

1 (Slide.)

2 This is one division of RHR complex.

3 MR. KERR: Other questions?

4 (No response.)

5 Thank you, sir.

6 Mr. McKelvey.

7 MR. McKELVEY: My name is Terry McKelvey. I am  
8 the principal electrical engineer involved in the design of  
9 Fermi 2. And I am going to present to you the reliability  
10 of our station power, including the effects of the loss of  
11 various stages of AC and DC, and get into the discussion on  
12 station blackout.

13 In order to do that, I would like to give you a  
14 feeling for the diversity of our offsite power source.

15 (Slide.)

16 Also for its independence and how we derive it  
17 from our electrical transmission system. First of all, the  
18 offsite power source at Fermi 2 is made up of five separate  
19 transmission lines, two from our 345-kV system and three  
20 separate lines on the 120-kV.

21 As you can see here, the 120-kV lines are from  
22 three separate sections on our system.

23 MR. CARBON: Could you step back and use the  
24 pointer, please.

25 MR. McKELVEY: Okay.

1           As you can see, the three 120-kV lines originate  
2 at three separate locations in our 120-kV transmission  
3 system. The 345-kV lines, transmission lines coming to  
4 Fermi 2, are both from our Brownstown station, which  
5 actually is a split station. It is treated as if it was two  
6 separate stations. They come into two separate switch areas  
7 located on the Fermi site.

8           The existing 120-kV switchyard was for the Fermi 1  
9 plant. It has been in existence for approximately 14  
10 years. The 345-kV switchyard is for the transmission of  
11 power offsite from Unit 2.

12           As you can see here, we have a tie to Consumers  
13 Power in the area. It has the Whiting power plant. It is  
14 approximately 20 miles from the Fermi site. In addition, we  
15 are tied to Consumers Power in nine different locations. We  
16 are also tied to Ontario Hydro and Toledo Edison. The  
17 combined total of our ties to neighboring facilities is 7300  
18 megawatts capacity.

19           MR. RAY: Those other locations are from other  
20 points on the system?

21           MR. McKELVEY: Yes, there are nine separate points  
22 there where we tie to Consumers. For example, two separate  
23 Ontario Hydro and three separate transmission lines to  
24 Toledo Edison.

25           MR. RAY: Are any of these ties to other pools at

1 345-kV?

2 MR. McKELVEY: Yes, they are. The ties to Toledo  
3 Edison are at 345, and also to Ontario Hydro.

4 MR. CARBON: How widely separated are the five  
5 lines coming into the plant?

6 MR. McKELVEY: Okay. There is a common  
7 transmission corridor into Fermi 2 for approximately five  
8 miles. That is as shown here (Indicating). The line -- the  
9 corridor is 500 feet wide. It has been designed to take the  
10 worst failure of any structure falling over that would leave  
11 enough lines -- all we need out of these five lines is one  
12 separate line existing to power adequate ESF at Fermi 2.

13 So we have designed the spacing of the  
14 transmission lines on this common corridor to accommodate  
15 the falling over of a 345-kV tower.

16 MR. CARBON: Each of the lines has its own --

17 MR. McKELVEY: Support of tower, right.

18 MR. RAY: When you say they are designed -- the  
19 falling tower will not impact an adjacent line?

20 MR. McKELVEY: There are five separate lines. The  
21 345-kV towers are on the outside of the 500-foot right of  
22 way. In the center are the three 120kV lines. Obviously,  
23 the largest structure is the 345-kV tower and if one of  
24 those lines fell over across the other transmission lines we  
25 would still have adequate transmission lines available to

1 shut the plant down.

2 MR. RAY: You have not answered the question, but  
3 you have given me an implied answer. I gather from what you  
4 say that if the EHF line went down it would take down one of  
5 the 120-kV lines, is that what you are saying?

6 MR. McKELVEY: Yes, it would.

7 MR. RAY: So you would have three left.

8 MR. McKELVEY: It might take a couple lines down.  
9 We would have at least one transmission line available to  
10 the site.

11 MR. RAY: All five lines are on the same right of  
12 way?

13 MR. McKELVEY: that is right.

14 MR. RAY: The two large ones are on the outside.  
15 So between the two large ones there are three others.

16 MR. McKELVEY: Right.

17 MR. RAY: Are you saying, then, that if one of the  
18 345-kV lines failed it would take out three 12-kV lines with  
19 it? It would take out three 120's? So a falling tower on  
20 the high line could leave you with one line.

21 MR. McKELVEY: That is right, in the worst  
22 scenario.

23 MR. RAY: Is the system stable under these  
24 conditions?

25 MR. McKELVEY: Yes. The system has been analyzed

1 with load flow and system stability programs for that kind  
2 of contingency.

3           MR. RAY: Using four lines you maintain stability  
4 of the system, it does not break up on you and thereby deny  
5 AC power to the system?

6           MR. McKELVEY: That is right.

7           MR. RAY: What kind of faults were assumed for  
8 that stability study? Can you tell me how comprehensive it  
9 was?

10          MR. McKELVEY: I did not take part in that  
11 stability study. I am afraid I cannot. I can get the  
12 information for you.

13          MR. RAY: The implications here are if you take  
14 out -- if there are four lines, one failure, they are all  
15 poly-phase, three-phase faults.

16          MR. McKELVEY: They are all three-phase faults,  
17 yes.

18          MR. COLBERT: Characteristically, all of our  
19 studies take into account all kinds of faults, that is  
20 three-phased faults, double phase to ground and single-phase  
21 faults. And we would take into account the various loss of  
22 generators under certain conditions with a reduced  
23 transmission system, and then see if the system remains  
24 stable and if the generators go out of step.

25          MR. KERR: Thank you.

1 Mr. Carbon?

2 MR. CARBON: Will a typical Midwestern tornado  
3 take down one of those power lines or all of them? Will it  
4 knock down some transmission lines like that?

5 MR. McKELVEY: In the common corridor?

6 MR. CARBON: There or anyplace, is the power line  
7 susceptible to being knocked down by a typical Midwest  
8 tornado.

9 MR. McKELVEY: Yes.

10 MR. RAY: It has happened.

11 MR. McKELVEY: However, I have one statistic. In  
12 the last ten years on the Detroit Edison system we have only  
13 lost two towers, two 345-kV towers to tornadoes.

14 MR. RAY: I notice in some of the background on  
15 your station -- I cannot say now where I picked it up, but  
16 on the Fermi site you have a 165 oil-fired unit and four  
17 small peaking units. Are these connected into the 120-kV  
18 system at that substation?

19 MR. McKELVEY: Yes. We will be getting into that  
20 if I can continue.

21 MR. CARBON: One more question. The supports for  
22 those transmission lines, are they designed to resist an SSE  
23 earthquake?

24 MR. McKELVEY: No, they are not.

25 MR. KERR: Please continue.

1           MR. McKELVEY: The two switchyards at Fermi 2 --  
2 and this is a very brief description of them. The 120-kV  
3 switchyard is located at the Fermi 1 plant.

4           (Slide.)

5           It has three separate lines coming from the three  
6 separate stations. Two of the lines feed bus 102, with a  
7 tie to our bus 101. The Fermi 2 auxiliary electrical system  
8 offsite power feed is developed from that bus 102.

9           In the 345-kV switchyard we have two separate  
10 lines, as I said before, from our Brownstown station in a  
11 breaker and a half scheme. We also have the Fermi 2  
12 generator, which generator voltage is transformed to the 345  
13 transmission network. And also we have a tap off of bus 301  
14 which feeds another system service transformer for the  
15 second source of offsite power.

16           I wanted to make a note that we do not use the  
17 unit auxiliary transformers to eliminate the switching.

18           MR. RAY: Is that bottom feed to the right that  
19 goes downward -- I cannot read it. The 120-kV, is that the  
20 point of connection of these other units that are on the  
21 Fermi site?

22           MR. McKELVEY: Right. The next slide will show  
23 that. Note that this is bus 102.

24           (Slide.)

25           The units in question, bus 102 and feed onto the

1 onsite power system, goes through a transformation down to  
2 an intermediate voltage where the peakers -- this symbolizes  
3 two peakers -- are tied into the system, two other peakers  
4 on a second wing. Those are for peaking duty. That voltage  
5 is again transformed through a system service transformer  
6 into our plant, into our ESF buses.

7           The two switchyards, I did not mention before, are  
8 located approximately a quarter mile apart, so they are very  
9 independent. The control power, the battery power, is also  
10 derived from separate battery stations.

11           The auxiliary electrical system is divided into  
12 two divisions. Again, one division is completely normal.  
13 Offsite power is fed from -- ultimately from the 345 and  
14 transformed down to two 4160-volt buses. Inside each  
15 division, each bus is backed by an emergency diesel  
16 generator at 4160 volts.

17           There are also associated 480-volt buses inside  
18 each division. They are divided up into load groups  
19 associated with each emergency diesel. We have  
20 intra-divisional ties between the 480-volt buses. Should  
21 either a bus or emergency diesel, for example, fail in an  
22 emergency situation, we could power one of a kind loads from  
23 either load group from the remaining diesel inside a  
24 division.

25           Similarly, for the division one power the ultimate



1 power source is the 120-kV system. Again there are two  
2 buses inside the division, backed by emergency transmissions  
3 for transmission at lower voltages. Again, any one of a  
4 kind type load could be powered from either remaining of the  
5 load groups.

6 MR. RAY: Where is the 165 megawatt oil-fired unit  
7 connected?

8 MR. McKELVEY: It was tied to the other bus, bus  
9 101 in my previous slide.

10 MR. RAY: I see it. I am sorry, I missed it.  
11 Yes, thank you.

12 (Slide.)

13 MR. McKELVEY: Getting into --

14 MR. COLBERT: I think that should be pointed out  
15 that that is an oil-fired peaker. It is an economy  
16 reserve. It is not normally running. It has to be started  
17 up, and it can be started up in a relatively short time,  
18 half-start, meaning on the order of hours. That is, it  
19 would be on the order of two to three hours to start it up.

20 MR. RAY: If you lost all other AC power off the  
21 site, could you live while you were starting this unit up?

22 MR. COLBERT: Could you repeat that?

23 MR. RAY: If you lost all other transmission into  
24 the site and you had -- the gas diesels did not respond and  
25 there was an AC blackout, could you start up this -- could

1 you survive while you started up this fossil unit?

2 MR. COLBERT: The term "survive," yes, we can  
3 black start that power plant. It is equipped with diesel  
4 engines to start with its own battery. By the way, that is  
5 not a small unit. That is 60 megawatts power.

6 MR. McKELVEY: You are sort of stealing my  
7 thunder.

8 MR. RAY: I was talking about the one big unit  
9 first.

10 MR. COLBERT: At the present moment that is an  
11 economy reserve and I was mistaken when I said it could be  
12 started in two to three hours. That would be if we were  
13 operational. But right now that plant is not manned. We  
14 have to make a conscious decision to send the people down  
15 there to man that plant.

16 MR. RAY: So you have your eye on --

17 MR. COLBERT: That is correct.

18 MR. RAY: How fast can they start?

19 MR. McKELVEY: Ten minutes.

20 MR. RAY: Are they gas turbines?

21 MR. McKELVEY: Yes.

22 MR. RAY: Good.

23 Excuse me. One last question. Somebody said 60  
24 megawatts. Are there four 60's?

25 MR. McKELVEY: 480 megawatt units.

1 MR. RAY: What do you need to start the plant --  
2 to shut down the plant safely? Do you have any idea?

3 MR. McKELVEY: Yes. All we need is one division  
4 power.

5 MR. RAY: How many megawatts is that?

6 MR. McKELVEY: That is approximately five  
7 megawatts. So we are well within the rating of one.

8 MR. ZUDANS: Only one of those four is a black  
9 start.

10 MR. LUSIS: A small addition. If we start one  
11 unit we can pick up the other three.

12 MR. McKELVEY: But there is really no need to do  
13 that.

14 MR. KERR: Please continue, Mr. McKelvey.

15 MR. McKELVEY: Getting into a failure analysis,  
16 for long-term cooling we need one of our two divisions to  
17 remain intact power supply-wise, and the loss of either  
18 division, as you can see, will be backed up by the second  
19 division. Loss of either division will result in the loss  
20 of that division's emergency core cooling.

21 (Slide.)

22 Loss of division one will also result in the loss  
23 of all power to the inboard isolation valves. However, in  
24 both cases we have divisional -- division two redundant  
25 equipment which can act to mitigate the accident.

1           Incidentally, the ECCS is shared among the four  
2 buses. For example, one RHR pump and one core spray pump  
3 are fed from each of the four buses and its associated  
4 valves are fed from the 480 volt bus associated with that  
5 load group.

6           The emergency diesel generator auxiliaries are on  
7 their own load group. They are also fed from that power  
8 train. Okay.

9           (Slide.)

10           Now, moving into the DC system.

11           MR. KERR: Mr. McKelvey, I do not want to rush you  
12 very much, but your time allocation shows 20 minutes and my  
13 watch shows you have already spent most of that. So we want  
14 the information, but talk a little faster.

15           MR. MCKELVEY: Will do.

16           The Fermi DC system consists of five batteries.  
17 They are of similar design. Three are at -- graded at 260  
18 volts, two at 48 volts. All five batteries are  
19 center-tapped for control at the half-voltage. Three -- one  
20 260-volt and the two 48-volt batteries run non-ESF  
21 equipment.

22           The overhead I have up here right now shows you a  
23 typical for either of the two divisions. The batteries are  
24 sized for four hours based on a worst case design basis  
25 event without battery chargers. The battery chargers were

1 sized for being able to carry the continuous load while  
2 simultaneously recharging the battery within 16 hours.

3 In addition --

4 MR. ZUDANS: Can I ask a quick -- if you would not  
5 have batteries, just a charger by itself, could you use it?

6 MR. McKELVEY: Definitely.

7 MR. ZUDANS: How do you maintain the voltages?

8 MR. McKELVEY: The chargers have their own  
9 automatic voltage regulation.

10 MR. RAY: I presume you could carry such loads on  
11 the chargers indefinitely.

12 MR. McKELVEY: Yes, as long as the AC system  
13 remains intact.

14 MR. RAY: Yes, yes.

15 MR. McKELVEY: In addition, we have an installed  
16 spare battery charger which is able to be connected to  
17 either side of the battery to replace either of the two  
18 normally installed chargers, normally operating chargers.

19 Now, getting into a loss of DC, if we lost the  
20 division one 260-volt battery we would lose the function of  
21 the RCIC system, we would lose the ability to depressurize  
22 using the auto safety relief valves. We would also lose the  
23 control to division one ECCS, the division one switch gear  
24 and also the emergency diesels. However, the loss of this  
25 battery can be covered by the existence of the division two

1 battery and any AC that is available in the division two  
2 side.

3           Similarly, for a loss of the division two battery,  
4 we would lose the function of the HPCI system, the outboard  
5 isolation valves that are DC-powered, the control of  
6 division two ECCS, the switch gear and the diesels.  
7 Similarly, again, it can be covered by the remaining  
8 division one battery and AC sources for the redundant  
9 loads.

10           MR. RAY: A quickie. You said should you lose one  
11 division DC supply -- maybe I am interpreting this too  
12 broadly -- you could back up those loads from the other  
13 division.

14           MR. McKELVEY: Right.

15           MR. RAY: This says you have ties between the two  
16 divisions.

17           MR. McKELVEY: No, not the same loads. Redundant  
18 loads.

19           MR. RAY: Okay. So therefore you do not have  
20 communication between the two DC systems.

21           MR. McKELVEY: No, they are fully independent.

22           MR. RAY: Thank you.

23           MR. ZUDANS: If you lose division number one, you  
24 lose RCIC and that is not recoverable by any redundant  
25 means.

1 MR. McKELVEY: The HPSI system along with the ADS  
2 --

3 MR. ZUDANS: But not the RCIC. If you lose the  
4 other division, you lose division two and you have RCIC.

5 MR. McKELVEY: Right, right.

6 MR. ZUDANS: Okay. One is ECCS and the other is  
7 not.

8 MR. KERR: Any time Mr. Zudans hesitates, you  
9 start talking.

10 (Laughter.)

11 MR. McKELVEY: I guess, moving to the last of the  
12 station blackout, we feel that there is no single equipment  
13 failure on our site that can get us into a loss of both  
14 offsite power sources. Beyond that, we do not believe it is  
15 credible to lose both offsite power sources and also  
16 simultaneously lose four emergency diesel generators.

17 However, if such a highly unlikely event were  
18 posed, we could through the use of the black start peaker  
19 which was previously mentioned power one entire division.  
20 It is easily sized, as we mentioned before, to do so.

21 That was the conclusion of my presentation, unless  
22 you have some other questions.

23 MR. KERR: Are there other questions?

24 (No response.)

25 Mr. McKelvey, can you tell me if you have

1 calculated what is the probability that you will be without  
2 offsite power for two hours?

3 MR. McKELVEY: Our system planning department has  
4 done such a calculation. However, it does not take into  
5 account all potential offsite power losses, such as a  
6 tornado. It does take into account storm-related ones, ice,  
7 wind.

8 MR. CARBON: Sabotage?

9 MR. McKELVEY: Sabotage was not included, either.  
-5  
10 But we came up with a 10 .

11 MR. CARBON: This is 10<sup>-5</sup> for the life of the  
12 plant or per year?

13 MR. McKELVEY: Per year.

14 MR. KERR: You did not take into account  
15 tornadoes?

16 MR. McKELVEY: We did not.

17 MR. KERR: Is that because you did not know how or  
18 you did not think a tornado was likely to occur?

19 MR. McKELVEY: We did not exactly know how. We  
20 are working on that, by the way, and plan to revise it.

21 MR. KERR: If you cannot do anything else, you  
22 will have to gin up a tornado.

23 MR. McKELVEY: Right. There are contingencies, by  
24 the way, for replacing poles in a rapid as possible  
25 situation to restore one line to the site should a tornado



1 go through our corridor.

2 MR. KERR: The 10<sup>-5</sup> does take into account ice,  
3 I assume?

4 MR. McKELVEY: Yes.

5 MR. KERR: Any other questions? Mr. Carbon?

6 MR. CARBON: Is it impractical to design tower  
7 power lines against tornadoes or does it become just --

8 MR. McKELVEY: To the best of my knowledge, it is  
9 darn near impossible.

10 MR. CARBON: Okay.

11 MR. KERR: Max, there is a slight variation of  
12 that which no utility in its right mind would mention, but I  
13 will mention, and that is you put them on the ground. But  
14 --

15 (Laughter.)

16 MR. ZUDANS: And saying everything is possible  
17 I have a question, a basic question. Why are the  
18 RCIC and the HPSI systems classified differently?

19 MR. McKELVEY: Classified differently?

20 MR. ZUDANS: In terms of safety grade.

21 MR. KERR: Mr. Colbert.

22 MR. COLBERT: Bill Colbert, technical director.  
23 The HPSI is classified as class 1. It is class 1  
24 backup, and the other division is actually the automatic  
25 ADS. The R-C-I-C is -- let's see, it is the reactor core

1 isolation cooling, and it was not designed originally to  
2 recover from an emergency, an accident, but an operating  
3 emergency. Why, way back 20 years ago, 10 years ago, that  
4 decision was made, I do not know. But the class 1-ness of  
5 the other division is the ADS valves. So you operate the  
6 ADS valves and you go back to your --

7           MR. ZUDANS: You lose one of your electric  
8 systems, you lose a HPSI with it, and you have no way of  
9 having high pressure injection. You have to depressurize.  
10 That is the normal procedure.

11           MR. COLBERT: You said if you lose HPSI. That is  
12 not true. You do have RCIC.

13           MR. ZUDANS: No, I think RCIC is not in the same  
14 category. It does not have to be there. It does not have  
15 to survive. In other words, it is a lower quality type of  
16 device and therefore in the case of some postulated  
17 situation it does not have to be there. It cannot be  
18 counted as a backup in your ECCS calculation.

19           MR. COLBERT: That is correct.

20           MR. ZUDANS: Therefore it is not there.

21           MR. KERR: But in real life it is there.

22           MR. ZUDANS: That is right.

23           Now -- and it is a very nice thing to have. I am  
24 wondering, what is the philosophy? Actually, not the  
25 utility, the NRC should tell us why they do not put this in

1 the same --

2 MR. KERR: Tomorrow morning at 8:00 o'clock.

3 (Laughter.)

4 MR. KERR: Okay. Any other questions of Mr.  
5 McKelvey?

6 (No response.)

7 Thank you, sir.

8 MR. LEHNERT: My name is Dan Lehnert, system  
9 engineer, Detroit Edison. And the topic is the Mark I  
10 containment issue. And what I would like to do is briefly  
11 describe the nature of the containment, primary containment  
12 design at Fermi 2, the plant-unique program for resolving  
13 the Mark I containment issue, and identify for you the  
14 results of our implementation efforts.

15 (Slide.)

16 The primary containment at Fermi 2 is a steel  
17 shaped structure designated by GE to be a Mark I  
18 containment. This slide shows the primary containment in an  
19 elevated sectional diagram. As you see here, it being the  
20 drywell, it is an inverted lightbulb shape connected to a  
21 torus-shaped wetwell or suppression pool, and it is  
22 interconnected with the drywell in the suppression pool  
23 between the vent line, vent header, and the downcomers.

24 The original design -- the primary containment was  
25 designed, erected for the ASME section 3 during the early

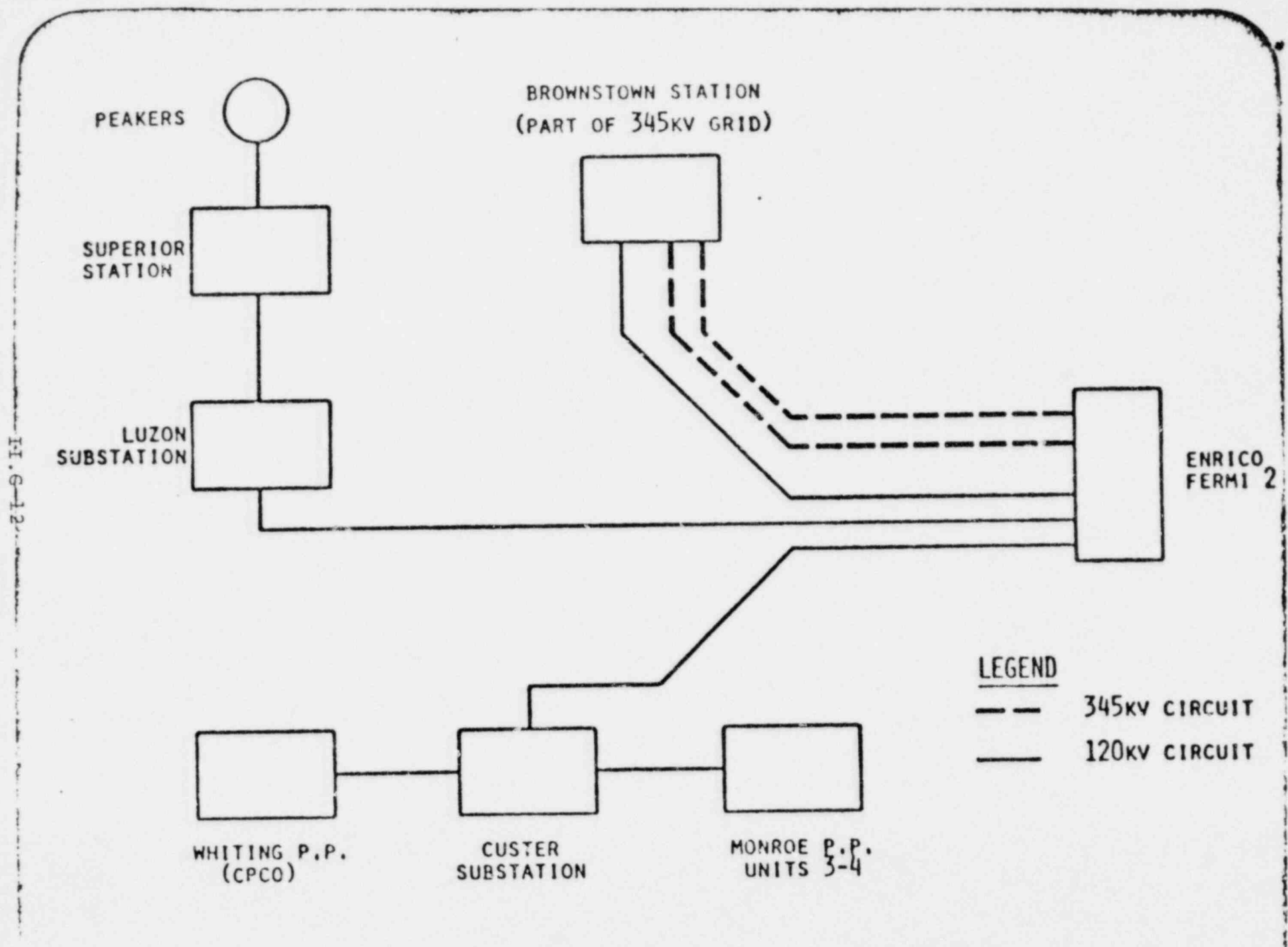


FIG 1 ENRICO FERMI 2 OFFSITE POWER SOURCES

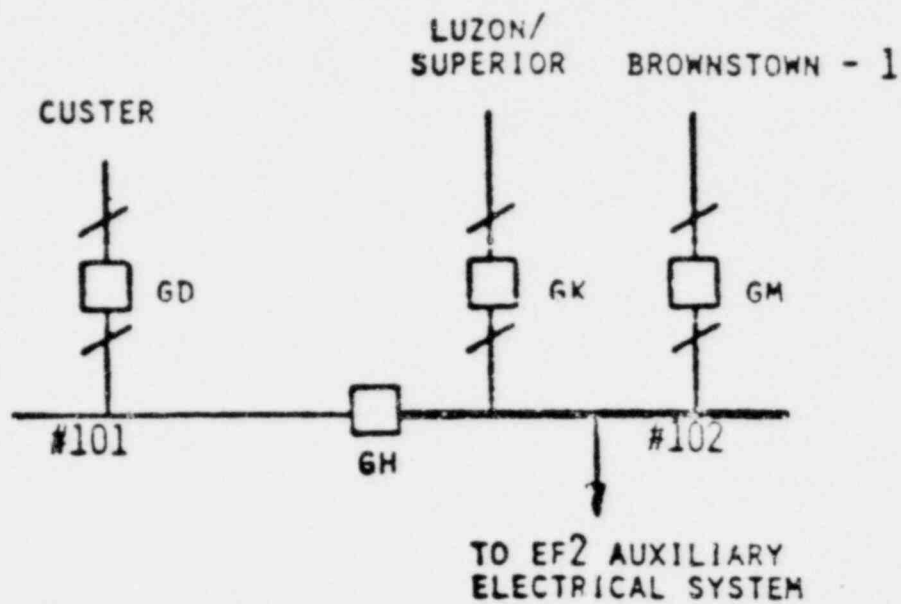


FIG. 2 ENRICO FERMI 1 120KV SWITCHYARD

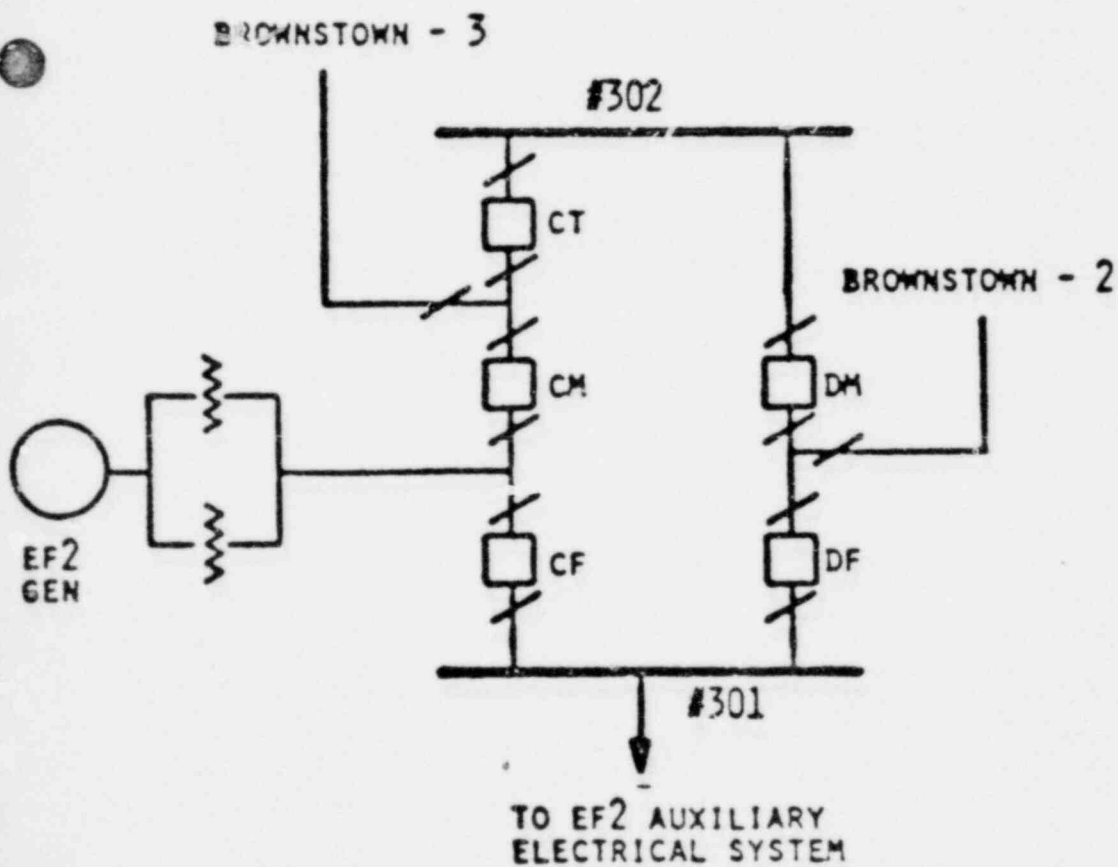


FIG. 3 ENRICO FERMI 2 345KV SWITCHYARD

II, G-13

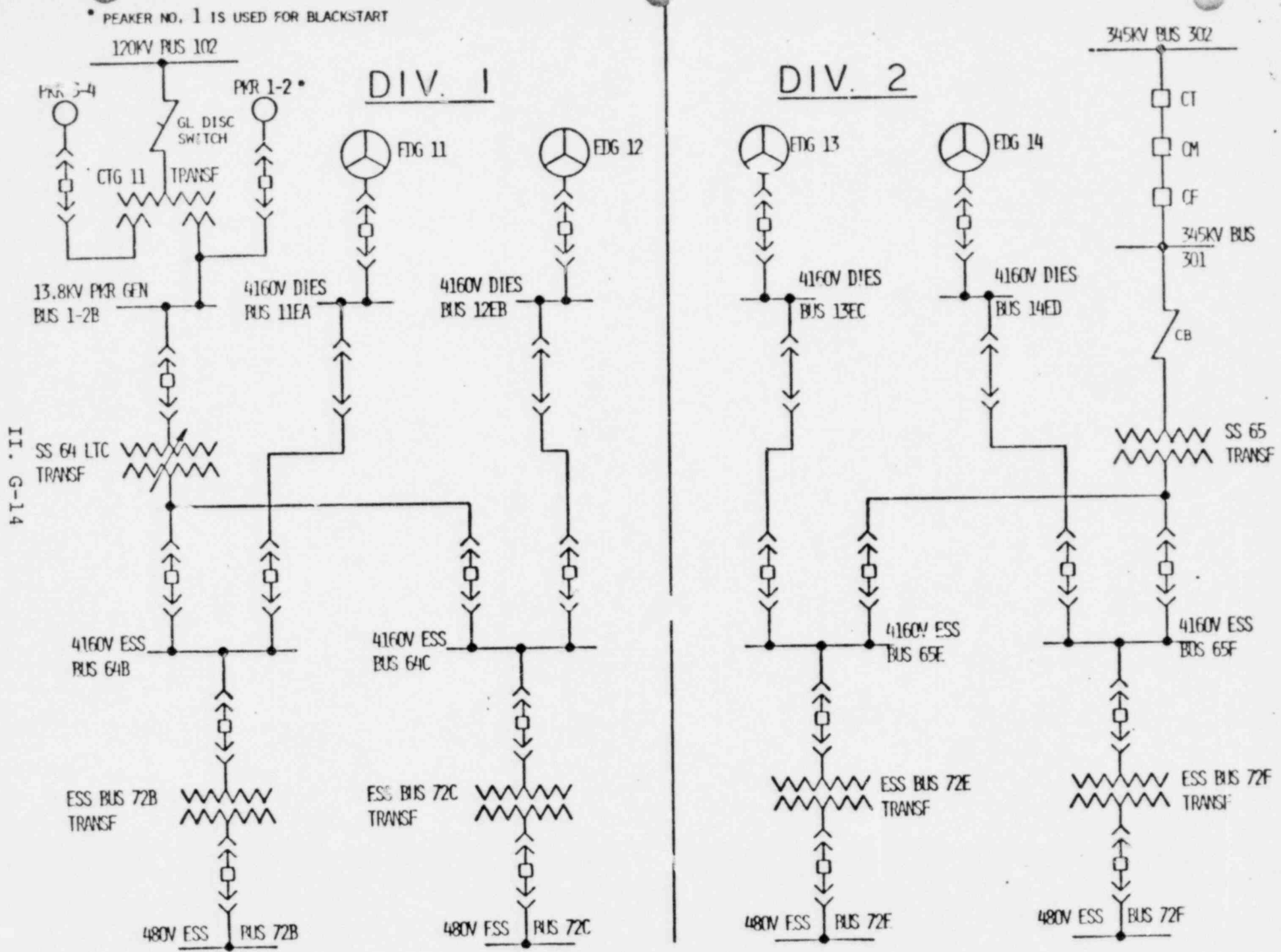
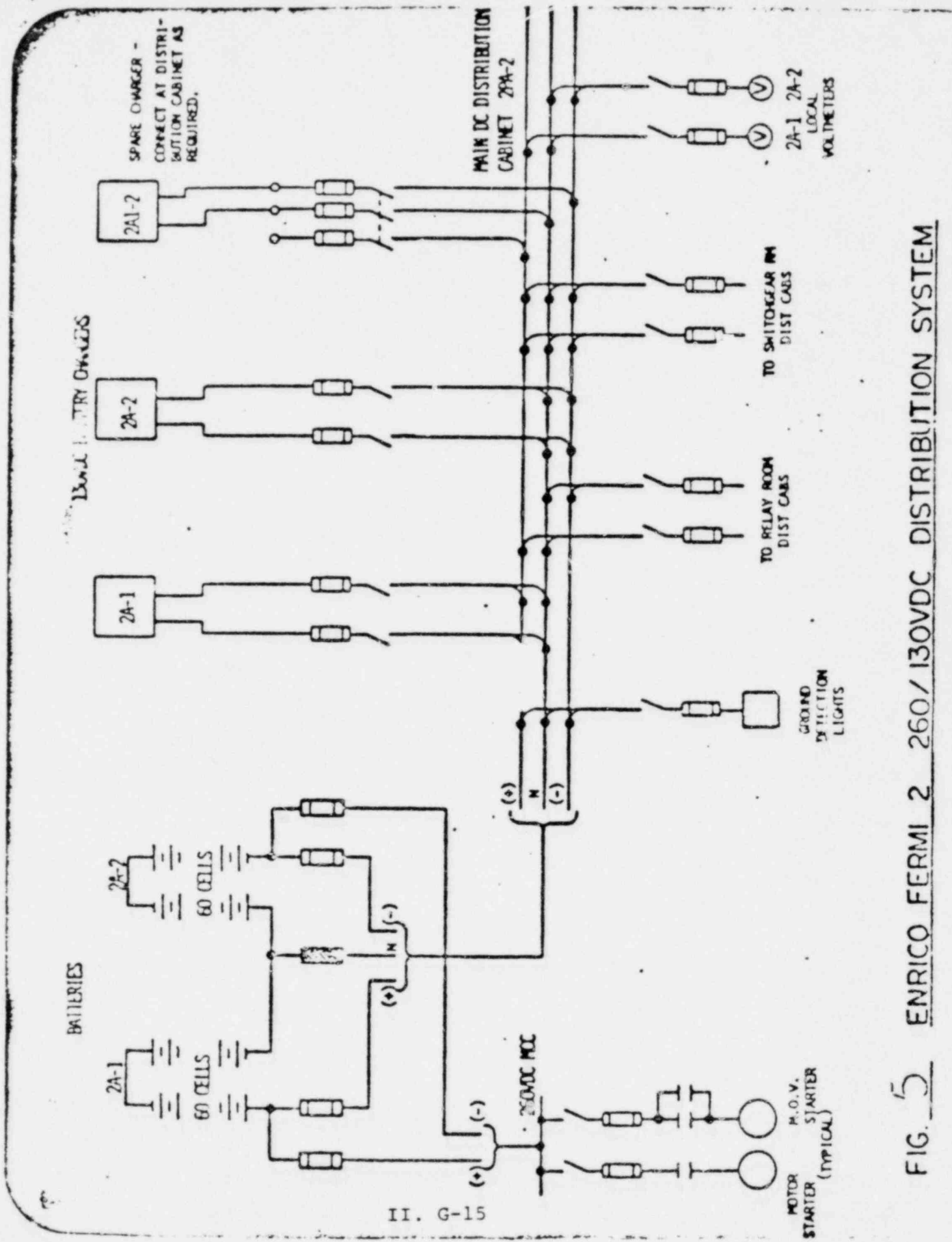


FIG. 4 ENRICO FERMI 2 AUXILIARY ELECTRICAL SYSTEM



II. G-15

FIG. 15 ENRICO FERMI 2 260/130VDC DISTRIBUTION SYSTEM

II. G-16

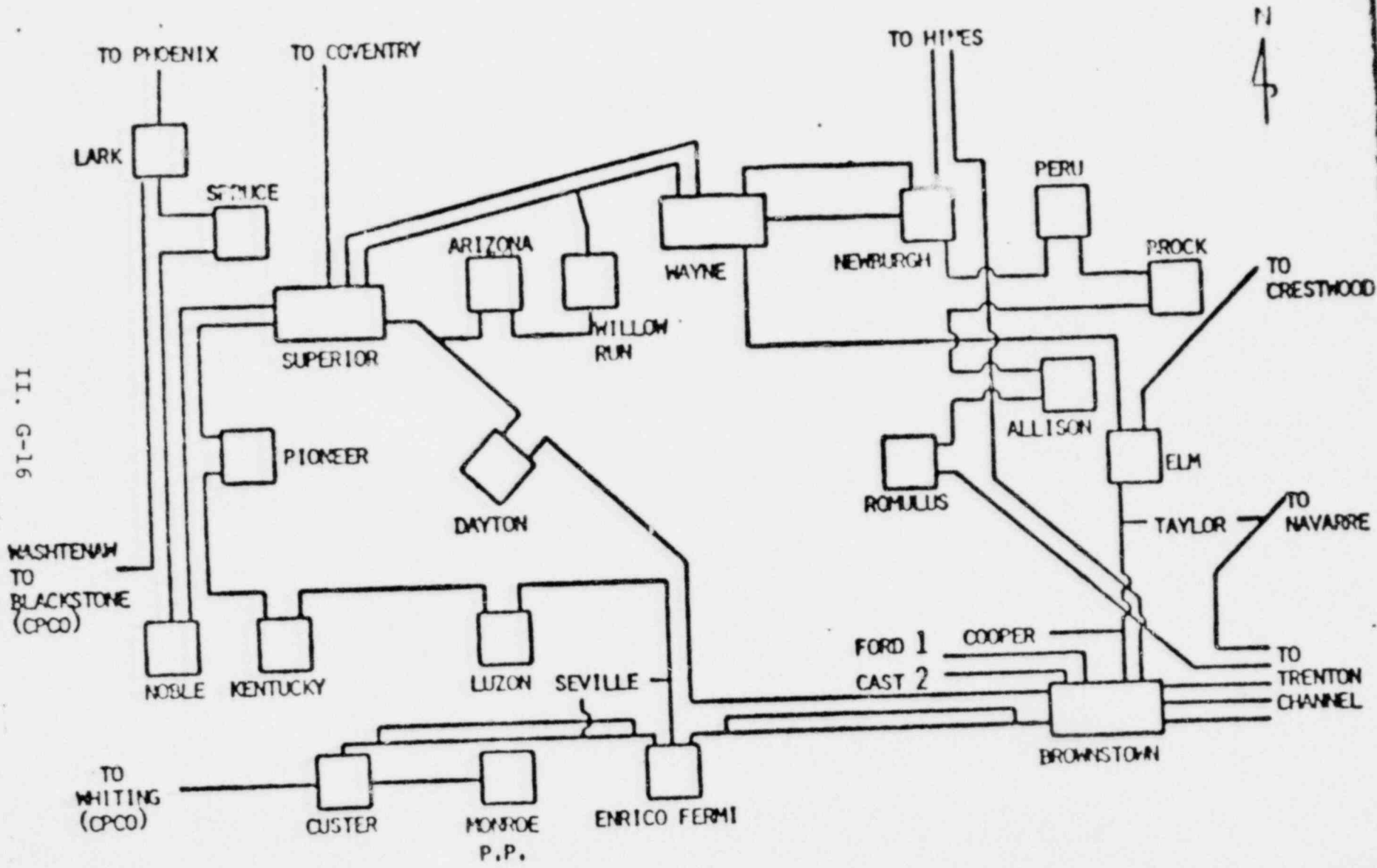


FIG. 6 120KV TRANSMISSION IN 1983 - SOUTH AREA

Visual Products Divis



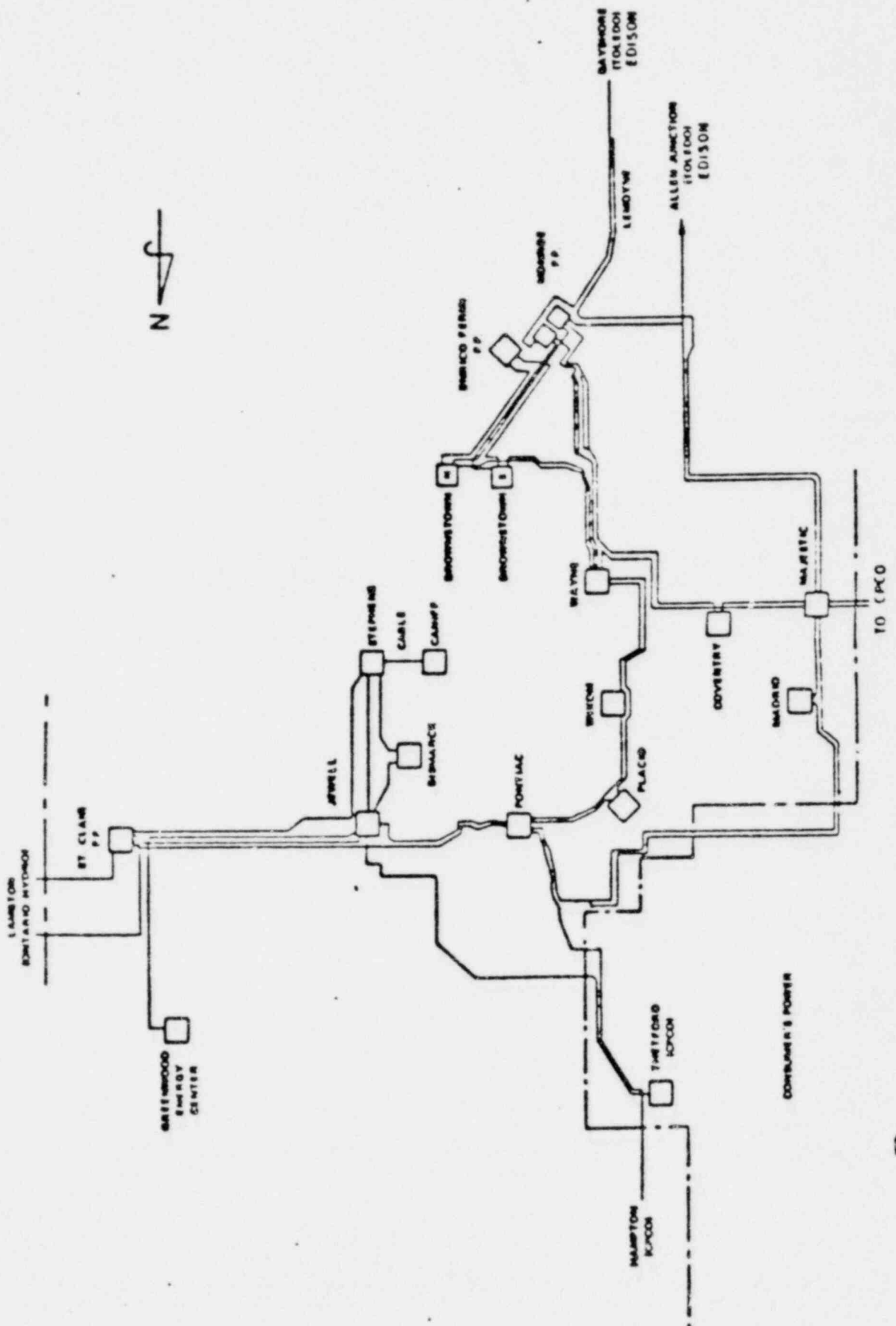


FIG 7 345KV TRANSMISSION IN 1983

II. G-17