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U.S. NUCLEAR REGULATORY COMMISSION

THREE MILE ISLAND
SPECIAL INQUIRY GROUP

TELEPHONE INTERVIEW OF DR. NORBERT ACKERMANN

THURSDAY, OCTOBER 25, 1979

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Interview Transcript

Dr. Norbert Ackermann

President of Technology for Energy Corporation

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Knoxville, Tennessee 37922

This is a transcript of a telephone interview of Dr. Norbert Ackermann conducted by Mr. Hartmut Schierling of the NRC Special Inquiry Group (SIG) on the subject of his participation in and knowledge of the industry support effort to the accident at Three Mile Island Unit 2. The interview was recorded on tape on October 25, 1979. Dr. Ackermann was informed of the contents of the SIG Witness Notification (Enclosure 1). He was informed that the interview was voluntary and that he would be provided with a copy of the interview transcript. The tape recordings of the interview have been placed in the SIG reference system.

Enclosure:
As stated

Summary Interview

Norbert J Ackerman

Technology for Energy Corporation

Knoxville, Tennessee

SCHIERLING: Briefly, let's talk about how your participation in the TMI-2 recovery effort began. You mentioned that you were called by Vic Stello on Tuesday, April 3 in the morning and you don't recall if the call was made by Vic Stello or by Denny Ross.

ACKERMAN: The call to me came from Tony Buhl, who was in Washington at the Crisis Center and he had a direct communications line with Vic Stello and Denny Ross at the site. Vic Stello and Denny Ross had requested for Buhl or Hanauer to get in touch with me and get me up to the site. Buhl called me here and informed me of that and then called Oak Ridge to request that they officially request me as part of the technical services support to them to come to the site.

SCHIERLING: Could you please identify, to the best of your recollection, what the purpose of the call was, why Vic Stello or Denny Ross requested your coming to the site.

ACKERMAN: Do you want me to tell you as Bill told it to me or the first thing that happened when I got to the site? When I got to the site, I went directly to Vic Stello and he told me then what he wanted me to do. Which version?

SCHIERLING: Okay. Why don't we go directly to the site?

ACKERMAN: When I got to the site, I went immediately to Vic Stello's trailer and met with Vic for about an hour and Vic reviewed with me the status

of noise analysis and diagnostic work that was being done and said that he wanted me to go in and look over all the work that Babcock & Wilcox was doing and all the work that other people were doing from noise analysis and diagnostic nature and to report back to him within two days of full understanding of all that was happening and giving my views on the adequacy of what was being done, whether anything else could be done, whether the interpretations that were being made were adequate to bring back / any recommendations of other work that needed to be done to him. So, in essence, the role I played for the first two days was one of looking over what measurements were being done, evaluating from my experience the way it was being done and the interpretations that were being made and what additional measurements and interpretations might be useful or needed.

SCHIERLING: Could you please identify who the people were from B&W that were involved in the diagnostics and also who the other people were that participated in that effort?

ACKERMAN: Okay. I apologize. I intended, when I left the phone yesterday to spend a couple of hours getting all the names put together but, unfortunately, a close friend of mine committed suicide last night.

SCHIERLING: Well, if you can't recall the names, were there other companies involved besides B&W?

ACKERMAN: I've just found it. I was just going through my files. When I arrived on the site, the people from B&W cam from two places: Reactor Diagnostic Services group which consisted of Walt Mercides (?), Bob Kaiser, Paul Mills, Jim Hudzduvitch (?) with Hudzduvitch being the lead manager of that group; and then

from the Lynchburg Research Center, Charlie Mayo, Don Stevens and Alan Morris and Jergen Brawl.

SCHIERLING: Was Paul Perone also one of these people.

ACKERMAN: Now they had a direct telephone communications link to Lynchburg there in the cable room which is right underneath the control room where all the diagnostic measurements were being performed. Paul Perone was in Lynchburg. Perone never came to the site that I know of. He was coordinating the entire B&W support effort there in Lynchburg and was in continuous direct communications with the cable spreading room at the site through this telephone link.

SCHIERLING: Could you please identify what the specific issues and the specific subjects were that these people from B&W were looking at? How did they apply the noise analysis in what areas?

ACKERMAN: Okay. It was an evolving thing as I noted to you yesterday. Their initial investigation focused on the Loose Parts Monitoring System, on the flow pressure and level instrumentation to determine whether there was any anomalies that they could detect relative to the reactor core; basically what they were doing is a technology called Signature analysis or some people call it Noise analysis. What you do is you're looking for fluctuating A-C component of signals and doing Signature analysis of those signals and evaluate what the Sinu, soidal components of those components look like to determine whether there are any characteristic changes in the signals which may represent phenomenological events going on in the core. Now for the Loose Parts Monitoring signal / all they were looking for were impacted signals and that's not direct noise analysis but the other process signals were being investigated using signature analysis. Rather there were pieces, large parts of the core broken loose or falling apart or hanging around, they were investigating, trying to find out whether there was gross boiling or blockages in the core; they were trying to do diag-

question and by cross correlating between signals and doing signature analysis, they tried to figure, tried to interpret phenomena that was going on in the core.

SCHIERLING: This was all done with the flow and pressure instrumentation, in principle.[2]

ACKERMAN: I don't know. Usually in those kinds of circumstances, what you do is you look at all processed variables in a methodical way, you process through all of them. In a situation where the reactor core in shut down like that, 90% of the signals are going to be essentially zero and will contain very little, if any, information content, and so you do a quick gross look at all process signals to find out which signals appear to be responding to some phenomenological events and then you start focusing on those signals. So I'm sure that when they first got there they looked at every signal they could get access to. Through a hit and miss process, they found those signals that appeared to have signal content and began investigating those signals. They had two things they were trying to do -- that is, take information and backtrack to find out what the status of the core was and how it got there.

SCHIERLING: You mentioned that they looked at the signal content to determine what the status of the core was at that time and that they had looked, B&W, at almost any parameters.

ACKERMAN: All the signals that they could gain access to didn't mean they looked at all of them. Unfortunately, we had a very difficult time gaining access to signals because of poor design of this plant and all plants in consideration of post-accident monitoring situation. I think you're going to find that to be a consistent thing with everybody that you talk to. We have not adequately addressed

the issues of post- accident monitoring in nuclear power plants. Very fortunately, in this plant, the utility had decided through associations with B&W to leave installed in the plant a system called the "~~Patrick Handle~~ Patch Panel" system(?). Now in the initial startup of nuclear power plants, the vendor installs a temporary instrumentation access system that allows the access to various safety and other process signals / in a very convenient and/very protected way to provide extraordinary information that you use during startup because you expect to have unexpected transients and trips during that period of time; you want to do post-trip analysis in a very rapid and very efficient fashion to assist you in your startup. Then/they, after the initial power operation, usually take this system out and leave the plant with its standard instrumentation/system which is not specifically designed for extraordinary post-trip analysis kind of access to signals. So here we come in at a post-accident situation which is similar to a post-trip situation startup needing the very same access, very fortunately we did have the patch panel available to us at this plant. Most plants do not have that available.

SCHIERLING: Was that patch panel accessible.

ACKERMAN: Oh yes. Immediately and directly. That's how B&W was able to initially canvass most of the signals, not all of the signals were available on the patch panel but a large fraction of them were, so it made their / job much much easier. Now for those signals that were not on the patch panel, it was an excruciatingly difficult but necessarily difficult process to write procedures for gaining access and then getting approval of those procedures and then getting plant engineers and instrumentation technicians to do the temporary hook-ups to allow you to gain access which is a ~~Rube Goldberg (?)~~ Rube Goldberg approach to trying to get the signals.

SCHIERLING: Was the difficulty because of the radiation hazard?

ACKERMAN: Oh, no. It's purely a procedure and a systems difficulty. These are signals that are hooked in, these are treated as safety systems -- aren't necessarily safety but in the post- accident situation we found ourselves in at Three Mile Island, a lot of processed instrumentation that was not considered safety instrumentation during the post-accident events were treated as safety instrumentation because they became the only channels of information that you could derive confident information from for the mode of operation that we were in. So we evolved to a point where we were relying on some instrumentation that wasn't part of the normal safety system. Now with that what you have is that gaining access to these signals has to be done under a very very refined set of procedures. You have to justify first why you want to have access to that signal, and in most cases, the reason was I want to investigate that signal to find out whether there's any information in it, where there 's a major reluctance to allow access to any signals because unquestionably anytime you allow access to it, you are degrading that channel some small fraction; you are introducing the possibility of damaging that instrumentation channel.

SCHIERLING: Who would authorize the access to a particular channel?

ACKERMAN: It was by the plant operating staff through the normal procedures. You had to write a request for access and a documented procedure of the measurements to be done; then you submitted it to their PORC Committee and then they would review it and approve it or decline it and I was the one that went with the first request; it took about 45 minutes to get the 9 signatures -- this must have been 7 days into the accident. For the first 7 days of the accident, we were restricted to access only the signals available through the patch panel. Then we began wanting to and getting

approval to extend it further and I took the first one through and it took about 45 minutes; over the next week, the bureaucracy set in and it took about 4 days, on the average, to get approval after that.

SCHIERLING: How were you so successful to get it done in 45 minutes?

ACKERMAN: I'm big and strong. I have to be. I was fortunte. I found all 9 people in the same room at the same time.

SCHIERLING: Going back to your activities. First of all you mentioned that you reported back to Vic Stello on your findings and that you made interpretations of what B&W was doing.

ACKERMAN: It wasn't only B&W. By this time, NRC had a crew of consultants also doing noise analysis, they had a crew there from the Oak Ridge National Laboratory.

SCHIERLING: Were they doing the same type of work you were doing?

ACKERMAN: They were doing noise analysis, but they were looking at the thermocouple signals and they were looking at the self-powered neutron detectors.

SCHIERLING: Now that was all work initiated by the NRC.

ACKERMAN: Yes.

SCHIERLING: Do you recall if the licensee, GPU/Met-Ed, had any input to that request to have the people look at the SPND's and the in-core thermocouples?

ACKERMAN: The situation at that point was a very deteriorated situation. Met-Ed had requested, they did not have adequate in-house capability for doing this work. They acknowledged that and they noted they needed help. Vic Stello noted that he had relied enumerous times on the instrumentation and control support from the Oak Ridge National Laboratory and I used to be in charge of that operation; that s

how Vic and I developed our relationship over many years past. But at the time of Three Mile Island, I had left the laboratory and was in private industry; I had been gone for about 3 years but I'm now doing that same kind of work in industry. So Vic called on the people at Oak Ridge who have expert^s and equipment for doing this kind of measurement and did it with the full knowledge of GPU people and I guess it was a tacit request from GPU that we need all the help and advance^d instrumentation and diagnostic work that we can get. So it was just an industry-wide appeal at that time in recognition that the GPU staff is not adequately able, either in capacity, expertise, or equipment for doing this kind of work and we have to go out with an industry-wide appeal for support. Well B&W had thrown all of their capabilities into it but there was need for considerable more. So I guess on the 8th day after the accident is when the people from Oak Ridge, the people from my company, some people from Combustion Engineering, from General Electric Company.

SCHIERLING: Westinghouse?

ACKERMAN: We didn't have anybody from Westinghouse for the instrumentation done activities. It just turned out that way. The kinds of activities that were being called for just didn't include them.

SCHIERLING: Well I just thought you mentioned the other 3 NSSS vendors.

ACKERMAN: What was called on were people who had special expertise in equipment that was available; there was from Arkansas Power & Light Company an individual that was called in because of a special expertise and a familiarity with the particular instrumentation channels that were there. The individual from Science Application, Inc., Gil Ziegler, was also called in and, in some cases, they were called in by NRC directly, and in other cases, they were called in by GPU directly; in other

cases they were called in by the Industry Advisory Group through/ Milt Levenson.

SCHIERLING: So the entire diagnostic effort that eventually became one of the more important aspects, it seems to me started to develop at about Monday, Tuesday and then continuously increase in size and scope.

ACKERMAN: No. I think it's fair to say it started Friday when B&W sent their Reactor Diagnostics Services team. On Saturday, NRC had one consultant in, G. Ziegler, and Pittsburgh Research Center sent two more people in, Don Stevens and Charlie Mayo. So it just continues to grow from there. On Tuesday, I came in, another person from my firm came in and 3 people from Oak Ridge National Laboratory came in. By Thursday, another 10 people came in,

SCHIERLING: You mentioned earlier that you reported back to Vic Stello on your findings of the first two days. I don't think, if indeed, you were able to spend the first two days and then report back

ACKERMAN: No. I reported back every 12 hours.

SCHIERLING: As a result of that, what were changes, if any, that were made in increasing the diagnostic effort? What were your personal recommendations where additional effort should be expended?

ACKERMAN: The first thing I recommended was that the entire operation had to be organized under a single coordinator that had to get a solid focus and communications chain set up.

SCHIERLING: Among all t people involved in that work.

ACKERMAN: Reactor diagnostics and services work, yes.

SCHIERLING: And you probably were assigned that leadership role, is that correct?

ACKERMAN: Yes. I can't remember what day it was but the next morning the

management group met and I don't think there was any question that it was needed to be done and somebody needed to step forward and start it and I was assigned whatever they called the coordinator for the special instrumentation group. I was to report jointly through Vic Stello and the Industry Advisory Group.

SCHIERLING: I see. You meant that there was a management meeting, I would say that would be on Wednesday morning, then.

ACKERMAN: Well I got a letter here. If I can find the letter, I can back-track from the date. They sent a letter out the next day announcing the selection. April 8th is when the letter went out and so it occurred on the 6th, I guess. It took about 2 days to get the letter typed and all that stuff so April 6th was when it was finally implemented.

SCHIERLING: Would it be possible for me to obtain a copy of that letter?

ACKERMAN: Sure.

SCHIERLING: I assume it is your appointment to coordinate that effort.

ACKERMAN: Yes. In fact there's two letters. What it is there's a letter from Bob Arnold to Milt Levenson on April 7 and that's the acknowledgement of the setup. Then on the 8th, Levenson sent out a letter to all the Industry Advisory Group people.

SCHIERLING: Now let me have the organization at least to some degree identified. What were the major efforts that you were involved in with the diagnostics work? You mentioned the SPND's before there were in-core thermocouples. Can you elaborate on that, the purpose of it and how it was?

ACKERMAN: Let me give you the broad purpose of our operation, talking about each individual channel. Our responsibilities were to continue the diagnostics work

in support of defining the status of the reactor core, the primary system and the secondary system. By this time we were using all methods of signal analysis, not just noise analysis but noise analysis was a major part of it and we were using perturbation testing techniques; we were using time series analysis, noise analysis, trent analysis, and every kind of measurement technique we had available that could give us some kind of indication of the health of the status of the reactor core and the primary system and secondary system.

SCHIERLING: And also equipment status.

ACKERMAN: Responsibility was to do diagnostics on the instrumentation itself -- that is, the instrumentation channels as to the health status of that channel. Could you truly believe the temperature readings that were coming from the thermocouples? What kind of failure modes might you be anticipating. could you give them an early warning signal that a certain instrumentation channel was beginning to fail? One of the problems that we had was that we recognized a week into the accident that it was going to be a long-term process of continuing like that and as you then recognize that the instrumentation channel had received a significant insult through the accident -- they were irradiated, they had a much higher radiation dose than their design life may have called for, they certainly had a lot of them under water, a lot of them had certainly moisture in them. What could we expect in the next few weeks as to the continued performance for the instrumentation channels. The third thing was as we encountered instrumentation failures, what could we do in reaction to it? Could we repair them, were there other modes of operation that we could get in with that particular piece of instrumentation or minor modifications to it that could still support what we were trying to do or were there alternate measurement techniques or measurement systems that we could use. One of the things that we spent a lot of time was trying to come up with other ways of making level measurements in the pressurizer and those sorts of things.

ACKERMAN: The ~~Board's~~ Group's responsibility that grew to be really burdensome was the collection, collating and cataloging of all the data that had been generated and preserving it so that in tasks like your and research and support activities afterwards would have a qualified body of data to work with. So it was going back and taking data that was generated on the fly in a very emergency situation and trying to make that it was documented properly, that it was confirmed adequately, and getting it into the archives so that it could be retrieved and utilized in the proper way by the investigating teams later on.

SCHIERLING: Does that body of information exist and, if so, when did you forward, who requested it?

ACKERMAN: The management team early, I guess it was around the 6th, the 5th or the 4th set up a data repository center under Bob Long for GPU/Met-Ed. All data that was generated by any operation was to have the originals sent to Bob Long in his trailer, Trailer City. That became one of my responsibilities -- to see that at the end of each 12-hour shift, the Shift Supervisor collected all of the data and sent it to Bob Long.

SCHIERLING: Do you recall how your resolving recommendations -- you mentioned before that you forwarded them to the IAG under Milt Levenson and that you also reported to Vic Stello?

ACKERMAN: After about another 4 or 5 days, my role evolved to officially reporting through Milt Levenson in the Industry Advisory Group and my channel through Stello stopped.

SCHIERLING: Would you recall how your recommendations were incorporated not so much in the IAG but ultimately I think it was in the Technical Working Group under Bob Arnold? What steps were taken as a result of your recommendations?

ACKERMAN: I attended the Technical Working Group's meetings.

SCHIERLING: Everyday?

ACKERMAN: No. Only when there was something of consequence from the instrumentation area. Otherwise, I'd spend all my time attending meetings and getting no work done. Anytime there was anything of consequence there to request or to report on, I attended with Levenson. Do you want to know how it was done or instances?

SCHIERLING: In particular, I would be interested in if there were any difficulties if you had recommendations -- were they indeed implemented or was there any reluctance on anybody's part to listen to your recommendations?

ACKERMAN: Oh there was tremendous inertia in the beginning because of having the GPU staff and the Met-Ed staff exhausted, demoralized and I guess they were just overwhelmed and overburdened with first, having to carry the task mostly on their back for the first few days and then trying to respond adequately to this massive response that was moving in on them. So you're going to go through a period of time where since this was not a well-planned, well-thought out recovery operation, there was not a good post-accident plan to follow, you didn't know who was in charge or anything and that filtered down all the way across the board so that when I arrived on site, the GPU and Met-Ed people, who we had to interface with, were just absolutely exhausted, overburdened and overwhelmed, and then here we come in adding additional burden trying to get plugged into the operation. And so that even taxed it further, so it took about a week to get through that. So it was a very difficult process of first gaining access to the people -- I couldn't do anything new, couldn't change anything unless I had approval and support of either Ivan Porter or John Brummer, who were the two chief engineers from the instrumentation side for the operations staff.

SCHIERLING: And they were at the site -- no, on-site.

ACKERMAN: They were at the site but by the time I arrived, they were totally overburdened by responsibilities of having to write and review procedures, because they were having to make up for not having adequate procedures prepared for response to the accident situation. Consequently, they were unavailable for the other things that they were badly needed for.

SCHIERLING: Could we stop here for a moment and just check the tape to see if things are working okay?

SCHIERLING: Okay. We can go again.

ACKERMAN: This is not a direct criticism of any individual, it's basically a criticism of the whole industry and operation and that you are not adequately planning for a post-accident situation and we paid the price in that first 10 days of recovering from that.

SCHIERLING: Well, I think that that's why it is so important for us now to talk to some of the people that were intimately involved very early in the event. Can you recall, identify for me the major activities that you were involved in, the major recommendations you came up with, and how they did indeed impact on the recovery of the TMI plant?

SCHIERLING: Let me ask you this before we go into that. Did you prepare, subsequent to your participation there, any kind of a report on your activities, did you take any notes?

ACKERMAN: All of our activities were reported on the site at the time and were submitted to the GPU archives center. All activities of the special instrumentation group from April 10 on were reported on daily and also topically.

SCHIERLING: By report?

ACKERMAN: By progress report daily, and as a particular area of work was completed, a topical report summarizing the entire extent of the investigation was written.

SCHIERLING: Would you have a summary listing? Very very many reports had been written and I just would like to go and look at those that you deem to be most important to your activities. Can you identify those?

ACKERMAN: I'll have to go and get them out of my file.

SCHIERLING: Would you have a summary listing of those reports?

ACKERMAN: There's a Table of Contents of all of them. All of these were compiled into the report of the Industry Advisory Group. I haven't seen it but I've been told that it exist.

SCHIERLING: I'm not aware that it does exist. This is the first time I've heard about it.

ACKERMAN: I've got a summary listing as of 4/22/79. This is a compilation of all the individual reports.

SCHIERLING: I'm aware of that compendium.

ACKERMAN: Well that's all I've got. EPRI ~~ENSAC~~ has prepared a very detailed sequence of events report that used a lot of information that came from the reports that my group generated.

SCHIERLING: Is that the EPRI Report?you're referring to?

ACKERMAN: That is the only one that where I know that data that we generated or compiled has been taken and investigated in greater detail, summarized and documented. Now in that case, it was data that we were really asked after the fact to

go back and retrieve and qualify as best as we could. That was a major effort that we kept having to pick up.

SCHIERLING: That was a request that was made to you and other people involved in the diagnostics work by the EPRI Group?

ACKERMAN: No. It came from the Technical Working Group.

SCHIERLING: Probably the end of May or sometime?

ACKERMAN: Oh no. It was in mid-April. They recognized then the value of this central repository of data that was being set up with Bob Long; and I came in and said if all we do is send raw data in to Bob Long, we're not doing our jobs rights because we're going to have hundreds of man-years of work in the next year going to be spent on investigating this data that's going in there; if we don't qualify it now as we're sending it in and backtrack as best we can now the data that's already there so that we can have quality and confidence in the data that we're using, then we're not doing our job right. At that point, the request was made that we do devote significant amount of time and effort to making sure that certainly any data in the future that was taken was taken with a great deal of care and documentation.

SCHIERLING: Could we go back again to the major issues that you look at? I'm aware, for example, of the work that was done by, some degree I'm aware of it, Paul Perone using diagnostic methods to determine the state of the bubble in the reactor vessel. I understand there was another activity initiated by Ed Zebroski; I think he requested you to do noise analysis on in-core thermocouples to determine

if there still was any boiling in the core the first week after the accident.

ACKERMAN: This had already been going on and Ed asked that we go back and do some more. We had already done a complete task of thermocouple noise analysis under Vic Stello's request.

SCHIERLING: That must have been very early.

ACKERMAN: On Tuesday. When Vic Stello called me in he also called the Oak Ridge people in and his charge to the Oak Ridge people was to go and look at the thermocouple signals and tell me what we know about them because it became evident that the thermocouple signals were going to be important for a long time, afterwards and he wanted as much investigation of those signals to be done as possible. THere's where we ran into our first big difficulty. The thermocouple signals were not available at the patch panel and so the only access that we could gain to the thermocouple signals was to actually go into the instrumentation panels and hook leads into them.

SCHIERLING: Is that the effort that ultimately led then to a continuous read-out of the TC ?

ACKERMAN: No. This was for noise analysis only. The thermocouples were hooked up and the only way you could read the thermocouples out regularly was through the plant computer system so they had a wholly inadequate method for continuous monitoring of the thermocouples. They were there for a physics investigation of the fuel only. We began using them as a process monitor and we didn't have an adequate means for using them in that method. So that was one of my recommendations, we as rapidly as

possible evolve to a mechanism where we could adequately monitor them from a process standpoint.

SCHIERLING: As a constant readout?

ACKERMAN: That's right. That was one of my greatest frustrations -- difficulty in getting that implemented.

SCHIERLING: Could you elaborate on that a little bit, the cause for these frustrations? Was it purely bureaucratic or was there a safety concern?

ACKERMAN: No. It wasn't safety, it was a bureaucracy and a procedures and an equipment availability and/a technic then / ian availability and just a monumental job of having to hook a whole lot of leads up in a very small space. The access to the signals was extremely difficult.

SCHIERLING: Whom can you attribute that difficulty to? Was it the licensee, GPU/Met-Ed, and I assume that they didn't have the people available to do that work. But talking about the bureaucracy, was it the internal bureaucracy or was it imposed on GPU?

ACKERMAN: By this time, we're talking about 2 weeks into the accident. We reverberated to a very bureaucratic state where everybody was afraid to do anything because of the tremendous amount of scrutiny that everybody wa receiving. You had so much overlap in review of every decision that was made; each decision was massaged so much before any collective decision could be made.

SCHIERLING: Can you elaborate what the cause of that may have been? This reluctance on proceeding on a more expeditious schedule? You mentioned that there was reluctance -- on whose part, was it recovery organization under GPU and what

was the reluctance that they didn't have the concurrence by the NRC or was it initiated by the NRC?

ACKERMAN: I guess the decision to go to continuous monitoring came fairly rapidly, so if you're talking the decision process at the NRC level, at the GPU Bob Arnold level, Jack Herbein level came very rapidly. That wasn't a difficulty. Implementation was the difficulty - - getting the proper procedures written, finding first off, the adequate instrumentation was not available to do it; so we had to go out, find a vendor who had the equipment to support us and so we started down one path. Let me back up. There were two concerns that we were addressing. One concern was we're going to be in this long-term cooldown mode and if everything works the way we expect it to be, eventually around early May we will eventually take it to natural circulation or maybe as late as early June. We need to have a method for continuously monitoring the thermocouples during the long-term cooldown, But most importantly at the time we go to natural circulation. We wanted to be able to have real-time monitoring capability during that critical period of time. The thermocouples were going to be the only instruments that were really going to be telling us the status of the in-core situation.

SCHIERLING: So you definitely had to need the instant readout when you did switch over to natural circulation.

ACKERMAN: That's right. That's the first concern, was under the assumption that everything's going to go smoothly and we're going to do it when we want to do it. My greatest concern was what happens if something fails tonight and we're forced to go to natural circulation prematurely or we go to some other mode of operation that we don't even know what it's going to be yet -- that is, the unforeseen circumstances. We need to have a continuous monitoring during that crisis period. We didn't have that at all. So what I instituted immediately was a method for at least looking at some of the channels in the short term.

ACKERMAN: What I tried to do was to get at least some of the thermocouples monitored in real-time by strip chart recording immediately. Then do the long-term in sequence to that afterwards. There was a bureaucratic problem. Obviously you wanted to have the hottest thermocouples monitored for the crisis but there was a significant reluctance to allow access to the hottest thermocouples signals because, as I noted to you, it involved having to clip leads into the system channel and there is a finite chance, non-zero, that it might damage the channel. So I could not get approval from NRC and GPU management to gain access to the signals that I actually had to have access to. So there was a bureaucratic reluctance at the top level to do what I felt was necessary and it took about 3 days to get through that problem.

SCHIERLING: What arguments were you able to put forth to finally resolve it?

ACKERMAN: I just asked them what were you going to do if you all of a sudden found out your both pumps died and we go to natural circulation whether we wanted to or not. What were you going to look at? As that thought sat there for awhile, they recognized eventually that they better have a continuous readout of those signals. So we gained access to them so I set up strip chart recordings of those signals.

SCHIERLING: You mentioned earlier that you had difficulty in obtaining the proper, what was it, the recording?

ACKERMAN: What we had coming from the thermocouples was a very low level voltage signal and what we needed was a means of providing a high gain to that voltage signal and very low noise amplifier.

SCHIERLING: And you needed for all of the thermocouples?

ACKERMAN: That's right. And we had some laboratory instrumentation that

would allow us to do that with a few channels and that's what I wanted to set up with the strip chart recorders for the critical channels that I thought might be needed in case of a crisis and place on order , now there's another problem with that. This gives a voltage reading not a temperature reading. You don't have a direct calibration in your channel that would allow you to read out directly in voltage.

SCHIERLING: What are these in-core thermocouples?

ACKERMAN: They're chromel-alumel thermocouples, had readings in the low millivolt range. In order to get a readout that read degrees fahrenheit what you had to do was to gain the signal up and then send it through a signal calibrator that then converted it to degrees fahrenheit.

SCHIERLING: Where did you ultimately get the equipment from?

ACKERMAN: I don't even remember who. The GPU purchasing department took care of that and there was difficulty in getting the proper instrumentation available. That's not standard off-the-shelf instrumentation that 20 different suppliers will provide. So we got 12 instruments in in a few days time and we got the other 36-40 channels 3 to 4 days later, then the problem that you got to was in order to hook up the signals, you had to gain access to the instrument clip leads there in the cable room. Again, we had to come to the decision of were we going to worry about the short term crisis and get set up to handle that more adequately and then worry about the long term move to natural circulation or go directly to get ready for long-term natural circulation. The instrumentation was set up for the short term crisis and then we calling for an orderly move to the long term cooldown mode with the intention of not disturbing the short term crisis potential. Jack Herbein came to visit the cable room and got very concerned that the readouts in the short-term crisis were going to be down in the cable room not up in the control room. He was very

unhappy with that and insisted that the readouts be in the control room immediately, that he wanted it immediately accessible to the operators.

SCHIERLING: For the short term crisis situation?

ACKERMAN: He did not have to rely on the operator with telephone communications down to the cable room. He instructed the instrumentation technicians to convert that system up to the control room. That added an additional burden of time to mainly just access to where the signals were. It wasn't that we didn't have enough manpower -- it would have been a problem but one we could handle. There was just not enough space to be able to get your hands and arms into to be able to hook and unhook quickly. Consequently, that added about 2 days of delay in getting the rest of the system implemented.

SCHIERLING: And we're still talking only about short term emergency instrumentation.

ACKERMAN: What that did was that it disrupted temporarily the short-term monitoring capability down in the cable room in order to bring it up to the control room. So there was a period of time when that information was not available because of that change. Then, in addition to that, that change created in a couple of days delay in the ability to get the long term system implemented.

SCHIERLING: We have been talking extensively about the thermocouples. What were other parameters that you were monitoring and how were they used? Before we talked about the flow measurements, pressure measurements, was there anything else and how were they used?

ACKERMAN: The Loose Parts Monitoring System was extremely valuable in confirming that we did not have loose parts. It allowed us to throw out large numbers of conjectures of what might be the status of the core. In a lot of cases, that's what this instrumentation investigation provided -- a means to prove that hypotheses weren't

true.

SCHIERLING: I thought there was a concept that the core was in a deteriorated state and wouldn't you pick up loose parts there?

ACKERMAN: We heard small tinging noises, there were very small parts. We were able to confirm that they were not major pieces of metallic structure banging around.

SCHIERLING: Was that information in anyway helpful to deduce anything regarding the status of the core -- the Loose Parts Monitoring System?

ACKERMAN: Yes, in the sense that we could confirm that it wasn't all distributed around the bottom of the vessel. We never detected large amounts of loose parts down around the vessel, so consequently that supported the assumption that the core is still in its original structure, that the core integrity is still there, that the upper portions may be in particles and may be considerably disruptive in the sense that it's kind of sunk in a little bit, but it's still being supported principally by the channels -- not redistributed around the bottom of the core.

SCHIERLING: Is there any additional information that you can provide us with regarding the difficulties that you encountered in performing your work. You mentioned already some of the bureaucratic difficulties you ran into and in general, the state of confusion. Again, I'm interested in where you had particular recommendation and had difficulty in having either GPU, NRC or someone listen to you and act according to your recommendation. Do you have anything to add to that?

ACKERMAN: The only real difficulty that I had was in the first 5 days -- the lack of organization that existed totally because there was wholeheartedly an inadequate plan for handling a post-accident situation. There was no defined organization, certainly there were completely inadequate support services, was a tremendous contributor to the inefficiencies of the operation. Telephone communications -- that plant

had the worse telephone communications systems I've ever encountered in an operating plant. There just wasn't enough telephone lines in and out of the plant and there wasn't enough telephone extensions throughout the plant. There was only one telephone line in the cable room and that telephone line was taken over by B&W RDS to provide a direct link back to Lynchburg. I don't discount that that shouldn't have been done but that then eliminated any telephone communications in that cable room and the cable room was generating some of the most relevant and at sometimes the most critical data about the status of the core. The only way we could have communications was through the in-plant PA system up to the control room or to run up to some other place where a telephone existed to be able to make a telephone call to get information in or to get information out. It took me 7 days to get another telephone line into that room. Now that was one of my biggest frustrations -- the inability to get a second telephone line.

SCHIERLING: Whom did you report to in your activities? You mentioned before it was directly to the IAG to Milt Levenson. Wasn't that a line of communication that was available to you? I mean in general communication and organization.

ACKERMAN: That wasn't existing for the first 5 days that I was there, in terms of how it was being implemented and so forth. When I was made special instrumentation group coordinator then the communications lines were straightened out and there weren't any problems. That's why that move was made.

SCHIERLING: You were identified as a specific element within the IAG.

ACKERMAN: That's right.

SCHIERLING: Once that had been done, things did work better.

ACKERMAN: Yes. It also coincided with the time that the GPU/Met-Ed staff was beginning to recover from their exhaustion and the overwhelming workload of all the procedure writing and review that they had to do and then were able to get back to paying attention to more of the engineering work. So I gained much better access to Ivan Porter and John Brunner and they were able to do their regular jobs now instead of having the procedures work they were having to do. There was a major problem in the early stages of the accident. For the first 3 days, John who was the most knowledgeable person of the instrumentation on TMI-2 was pulled out of TMI-2 and sent to handle communications, external communications, of a technical nature, over in central operations office. So I believe that that was a crucial move for creating tremendous inefficiencies in the plant for doing the engineering work that needed to be done.

SCHIERLING: When was he pulled off?

ACKERMAN: Friday morning and was not back available to the plant until about Tuesday or Wednesday and then again when he was made available, it was in the role of procedures writing and procedures reviewing. So the critical engineering staff were unavailable to a great extent to support the support operations that were going on because they were having to make up for the inadequacies in the procedures area.

SCHIERLING: Did you identify that problem when you arrived at the site?

ACKERMAN: It took me 3 days to realize what the problem was. It was both a case of exhaustion of the individuals. These men had been through a very very trying 4 of 5 day period of time and really needed a day or two off just to recuperate.

SCHIERLING: Is there anything else that you like to add or areas that we haven't covered that you think you should be addressed?

ACKERMAN: In the instrumentation area, there's no question that a much better logistics support will have to be planned for any future accident recovery situations. In addition to just the general planning of who's going to be responsible for what communication links, both the official channels of communication and the mechanism of communications (telephone, etc.),the area of logistics and instrumentation availability of experts instantaneously and also specialized equipment instantaneously and coordination of efforts requires a tremendous amount of planning from a logistics standpoing, that is, transportation (United Airlines on strike and a truck strike at that time) -- this created a tremendous problem in being able to get specialized equipment from point A to point B. We gained access to charter flights very readily and that helped an awfully lot.

SCHIERLING: Probably that supplier from whom you requested that equipment did not have such an immediate access to it?

ACKERMAN: I'm talking about laboratory equipment. It is going to have to be a better mechanism for gaining access to special signal conditioning instrumentation and signal processing instrumentation that can be dedicated to a diagnostic service operation such as this. We were having to rely on finding equipment -- many times this equipment was obligated for other things and we had to piece it around schedules, just the logistics of access to equipment. Then getting the equipment on site, operating and then when a piece of equipment breaks, having to get replacement parts or replacement components.

SCHIERLING: Well, would you expect that an individual utility would have cognizance of the existence of all that information?

ACKERMAN: That's something that going to have to be done on an industry-wide basis to provide this available on-call in a pooled effort. There's no question that this sort of thing cannot be provided by individual utilities. It's not the

sort the thing that they're competent in doing or that they will maintain the equipment to where it will be ready to go. And in a lot of cases you're not going to be able to identify what kind of equipment is going to be necessary so you are still going to have to rely on on-call utilization of specialized equipment from laboratories or from researchers as you identify a particular measurement that needs to be done. I think an awful lot of planning can go into getting you ready to respond better than what we found ourselves in at Three Mile Island.

SCHIERLING: Again, with only that few people in the forefront of a particular area, you would expect that this effort would be provided by some kind of an organization instead of a utility.

ACKERMAN: Oh yes. No doubt about it. I think that what the industry and NRC are going to have to do is to tax themselves adequately and regularly to provide a reserve capacity always alert to the fact that I may have to have that instrumentation instantaneously on-call and dedicated for several months to a recovery operation. And address it and have it already identified and have the organization that has that equipment tcontinually on alert in maintaining the equipment, both in availability and in its calibration and operability status.

SCHIERLING: Is there anything else that you can think of that you would like to add?

ACKERMAN: Yes. I think in the area of access to signals at the plant for instrumentation.

SCHIERLING: You were fortunate this time?

ACKERMAN: Well we still needed to be a lot better off but we really need to recognize how fortunate we were that they did have the remnants of that system still available. There are a lot of plants where that's not available and a lot of the things that we were able to do could not have been done, certainly in the time frame

that we did. This is something that is going to have to be really looked at, in an emergency situation, how do you gain access to the signals, maybe not in all cases where you have a separate patch in panel available to you, but certainly you will procedures already written and plant personnel already primed for interfacing with the specialized measurement people. You're always going to have to recognize that in an emergency situation you're going to be relying on complete strangers coming into the plant, not necessarily complete strangers but people who are not regularly in that plant all the time coming in and having to gain rapid access to these signals. You're going to have procedures and plant personnel already primed and ready for this kind of interfacing effort.

SCHIERLING: Based on your experience at TMI, do you recall any instances where you had difficulty communicating or working together with the GPU people with the plant staff?

ACKERMAN: Oh, yes.

SCHIERLING: As far as reluctance is concerned.

ACKERMAN: There was no reluctance. The whole problem in communications was one of arriving and finding a staff that was tremendously exhausted both mentally and physically. They were tremendously overwhelmed with the task that they were faced with and in the area of special instrumentation, they were overwhelmed with the technology that they were having to interface with. Added on top of that was the key instrumentation people were not available; they were off having to make up for things that hadn't been done previously, i.e., the proper procedure preparation for the accident situation. So all of that created a situation where the plant staff was just not able to respond adequately to our needs in the first 3 days that I was there. As soon as they got out from under the overwhelming effects of the physical and mental exhaustion and out from under the burden of procedure

writing and reviewing they responded very well, no question about it. I am confident that given that if they did not have those problems facing them 5 days prior, when I first arrived, we would have interfaced very well. It was a very very difficult period living through that period of time where they were able to get out from under that exhaustion and burden of work.

SCHIERLING: Do you think that other people, technicians from the outside, could have assisted GPU in their work if they had been called in? I think you're talking about the individuals that were totally exhausted were GPU principally technician people.

ACKERMAN: No. These individuals were engineers. In a lot of cases, the technicians sat around idle because they didn't have their engineering staff available to instruct them on what they were supposed to be doing.

SCHIERLING: Do you think engineers from other facilities could have assisted GPU in taking some of the load off their shoulders?

ACKERMAN: No. I think the problems they were faced with were things that have to be taken care through planning ahead of time.

SCHIERLING: Is it primarily that the engineering staff which GPU had was misused by GPU?

ACKERMAN: Oh, no. I don't want to leave that impression. Given that the procedures did not exist, there's no qeustion they had to get the procedures written and reviewed by those engineers. They were the only people in the plant who had the adequate knowledge to do it. They made the right decision, the mistake that was made was inadequate planning for the accident ahead of time because those procedures should have been written 2 years or 3 years before the plant went into operation.

SCHIERLING: Now back again, do you think that if these engineers, GPU engineers, had had available to them or if they had been supplemented by their counterparts from other nuclear power plants would that have helped?

ACKERMAN: Yes. And it did happen. By Tuesday or Wednesday, Duke Power brought in, I know, quite a few people who were counterparts from the Oconee plants and they took over a lot of the procedures activities. Babcock & Wilcox sent in some people and they assisted considerably.

SCHIERLING: So if these individuals had arrived earlier it would have made it easier on the GPU personnel too.

ACKERMAN: I think it would not have made their access any easier to us but it would have kept them from getting in such exhausted states. So that when we did get access to them, my first encounters were really, really difficult encounters. They were highly emotional, very caustic because of the exhaustion of the staff. The initial reactions to our operation was one of , "My God. Get the hell out of here, you're bothering us!" They didn't have the comprehension of what we were trying to do; it was an area of work that was completely outside their realm of experience.

SCHIERLING: Could we interrupt for just a moment? Mr. Ackerman, I'll call you back in just a moment.

ACKERMAN: Okay, fine. I need to take a break anyway..

Enclosure 1

NRC SPECIAL INQUIRY GROUP: WITNESS NOTIFICATION

This interview is being conducted by members of the Nuclear Regulatory Commission's (NRC's) Special Inquiry Group on Three Mile Island. This Group is being directed independently of the NRC by an outside law firm, Rogovin, Stern and Huge. It includes both NRC personnel who have been detailed to the Special Inquiry Staff, and outside staff and attorneys. Through a delegation of authority from the NRC under Section 161(c) of the Atomic Energy Act of 1954, as amended, the Special Inquiry Group has a broad mandate to inquire into the causes of the accident at Three Mile Island, to identify major problem areas and to make recommendations for change. At the conclusion of its investigation, the Group will issue a detailed public report setting forth its findings and recommendations.

Unless you have been served with a subpoena, your participation in this interview is voluntary and there will be no effect on you if you decline to answer some or all of the questions asked you. However, the Special Inquiry has been given the power to subpoena witnesses to appear and testify under oath, or to appear and produce documents, or both, at any designated place. Any person interviewed -- whether he has been subpoenaed or is being interviewed informally -- may have an attorney present or any other person he wishes accompany him at the interview as his representative. Witnesses should realize that while we will try to respect any requests for confidentiality in connection with the publication of our report, we can make no guarantees. Names of witnesses and the information they provide may eventually become public, inasmuch as the entire record of the Special Inquiry Group's investigation will be made available to the NRC for whatever uses it may deem appropriate. In time, this information may be made available to the public voluntarily, or become available to the public through the Freedom of Information Act. Moreover, other departments and agencies of government may request access to this information pursuant to the Privacy Act of 1974. The information may also be made available in whole or in