problems built up again. There were two big

peaks of trouble: one was right after the aqueduct was built and right after the bank failures, and the other then came along here in the last twenty years. But I never mixed into the politics anyway.

TC: Well, who was head of the Power System in those days? I'm trying to think here, Scattergood died in 1947.

LS: Yes, and then there was Peterson . . .

TC: Actually, Scattergood when he died was called a consulting engineer, but I would assume that he still had a big say in what went on.

LS: I don't know.

TC: You don't know?

LS: Well, I was down on the totem pole where I didn't know what was going on in the executive offices at all. But anyhow, then came . . . gee, I can't remember his name now.

TC: Well, in the Power System, along the line somewhere, there was Garman and [R. R.] Robertson.

LS: Oh, and [Arthur L.] Williams.

TC: And then Peterson?

LS: Peterson was the first one after the war, I think. Then Garman and then I guess Williams.

TC: So whose baby would the Gorge Plant Project have been?

LS: Well, I can't really say. I really can't.

TC: I'll have to track that down to sort of locate it with a personality.

LS: Isn't that funny? That might have been by the time that the fellow from the Water System, big Sam Nelson was General Manager. He might have been there then during the Gorge Project, he could have been. So we finished with the Gorge and, boy, I'll tell you, I don't think I've ever done anything in my life that I was more proud of. I just felt like the Gorge was my baby and it worked. (chuckling)

I came back out of that . . . I was going to say I came back to town, but I really hadn't been out of town, and then everybody was getting fired-up over Scattergood [Steam Plant]. My squad was going to be transferred into the Scattergood group, and I'd been kind of getting tired of building steam plants. We had had a section leader named [O. L.] Seidenfaden, who had become a Principal Engineer. They had set up a new section for him, which included the Test Lab and Drafting and some other things. I heard that the head of the Research Lab was going to retire, so I saw Seidenfaden at a Speaker's Club dinner one night. I said, "I'm kind of thinking I might like to go back to the Test Lab." He said, "What's down there?" I said, "Oh, I understand that [M. A.] Mason is going to retire." I don't think he realized it until then and he said, "Really?" I said, "Yes, I guess so, he's sixty-five." He said, "Do you want the job?" I said, "I'd kind of like to be considered." He said, "You've got it." (chuckling) So it was another three months or so before Mason retired, but then when he retired I went to the Test Lab.

TC: Is this, say, 19 . . .

LS: Nineteen fifty-five.

TC: This is 1955?

LS: Yes. So I went down and took over as head of the Research Lab. We started some big projects there that occupied most of my time as head of the Research Lab. One was a circuit breaker testing program. They'd had trouble, especially on the 5 kv switchgear. They were having breaker blow-ups. A lot of the old gas company stations' switchgear was failing right and left, and the 34.5 system by that time had built up so much that the duties were really too high. So they appointed a committee, which I was not on, but the committee was to develop a program of what they wanted to test, what breakers, how they wanted to do it, and then it was turned over to the Research Lab to develop the techniques and the procedures.

At first we tested some 138 kv breakers down at Station B. They had a spare battery room that had never been used down there and we made that into a lab where we put all our instrumentation and we started testing the breakers out in the yard. One reason for that was that B had enough source of power so we could get the short circuit duty we wanted. One of the big problems with our circuit breakers, all of them, was that when they were built there was no way that you could test a breaker to full capability. You'd test components and you'd say, "Well, now if we add these all together, now the

capability will be this much." But this we found out was not true. All utilities were having the same big problems about this time, and all over the country they were starting breaker test programs.

So we had a point there at B where we could get lots of duty at 230 kv. We had a Boulder line in at B--only one at that time, the other one had been moved over to Station F--and we had five units at Harbor. Edison had gone to 60 cycles then and we had an Edison tie at 230 kv coming into B, so we had enough duty to really test any of these breakers right up to their rating. So we did two or three 138 kv breakers there and then they decided that the critical thing was the 5 kv breakers. It was really getting to be a dangerous situation, and we had hundreds of them. We had about 2,000 feeders at that time, and each had at least one breaker on them, some had two, and then there were all the breakers on the low side of the transformer banks and the industrial stations. We must have had 5,000 breakers at least, and all kinds of makes and models. We decided to set up a test facility at Power Plant 2, because we could get just about the duty we wanted out of one or two of those generators up there. We built quite a setup out alongside Power Plant 2, and it was tied onto their 69 kv bus. Their operating voltage was 69 kv, but we could take off whatever machines we wanted to reduce the duty and put them on this test set-up and lower the voltage to 5 kv.

For instrumentation, there was no place up there to set up all of our instrumentation, so we built a trailer. We got the biggest travel trailer we could buy. In fact, it was so big it had to be towed on the back of a prime mover truck. (chuckling) That was a problem, moving it around from place to place. We equipped it as a laboratory with everything, including a darkroom. We parked it in the roadway outside of Power Plant 2, and our test rack with all the circuit breakers under test was maybe sixty or seventy feet from it. They brought a breaker up there from town, which they wanted to test. It was torn down and put into perfect condition, set in the test rack and connected up, and then we'd put different short circuits on it. We'd put a fairly low level short circuit on it and then tear it down and see what it had done and then repeat at higher levels, each time giving it an overhaul so that it was back in A-one condition. We went on until we saw signs of distress or failure and then we re-rated the breaker to that level. Then it could be used in a different location than it had been if necessary, but they were all down-rated, some by 50 percent.

We had some exciting times up there. One time we had a breaker with which we'd had quite a bit of trouble, but the manufacturer--we always had the manufacturer up there when we tested--kept saying that the breaker was all right. Well, we kept testing it higher and higher, and finally we got up to about 80 percent of its rating. The test crew all felt that

we were getting awfully close to its limit and the manufacturer's representative kept insisting those breakers were all right. So I said, "All right, we'll go ahead and test it at 80 percent." So we got all set up, and then I realized the manufacturer's people had taken off across the fields. They were about 200 yards out in the tules. (laughter) We tested it then and all hell broke loose. It was a good-sized 5 kv breaker, and it just blew to pieces. It was like shrapnel all over the place, oil was thrown all over the hillside and burst into flame. It set fire to the hills and started a small forest fire. We had fire hoses all laid out in case of such a problem, and the crew all got out and manned the fire hoses. All but one of the fire hoses burst. They hadn't figured the proper pressure on the hoses, which they were feeding off of the penstock, I guess. So that turned into a pretty exciting day and it stopped our testing for a couple of months till we rebuilt our test facility.