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Mr. Stan Helfman
President's Commission on Three Mile Island
2100 M Street, NW, Suite 714
Washington, DC 20037

Dear Stan:

Here are the transcript extracts Karl Seyfrit promised as a result of his interview.

I regret the delay, but one transcript was misplaced and both had to be pulled from microfiche.

T. A. Rehm, Assistant to the
Executive Director for Operations

cc: Kevin Cornell, NRC TMI Inquiry Group
Bill Besaw, ADM

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210th ACRS TRANSCRIPT
Oct 7, 1977

often cause some degradation of the rotor disk, but it might take a long time before it made any difference.

Once the turbine was vibrating, they do add some —

MR. VERRELLI: The intent was to eliminate the lower harmonic modes, to minimize that.

CHAIRMAN BENDER: How many plants are correcting the condition? Are all of them?

MR. VERRELLI: As I indicated, we didn't see a safety concern so we didn't make a survey of all the plants. I attempted to find out as much as I could for the committee.

I indicated — I know that Surry has completed it, and Diablo Canyon and Turkey Point 3 is coming down.

CHAIRMAN BENDER: This would not be reported as part of your LER system?

MR. VERRELLI: It is not a safety concern.

PROF. KERR: I hope Mrs. Horner is told about the harmonic difference.

CHAIRMAN BENDER: I am not sure what we will tell here yet.

Next subject.

MR. CROCKER: The next problem is Davis-Besse, The problem with Davis-Besse, and Karl Seyfrit from I&E will handle that.

MR. SEYFRIT: I am Karl Seyfrit from Inspection and

Enforcement.

The event occurred on the 24th of this month. The reactor was operating at only 9 percent power at the time. The turbine was bypassed and steam was being rejected to the condenser. They are still in their start-up testing program. This event was initiated by a spurious signal which gave a one-half trip of the steam and feedwater rupture control system.

This plant is one -- I am not sure whether it is the only one -- but it is at least one of the very few that has the steam and feedwater rupture control system which is designed to make sure that if you get a rupture of the stea line or the feedwater line, you can isolate the affected steam generator and use the other steam generator then as the heat sink further into the accident.

The half-trip caused the closure of the startup feedwater flow to the number two steam generator as part of the action that occurs automatically.

As a result of this, the level in that steam generator dropped, which caused the primary loop temperature in the affected loop to increase, and the steam generator level, of course, to go down, and eventually it reached the low water level trip which is 17 inches of indicated level.

When you reach that point, then you get a full actuation of the steam feedwater flow — steam water rupture control system.

The actuation of this system causes the main steam isolation valve to close, and when this occurred at this facility, it resulted in an increased pressurizer level, increased primary system temperature and pressure and steam generator pressure.

About one minute after the initiation of this event, the primary system pressure reached the relief valve setting of about 2250 pounds. And the relief valve — the pressurizer relief valve opened as required, but then cycled open and closed about nine times in a short — about 25-second period, and finally failed in the open position.

About 30 seconds after the valve stuck open, the operator manually tripped the reactor because at that time the pressurizer water level was continuing to increase rapidly, and as it turns out, the automatic scram would have caught him with a few more seconds.

You can't put a number to that, but it was very close. Following the reactor trip, the pressurizer level began dropping. The primary coolant temperature began dropping and, of course, the primary system pressure continued to drop due to the stuck-open relief valve as well as the fact you would reduce the amount of heat you are putting into the system.

At about 1600 psi, the safety features actuation system actuated. All of that equipment responded as designed. This included the closure of the quench tank isolation valve because that system caused the containment isolation signal.

With the pressurizer release discharging into the cold quench tank, quench tank pressure increased and the rupture disk in the quench tank ruptured as designed.

Ultimately, steam generator number 2 actually went dry, and some boiling occurred in the primary system when the temperature and pressure dropped down to the saturation point.

The auxiliary feed pumps had started about one and a half minutes after the start of the event. However, auxiliary feed pump number two did not come up to full speed, and at its low speed it didn't develop sufficient discharge head to actually put any water into the steam generator because the steam generator pressure was still up in the 800 or 900 pound range.

About 15 minutes after the event started, the operator put the number 2 auxiliary feed pump on manual control and was able to get it to full speed and, in essence, that then completely terminated this transient.

There are two other things that we could get into, but I think without getting into a great deal of detail, it probably would be more confusing than helpful. I would prefer not to do that now. I anticipate that we will come back to the committee with a report of the resolution of this event after the investigation is completed.

I wanted to point out that the evaluation is still in progress. The findings to date include the following, which I think begin to put the story together pretty well.

It looks like some loose termination lugs were probably responsible for the initial spurious half-trip of the steam feedwater rupture control system. Two such connections were found in that system.

As you ll know, I am sure, it is very difficult to prove positively that that kind of an event was caused by these loose connections, but at least it is quite certain that these loose connections had the capability of causing it.

In addition to having found those, the licensee is putting some instrumentation in this system to provide a permanent record should they ever get such a thing again, and will be able to then track it better and be sure that we really get the culprit the first time or at least find what it is the second time.

A second finding which probably was instrumental in causing the relief valve to fail, and this one we have not yet chased down as to why, but there was a relay that had been removed from the relief valve control circuit and this relay effectively eliminated the intended depth band for that relief valve, so that the relief valve, instead of opening and remaining open until the pressure had dropped some significant amount, opened and closed very rapidly, right around the set point.

A third item, the problem with the auxiliary feed pump, it was found that the governor on the auxiliary feed speed pump had bound. Partly this is something that they had had some difficulty with before, although the difficulty in the earlier time had been during some pre-op testing and we had no report of this.

It appears there is some mechanism by which a rod in this governor gets a buildup of crud on it, and then doesn't actuate. After this event, they tested this thing six or seven times, and it worked fine until the last time they tested it, then it hung up again.

MR. ETHERINGTON: Don't they also have a motor-driven auxiliary pump?

MR. SEYFRIT: I don't believe they do. I believe theirs are both turbine-driven.

A fourth finding, when the quench tank rupture ann2

disc ruptured, several insulation panels were knocked off one of the steam generators, and, however they weren't chewed up. The whole panel came off. These are panels that are pretty sizable.

I don't know the exact size of them, and they are kind of put on in an overlapping fashion and steam impinged and got underneath the panel and just lifted it off.

The fifth finding was that some safety-related cables were damaged. However, when they designed the plant they recognized the potential for steam discharge around the quench tank and there were no safety-related cables in that vicinity, so no safety-related cables were damaged.

The regional office has sent an immediate action letter to the licensee which, in effect, requires that the plant shut down unless analysis of the event has been completed and we have had a chance to review that and determine that a return to operation is warranted.

MR. EBERSOLE: Did the pumps continue to run, the main coolant pumps?

MR. SEYFRIT: They did until they were manually tripped by the operator some minutes into the event.

MR. EBERSOLE: Did the high-pressure ECCS pumps come on and start to inject?

MR. SEYFRIT: Yes. They came on at the time — I have forgotten now for the moment what initiated those.

MR. EBERSOLE: Low-level in the pressurizer?

MR. SEYFRIT: Yes. It was about 1600 pounds. It was the low pressure system that got it.

MR. EBERSOLE: Did that charge the system with water?

MR. SEYFRIT: No.

MR. EBERSOLE: The operator turned them off?

MR. SEYFRIT: Yes.

DR. SHEWMON: What was the setting supposed to be?

MR. SEYFRIT: I don't really have an answer to that.

DR. SHEWMON: There is no spec on this thing. Failing six times or nine times doesn't surprise you?

MR. SEYFRIT: I didn't say it didn't surprise me. The fact that it banged back and forth nine times, I think the rapidity is probably more important, than what one would expect from a opening and closing. I think there was a quite a different set of circumstances.

PROF. KERR: How long would you guess it would take to get back on line?

MR. SEYFRIT: I anticipate they will be back on the line within the next few days. Our inspectors are at the site now. Except for the items I have mentioned, all of the safety-related instrumentation did function as it was supposed to. Our region 3 people feel on the basis of this presence at the plant that the licensee is taking appropriate action to correct those items that were found to be defective. They are committed to doing suitable testing of the components, that's what our people are there at the site for now, and the major thing that we are holding up for right now is a more formal analysis which says, we think things are okay, because. It's the because that we don't really have in hand right now.

DR. SIESS: Karl, it seems to me that I have seen abnormally large numbers of LERs from Davis-Besse, one during startup. It looks like there are three possibilities. One is, it is abnormally large for startup at a plant and another is, it's typical of plants during startup, and another is, there is a different interpretation on what is an LER, either by the applicant or by the NRC now.

MR. SEYFRIT: I would suggest a fourth possibility, frankly, and that is all three of these things are active to a degree. It is typical that there are a large number of LERs during the startup period for any facility. There has been, as you know, about a year ago, a new set of instructions for reporting these kinds of events, which probably has increased the reporting in some areas, and the last item, of course, is that there are differences of interpretation as to what is reportable and Davis-Besse, the Toledo Edison are a new utility, and in my opinion are probably reporting more than would be strictly required by the reporting requirements as we interpret them.

DR. SIESS: A lot of things seem to be the kind of thing you expect to find during startup, but these are reportable in your opinion?

MR. SEYFRIT: That is true. We make no distinction about whether they happen during the startup testing phase or whether they start -- whether they happen later in life. The reportability is based on the event, not when it occurs.

DR. SIESS: In your judgment, it's really not unique or very unusual.

MR. SEYFRIT: I don't believe it is.

MR. EBERSOLE: This you say, occurred at 9 percent. This was at some few hours after they were at 9 percent. Do you intend to extrapolate what would have happened at 100 percent?

MR. SEYFRIT: At 100 percent --

MR. EBERSOLE: There is every reason to think this could have been deferred until they were at 100 percent for 30 days.

MR. SEYFRIT: Without getting into all the details which I'm not really prepared to do, I think you will find it's not likely they could be in this particular position at 100 percent power. There are another number of factors involving how systems have to be aligned, which they couldn't do at 100 percent power.

CHAIRMAN BENDER: Further questions?

Thank you, Karl.

MR. CROCKER: The next item on the agenda then, Mr. Chairman, is a summary of Nureg 0312 on feed water nozzle cracking.

Dick Johnson from OR is to talk about that.

211th ACRS TRANSCRIPT
Nov 3, 1977

CR3428
EP:hw1
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CHAIRMAN BENDER: Other questions?

MR. SEYFRIT: The next item I was asked to discuss was the Davis-Besse spurious steam water control system event. At the October ACRS meeting the event which occurred at Davis-Besse on September 24th was discussed. This event involved the spurious half-trip of the steam feedwater rupture control system, followed by failure of the pressurized power relief valve in the open position, the rupture of the quench tank rupture disc and the failure of one auxiliary feedwater pump to reach full speed.

As a result of these circumstances, one steam generator was blown dry and some boiling apparently occurred in the primary coolant system.

We have not yet received the Licensee's detailed evaluation of this event. This is expected about November 15th. However, based on a comparison to analyzed transients, we have concluded that resumption of operation was permissible, following the correction and testing of the components which malfunctioned during the event.

The Licensee made the necessary repairs and completed the testing to demonstrate operability and has resumed testing.

A repeat of the spurious half-trip of the steam feedwater rupture control system occurred on October 22nd. At that time all other systems functioned correctly.

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Following the first event, the Licensee installed instrumentation which was intended to determine what specific event triggered the half-trip of the SFRCS.

The instrumentation was installed on the inputs to the logic network. Nothing was detected in this second spurious actuation.

By a process of elimination, the Licensee believes he has traced the problem to two areas of logic network..

The suspect components have been replaced and official monitoring equipment has now been installed in the logic system in an effort to detect any future spurious signals in these circuits.

To get back to the initial event --

DR. CATTON: Can you put that initial event in a little better context? I don't really follow what you are saying,

MR. SEYFRIT: That is what I hope to do now. I was trying to go through a series of overall events. Now I will go back and talk about the specific initial event. The reactor was operating at 15 percent power. As I stated in the October meeting, following the SFRCS half-trip, and this half-trip, incidentally, causes some things to happen in part of the secondary system, the feedwater is shut off in the system that receives the trip, in that half of the system.

Following the half-trip, the number two loop start-up feedwater control valve closed, which stopped water supply to the number 2 steam generator.

The steam generator level began decreasing and, at the same time, because you remove part of the heat removal capability,reactor coolant temperature was increasing.

At this point thereacter has not yet been tripped. The pressure level increased.

the number 2 steam generaotr reached the low level trip which caused the full steam feedwater rupture control system trip. That is a mouthful.

This trip results in closure of the MSIV's on both loops now. The steam generator pressure, with the steam, MSIV's closed, increased.

We still haven't tripped the reactor. This caused the pressurizer relief valve to open. A relay in the valve control circuit had been removed for unknown reasons. We still don't know why it had been removed, but it was out of the circuit.

This, in effect eliminated the usual dead band from the valve controls. And the valves then cycled open and closed, rapidly, about nine times, right around the relief set point, because there was no dead band allowance to allow the pressure to drop down some value, and then reseat. It reseated immediately when it passed the trip point.

After cycling about nine times very rapidly, it stuck in the open position.

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The aux feedwater pump started as the level dropped down in the steam generator. The number one pump came up to full speed and began putting water in the steam generator number 1.

The number 2 pump, however, failed to reach full speed. It reached only about 2600 rpm. At this point, the discharge head developed is about, oh, a maximum of 700 psi.

I believe that I gave you some curves which show -- did you get the handout? There is a pump performance curve in that material --

DR. MARK: How is the opening and closing nine times? How is that believed to be nine?

Is that recorded somewhere?

MR. SEY [illegible]IT: That was based on pressure recordings and oscillations in the pressure.

At the time that the auxiliary feed pump came on and failed to reach speed, the steam generator pressure was higher than the discharge head that the pump was capable of developing, and, therefore, no water was being added to the steam generator number 2 for several minutes. This allowed the level to drop until the steam generator finally went dry.

The Licensee and his nuclear steam supply system has evaluated the event and the conditions experienced during the event by comparing the observations recordings, and so forth, to values obtained in the analyzed transients that are

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reported in the FSAR. Pertinent aspects of this initial evaluation include the following: Steam generator components are designed to accept 40 cycles of depressurization, where the pressure drops 1400 psi and the temperature drops 62 F in 15 minutes.

In this axial transient, the pressure dropped about 1250 psi and the temperature dropped about 45 degrees in 7 1/2 minutes. Since the pressure change of the axial transient is less than the generalized transient, the stress effect due to pressure would likewise be less. While the rate of temperature change is somewhat greater in the axial transient than for the generalized transient, the overall temperature change is about 17° F ess, These differences tend to be somewhat offsetting, and thus we believe the resulting stresses will be little different due to the temperature than the generalized case. And will likely be somewhat smaller.

Number 2, the design transeitns include 20 cycles, in which the feedwater is lost to one generator and the generator evaporated to a dry pressurized condition, followed by rapid introduction of feedwater.

The major concern here is variation in the tube to shell tube temperature differences.

In the axial transient the steam generator was dry for about 13 minutes during which the reactor coolant temperature dropped 50 F.

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We believe this condition was not sufficient to cause stress or deformation within the tubes.

It is within the established design limits.

Number 3, there was some possibility of cavitation damage to the reactor coolant pump impellers, bearings and seals, due to the boiling which appears to have occurred in the primary system.

The evidence for this boiling basically was interruption of seal water flow and some instability in the seal cavity pressures. All four pumps had loss or erratic seal injection flow for about one and one quarter minutes.

The pumps following this event, were instrumented to measure shaft vibrations, seal cavity pressures and other significant parameters, and tested prior to resumption of operations.

No indications of damage were observed. Additional tests were performed on the pumps after the pressure, the system pressure now we are talking about, was increased above 1300 psi and again there were no abnormal conditions observed.

Number 4, Babcock and Wilcox has evaluated this event with regard to the effects on fuel, and has concluded that there are no reasons to believe the fuel was adversely affected.

This is based on the fact that the core burn-up at the time of the event was only about an effective full-power day.

of NRC's.

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The maximum fuel clad temperature was 550° F. There was no more than about 300 psi pressure differential across the cladding at any time, which would have existed at the most for something less than an hour.

With the low irradiation history this pressure temperature combination would not be expected to produce any undue demands on the fuel or cladding. Because of the lower power history, there was no significant heat generation in the reactor core after the reactor had scrammed.

There was essentially no decay heat at this point. Testing of the relief valve after its repair and readjustment demonstrated satisfactory operation after several open-close cycles.

The major adjustment made was to reduce the stroke of the pilot valve system from about 3 at the inside to one at the inside. The reason given for this, in this valve the process steam with some boron, boric acid in it, impassed the system, and with more of the system exposed to this fluid, more boric acid can be plated out on the system, because of the drying effect of the hot steam. With less of the steam exposed to this, there is less chance of that material adhering to the system and, therefore, less chance of it interfering with free movement of the system.

DR. SHEWMON: I trust the relays, giving it the dead band --

MR. SEYFRIT: The relay was reinstalled, yes. The Woodward governor on the auxiliary feed pump turbine driver was tested several times after modification of the governor. Modification included removal of portions of a pneumatic speed setting mechanism which was installed in this particular governor, and was really unnecessary, because they had a pneumatic -- well, they had a servomotor for speed positioning, for this governor, and the pneumatic speed positioning function was really unnecessary. That portion of it was removed. They tested the governor then at the Woodward governor co-facilities a number of times, and then after they reinstalled it in the plant, additional tests have been performed on the equipment and operation has been satisfactory and as I said, in this latest test the half trip of the FFSRCS, operation was satisfactory.

CHAIRMAN BENDER: Is that it?

DR. MARK: I may have missed something you might have said about the probable course of the spurious signal. Is this a misplaced bit in a solid-state control computer, or something of that sort?

MR. SEYFRIT: We really haven't yet pinned down where this signal came from. Following the initial event, they put in a pump of instrumentation and the thought was, it was a spurious input signal to the logic circuitry that had caused the trip. So all of the input signals were instrumented in an effort to detect which one might have given the spurious signal. It turned out, when we got the second one, that was not the cause. So, by looking at the circuitry and looking at what could conceivably cause such a thing, the licensee believes he has narrowed this down to two components, both of which have now been — components — what is the next larger thing than an individual component? Device. Which has several components.

DR. MARK: A circuit problem in this case.

MR. SEYFRIT: It gets difficult to talk about. But some of the individual devices or components within the framework, for example, of the amplifier, and one of the components they are talking about is an amplifier. They have gone in there and replaced some chips and individual solid-state components.

In addition to that, they have now instrumented the logic circuitry in such a way that they believe if they should get another one of these, they will be able to pin it down to a specific defice.

CHAIRMAN BENDER: Other questions?

MR. EBERSOLE: This is a B&W plant?

MR. SEYFRIT: Yes.

MR. EBERSOLE: Did you make reference to secondary side levels, being one of the parameters that caused some of these actions?

MR. SEYFRIT: Steam generator level.

MR. EBERSOLE: Could you clear up for me how you get steam generator level in a once-through boiler? I thought they just had a variation, if you don't have a pot to detect level from.

MR. SEYFRIT: You are asking me some very embarrassing questions. You know, really, to be honest with you, I hadn't given any specific thought on that. There is a level signal, but how it's generated, I can't tell you.

MR. EBERSOLE: It has to be synthesized somehow. Maybe by the super heat level.

MR. SEYFRIT: I think maybe it's based on the level in this downcomer area outside the two-bundle area.

Does anybody over there know? Is anybody familiar enough with B&W steam generators to help me out here?

MR. CROCKER: No help here.

MR. SEYFRIT: Only the outboard level you have an auxiliary level.

CHAIRMAN BENDER: Karl, why don't you run it down for us and let us know.

MR. EBERSOLE: Are there any indications that this accident, if it would have happened at full power with old fuel, would it have produced substantial different results on the fuel, other than a little bit of boiling?

MR. SEYFRIT: I think we are into an area where we are sort of comparing apples and oranges a little, because if you had been at full power, there would have been a number of things differently aligned in the system.

MR. EBERSOLE: It's not regarded as a possible combination of events at full power.

MR. SEYFRIT: I think it would be highly unlikely to get into the same combination of events at full power. For example, the turbine was not in service. All the steam

a-22 was being bypassed back to the condenser.

There were other alignments in the auxiliary feed water pump system that were different than would be the case at full power.

CHAIRMAN BENDER: If there are no other questions, let's go to the next item on the agenda.

I believe, Mr. Crocker, you wanted to take up Arkansas Nuclear One, then the Florida Power & Light system disturbance.

MR. CROCKER: That's correct, Mr. Bender. Walt Butler will handle that for the Staff.

(Slide.)

MR. BUTLER: This is Arkansas Nuclear One. Space coolers issue.

The licensee advised us of a design inadequacy about two months ago. On the 9th of September, the NRC held telephone discussions with the Bechtel Company San Francisco Office to determine whether this issue could be a generic issue.

On the 13th of September, the Staff met with Arkansas, the licensee, to discuss the specific problem and what corrective measure Arkansa proposes.

On the 19th of September, we had another telephone conversation with Bechtel and received confirmation from them that this design inadequacy or design error was not generic in character and was not expected to be in other Bechtel design plants.

(Slide.)

Briefly stated, the problem is: there are four