OYSTER CREEK

SEPTEMBER 17, 198
SAFETY LIMIT VIOLA

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SEPTEMBER 11, 1987
SAFETY LIMIT VIOLATION

PREPARED FOR
GPU NUCLEAR CORPORATION

by

STIER, ANDERSON & MALONE

MARCH 31, 1988

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SAFETY LIMIT VIOLATION

I. INTRODUCTION

A. Origin and Purpose of Investigation

This report has been prepared for General Public Utilities Nuclear Corporation (GPUN) concerning a safety limit violation that occurred at the Oyster Creek Nuclear Generating Station on September 11, 1987. The report is based upon an investigation commissioned by GPUN to be performed independently of the company under the exclusive control of Edwin H. Stier.

This report deals with the events leading up to the safety limit violation, the violation itself, and the conduct of members of the control room shift and higher management personnel following the safety limit violation. It focuses on the reporting of the safety limit violation within the GPUN chain of command and to the Nuclear Regulatory Commission (NRC), the removal and disposal of portions of a record of the violation, and the reporting, both internal and external, of the circumstances concerning the record that had been removed.

On September 11, 1987, Stier was retained by GPUN to conduct this investigation.[1] The company's instructions

concerning the scope and purposes of the investigation were conveyed to Stier by Philip R. Clark, President and Chief Executive Officer of GPUN. Clark's instructions were to conduct a thorough, complete and independent investigation of the response of Oyster Creek personnel to the safety limit violation and its aftermath.[2]

At the outset of the investigation, Clark committed the company to provide complete access to all records and personnel. GPUN chose to waive any attorney-client privilege that might limit the release of the results of the investigation. We were given full authority for any decisions on "methods, approach, and structure of the investigation and findings thereof."[3] GPUN has fulfilled all of its commitments. Although we reported our progress to Clark and the GPUN Board of Directors, this investigation, the analysis of the evidence, and the preparation of this report have been solely under our control.

B. Organization of Staff

Stier is engaged in the private practice of law in New Jersey.[4] The investigative staff consisted of attorneys also licensed to practice in New Jersey, Howard T. Anderson,[5] Mark J. Malone,[6] Robert DeGeorge,[7] and Mary K. Brennan.[8]

Taylor Associates, Inc., a New Hampshire-based firm specializing in technical litigation support, was engaged to

assist in analyzing the complex technical data.[9] Professor Frank J. Landy, a professor in industrial psychology at The Pennsylvania State University,[10] provided assistance in formulating deposition questions and evaluating responses directed toward identifying the causes and motivations behind certain behavior relating to the safety limit event and its aftermath.

C. Investigative Process

The investigation had three basic objectives: first, to determine with as much precision as possible what occurred on September 11, 1987, with respect to the safety limit violation, the apparent destruction, concealment, or disposal of records pertaining to the violation, and the reporting of these events; second, to identify the causes and motivations behind the occurrences of September 11; and third, to assemble a comprehensive factual record and analysis supporting our findings.

At the beginning of the investigation, we focused much of our attention on the six individuals who were on duty in the control room on September 11, 1987, as part of the midnight-to-eight shift. These six comprise what is referred to throughout the report as the "B" crew. (To avoid confusion with time shifts -- e.g., 12 to 8 -- we have used the word "crew" instead of "shift.") The crew members were [HH], the Group Shift Supervisor (GSS), [A], the Group Operations Supervisor (GOS), Control Room Operators (CROs),

[VV], [II], and [ZZ], and [I], a control room operator trainee. All of these individuals were questioned extensively, both informally and under oath, and their testimony was compared to other evidence.

The scope of this investigation, however, was not confined exclusively to the conduct of "B" crew. Management personnel in the Operations chain of command were also subjects of the investigation. Additionally, to understand the circumstances contributing to the safety limit violation and its aftermath, it was necessary to question numerous individuals who were neither members of "B" crew nor in the reporting chain of command above the crew. For example, we questioned everyone who was in or out of the control room during the critical period from 2 a.m. to 7 a.m. We also explored the crew's perception of the company's policies respecting discipline to determine whether such perceptions could plausibly have motivated an attempt to conceal evidence.

The investigation began less than 24 hours after the safety limit violation. On the evening of September 11, 1987, the investigative staff was briefed on the day's events. Early the next morning, the staff inspected physical evidence and was given a tour of the control room. The remainder of the day was spent in intensive debriefings of knowledgeable employees, including each member of "B" crew.

In an effort to reconstruct critical events and thereby

test the credibility of witnesses, we immediately began collecting data from plant records for technical analysis, the results of which are set forth in Volume III of this report, the Taylor Report.

We later obtained sworn question-and-answer statements from the following categories of witnesses:

1. All members of the "B" crew on duty on September 11, 1987, including control room operators, supervisors, and the trainee;

2. Management personnel outside the control room who first learned of the safety limit violation and participated in its initial investigation;

3. Plant personnel who at relevant times on September 11, 1987, were present in the control room, including the time period encompassed by the safety limit violation and the subsequent disposal of documents, or who participated in the search for the missing documents;

4. Plant personnel knowledgeable about conditions which preceded and followed the safety limit violation; and

5. Any other witnesses, identified in documents or testimony, who might possess relevant knowledge concerning the safety limit violation, the disposal of documents, or the reporting of those events.

All witnesses cooperated in the investigation. Based

on the testimony of the witnesses, and all the additional evidence that we considered, we are satisfied that a sufficient record exists to reconstruct the relevant events and to assist GPUN in assessing responsibility for any improper conduct that existed.

Volumes III-V of this report include all of the evidence we determined to be relevant to the issues under investigation. Other evidence, such as our notes of interviews, has been retained on file and can be reviewed upon appropriate request.

D. Organization of this Report

This report is divided into five major parts, each contained in a separate volume. Together they contain our analysis of the evidence, the technical analysis performed by Taylor Associates, and the evidence we considered in reaching our conclusions. The following is a brief description of each of the major parts of our report:

VOLUME I

Introduction, Background, Executive Summary and Detailed Discussion of Issues and Conclusions

- A summary of the backgrounds and duties of members of "B" crew and key GPUN Operations managers.

- A summary of events of September 11, 1987, with emphasis on conduct of the "B" crew members and GPUN Operations

managers.

- A listing of the main issues addressed in the investigation and a summary of the conclusions reached with respect to those issues.

- A description of the Oyster Creek Nuclear Generating Station Technical Specifications relevant to the safety limit violation and the safety limit's history.

- An analysis of the history and technical requirements of the "less than two loops" alarm which signaled the safety limit violation, as well as an analysis of the sequence of alarms recorder (SAR) which produced the computer print-out that was partially disposed of by one of the control room operators.

- An analysis of the crew's responsibilities and actions in reporting to higher management both the safety limit violation and the discovery that evidence was missing.

- An analysis of the management reporting, both internal and to the NRC, and the management response to the safety limit violation and the disappearance of evidence.

Tables

- A table listing all documents used as exhibits to this report (Table 1).

- A table listing all witness statements taken during

this investigation (Table 2).

VOLUME II

Individual Assessment of Members of "B" Crew and Key Management Personnel

- A report on each person who was a member of the "B" crew on September 11, 1987.

- Reports on those in key management positions above the crew level.

VOLUME III

Taylor Associates' Report

- Taylor Associates' technical evaluation of the safety limit violation event based upon an analysis of technical data from the event itself, additional plant test data, and other plant records, together with supporting tables, charts, and appendices.

- Description of key plant equipment, instrumentation and controls, and other plant features relevant to the event of September 11, 1987.

- Description of the sources of data utilized, including a detailed description of the recovered sections of the SAR tape.

- Detailed documentation relating to the tests that were conducted on the reactor recirculation system pumps and

valves subsequent to September 11, 1987.

VOLUME IV

Exhibits

- Any documentary evidence that we relied upon, in addition to that which Taylor Associates has included in its report.

VOLUME V

Witness Statements

- All sworn statements taken during our investigation.

- Witness statements are arranged alphabetically. Multiple statements of a witness are in chronological order. Each statement begins with a page identifying the witness, the date of the statement, and by whom the statement was taken.

NOTES

1. Letter from Edwin H. Stier to Philip R. Clark, President, GPUN (Sept. 21, 1987) (Exhibit 35).

2. Ibid.

3. Ibid.

4. Edwin H. Stier -- Member of the New Jersey Bar. Partner, Stier, Anderson & Malone, 11 East Cliff Street, Somerville, New Jersey 08876. October 1, 1982, to October 1, 1984, Member of the firm of Kirstein, Friedman & Cherin, P.C., Newark, N.J. 1977 to 1982, Director, New Jersey Division of Criminal Justice (Assistant Attorney General). 1969 to 1977, held the position of Deputy Attorney General in charge, Organized Crime and Special Prosecution Section; Assistant to the Director and Deputy Director in the New Jersey Division of Criminal Justice. 1967 to 1969, Chief of the Criminal Division, Office of the United States Attorney, District of New Jersey. 1965 to 1967, Assistant U.S. Attorney, District of New Jersey. 1964 to 1965, Law Clerk to the Honorable Arthur W. Lewis, Judge of the Appellate Division, Superior Court of New Jersey. Graduated from Rutgers University (AB) 1961 and Rutgers Law School (LLB) 1964.

5. Howard T. Anderson -- Member of the New Jersey and District of Columbia Bars. Partner, Stier, Anderson & Malone, 11 East Cliff Street, Somerville, New Jersey 08876. 1979 to 1987, Morgan Associates, Chartered, Washington, D.C.; currently Of Counsel. 1978 to 1979, Consultant, Senate Small Business Committee. 1977 to 1978, Investigator/Attorney for Subcommittee to U.S. House of Representatives Foreign Affairs Committee conducting investigation of Korean-American relations; 1971 to 1977, Deputy Attorney General, Special Prosecutions Section, Division of Criminal Justice, New Jersey Attorney General's Office. Graduated from Dartmouth College (BA) 1968 and Harvard Law School (JD) 1971.

6. Mark J. Malone -- Member of the New Jersey and New York Bars. Partner, Stier, Anderson & Malone, 11 East Cliff Street, Somerville, New Jersey 08876. March 1987 to December 1987, Law Offices of Mark J. Malone. September 1982 to February 1987, Partner in Malone & Villere, Esqs. April 1978 to September 1982, Assistant U.S. Attorney and Deputy Chief, Special Prosecutions Division, U.S. Attorney's

Office. September 1974 to April 1978, Deputy Attorney General, Special Prosecutions Section, Division of Criminal Justice, New Jersey Attorney General's Office. September 1973 to September 1974, Law Clerk to the Honorable Frederick W. Hall, New Jersey Supreme Court Justice. Graduated from Rutgers College (BA) 1967, University of Oklahoma (MA) 1972, Rutgers University School of Law (JD) 1973, and New York University School of Law (LL.M) 1978.

7. Robert DeGeorge -- Member of the New Jersey Bar. January 1988 to present, Senior Partner, DeGeorge & Avolio, Trenton, New Jersey. 1986 to 1988, Senior Partner in Robert DeGeorge & Associates. 1982 to 1986, Senior Partner in Paglione, Massi & DeGeorge. 1981 to 1982, Partner in DeGeorge & Gendzel. 1981 to 1983, Special Counsel to the New Jersey Division of Motor Vehicles. 1980 to 1981, Deputy Attorney General in charge of Organized Crime and Special Prosecutions Section, New Jersey Division of Criminal Justice. 1979 to 1980, Deputy Attorney General in charge of Corruption Investigation Section. 1964 to 1966, Deputy Attorney General in charge of Drug Division Investigations Section. Intelligence Analyst, U.S. Army Intelligence Corp. Graduated from Rutgers University (AB) 1960 and Rutgers Law School (JD) 1964.

8. Mary K. Brennan -- Member of the New Jersey, New York, and Maine Bars. Formerly a Managing Partner of Brennan & Brennan, Portland, Maine. Served as a Board of Director for Maine Law Enforcement Planning & Assistance Agency. 1985 to 1986, Of Counsel Stryker, Tams & Dill. Was General Counsel for the Center for Health Affairs, Princeton, New Jersey. Teaches medical jurisprudence at New Jersey Medical School. Faculty fellow at Princeton University, Butler College. Past President of the New Jersey Society of Hospital Attorneys. Received undergraduate (1968) and law (1971) degrees from the University of Maine. Graduated from Harvard University (MPH) 1975.

II. SUMMARY OF EVENTS OF SEPTEMBER 11, 1987

A. Organization of Operations Management and "B" Crew at Oyster Creek

On September 11, 1987, "B" crew was one of six operating crews at the Oyster Creek Nuclear Generating Station. Each crew worked rotating eight-hour shifts on a six week cycle, and was headed by a Group Shift Supervisor (GSS), who was assisted by the second-in-command, the Group Operations Supervisor (GOS).[1] The GSS was required to have a Senior Reactor Operator (SRO) license from the NRC.[2] Each crew also had NRC-licensed Control Room Operators (CROs) and nonlicensed Equipment Operators (EOs). In addition, the Oyster Creek Technical Specifications required each on-duty shift to include a Shift Technical Advisor (STA), except during cold shutdown and refueling modes.[3] The STA, however, was not a permanent member of the crew; individual STAs rotated among the various crews.[4]

For labor relations purposes, the GSSs and GOSs were considered management personnel, while the CROs and EOs were members of the local IBEW bargaining unit.[5]

Each GSS reported directly to the Manager, Plant Operations.[6] While a shift was on duty, however, the GSS was "directly charged with both the responsibility and the command authority over all shift operations, and maintenance activities, and implementation of radiological controls under normal and abnormal conditions."[7]

1. GPUN Operations managers above crew level

The GPUN Operations chain of command at Oyster Creek above the Manager-Plant Operations consisted of the Plant Operations Director, the Oyster Creek Deputy Director, and the Vice President-Director.[8] Set forth below are brief profiles of the persons who held these positions on September 11, 1987, together with a general description of their duties.

Director and Deputy Director

Peter B. Fiedler was the Vice President-Director, Oyster Creek Nuclear Generating Station. His sphere of responsibility included engineering and operations. Fiedler, however, was on vacation on September 11, 1987, and he did not participate in the events immediately following the safety limit violation.

Fiedler's second in command, [SS], was the Deputy Director and the highest ranking Oyster Creek Operations manager on the site in the immediate aftermath of the safety limit violation. The Plant and Materials Department reported directly to [SS], and [SS] reported directly to Fiedler. As Deputy Director, [SS] traditionally assumed responsibility for maintenance, and control of outages.[9]

Plant Operations Director

The Plant Operations Director was [N], who had held this position since approximately 1981. [N] was responsible for the overall direction of the Operations department, which included plant operations, radwaste operations, and chemistry. [N] also played a key role in disciplinary policy and administration. He reported directly to Fiedler.[10]

Manager-Plant Operations

[R] had been the Manager-Plant Operations since July 1987. He had started with GPUN as an STA, and later served for two years as Operations Control Manager. [R] reported to [N], the Plant Operations Director. [R] was the GPUN Operations manager immediately above the crew level. The control room shift supervisors reported directly to him, as did the senior engineer and the department administrator.[11]

2. "B" crew

The members of "B" crew primarily involved in the events of September 11 were the two supervisors (GSS and GOS), the three CROs and the CRO trainee. (Unless otherwise specified, when the term "B" crew is used in this report it refers only to these persons; EOs and others who worked during the same shift are excluded.)

Group Shift Supervisor

The GSS was [HH], who reported directly to [R], the Manager-Plant Operations. [HH] had been GSS of "B" crew since 1984. He received his SRO license in 1983.[12]

Group Operations Supervisor

[HH]'s assistant was [A]. He had been GOS of "B" crew since 1986. Prior to that, he had been a CRO on the same crew since 1981.[13]

Control Room Operators and Trainee

The most senior CRO on "B" crew was [VV], who had been a CRO on the shift since 1981.[14]

[II] also received his license in 1981. He had been a member of "B" crew since 1985.[15]

[ZZ] was the least experienced CRO, having received his license in 1985. He had been a member of "B" crew for approximately a year prior to the safety limit violation.[16]

[I] was a CRO trainee, who had previously worked on "B" crew as an EO since approximately 1981.[17]

Within the "B" crew, the Control Room Operators assigned responsibilities among themselves on a rotating basis. On September 11, 1987, [II] was operating as the "lead" control room operator for the night. He was responsible for maintaining the control room log and handling

communications. This was a responsibility which he had shared with [VV] in the past.[18] The remaining two Control Room Operators were designated as a technical specialist and an extra. [ZZ] was operating as the "Tech Spec man" and [VV] was serving as the extra on September 11, 1987.[19]

Also assigned to the "B" shift were three Equipment Operators: [WW], [AAA], and [D].[20]

No STA was on duty on September 11, 1987, because the plant was in a cold shutdown mode and the reactor temperature was less than 212 degrees.[21]

B. Sequence of Events

The following is a summary of the sequence of events before, during, and after the September 11, 1987 safety limit violation. References are to other sections of this report which discuss the events in more detail.

1. Events prior to safety limit violation

On September 11, 1987, "B" crew was on the last day of a midnight to 8 a.m. shift. During the 12-8 shift on the previous day, September 10, "B" crew had conducted operations to put the plant in a cold shutdown condition, and the plant was in that condition when "B" crew commenced its shift on September 11.[22]

One of the shutdown operations was to remove from service all but two of the five recirculation pumps. These

are the pumps that keep water flowing between the annulus (or downcomer) and core regions of the reactor. Such communication is essential because it enables operators to monitor water levels in the core. Each recirculation "loop," in addition to a pump, consists of a suction valve, a discharge valve, and a two-inch bypass valve.[23]

In the aftermath of an event that occurred on May 2, 1979, during which all five recirculation loops were closed and an alarm was received indicating low water level in the core region, the NRC imposed a "safety limit" requiring that at least two recirculation loops be kept open at all times, except when the reactor head is off and the reactor flooded to a level above the main steam nozzles. The purpose of the safety limit was to insure communication between the core and annulus regions. Violation of a safety limit required shutdown of the reactor pending NRC permission to restart.[24]

The practice of running only two pumps while the plant was in a cold shutdown condition had been instituted approximately a year earlier in order to save wear and tear on the pumps. When pumps were removed from service their associated discharge valves normally were closed. This was done to prevent a condition known as "reverse flow."[25]

When "B" crew began its shift on September 11, the "A," "D," and "E" recirculation pumps were out of service and their discharge valves were closed. Only the "B" and "C" pumps were operating with their associated suction, bypass

and discharge valves open.[26]

Shortly after 2 a.m., a maintenance mechanic began removing the packing from an isolation valve (V-5-167) on the Reactor Building Closed Cooling Water (RBCCW) system in the course of performing a maintenance operation.[27] The RBCCW system provides cooling water to a number of components, including the recirculation pump motors.[28] The valve was located in the area of the reactor building known as the "twenty-three foot level." When the mechanic removed the packing, a leak developed from the valve, spraying the mechanic and spilling onto the floor below. The leaking water was slightly radioactive and contained corrosive chemicals.[29]

A radiological control technician ("Radtech") who was in the vicinity heard the mechanic's call for help and saw the water spraying out. He telephoned the control room for assistance.[30]

In the control room, CRO [II] took the call. He notified GSS [HH] and GOS [A] about the leak on the twenty-three foot level, and [A] obtained further details from the Radtech over the telephone.[31] At 2:11 a.m., [A] and an EO, [WW], exited the control room and proceeded to the twenty-three foot level to attend to the leak.[32]

After arriving at the site of the leak, [A] reported to the control room that its source was the RBCCW system. He

also reported that the leak was heavy and was forming a large puddle on the floor that, in [A]'s view, threatened to damage electrical components.[33] [HH] decided to attempt to isolate the leak by closing valves in the RBCCW system. One such valve could be closed electronically from the control room. The other was a manually operated valve located on the fifty-one foot level of the reactor building.[34]

Closing these valves would have the effect of stopping RBCCW flow through the drywell. Operating procedures specified that recirculation pumps could not be run without RBCCW flow. (This was to prevent overheating of the pump and motor generator components.) Accordingly, [HH] ordered the "B" and "C" pumps -- the only ones operating at the time -- to be "secured," i.e., taken out of service.[35]

2. Safety limit event

CRO [VV] responded to [HH]'s order to secure the pumps. Standing in front of the section of the control panel where the "B" and "C" loop controls are located, he began what he termed a "normal pump shutdown." Under this procedure -- which, because of the safety limit, was not to be used when only two recirculation loops were open -- a pump was shut down after a sequence of steps, one of which was to close the pump's associated discharge valve. Seconds after [VV] moved the "B" discharge valve control to the closed position, the "less-than-two-loops-open" alarm appeared, indicating that a safety limit violation had

occurred.[36]

[VV] reacted immediately to the safety limit alarm by opening the "A" and "D" discharge valves. As a result, the alarm cleared less than two minutes after it had come in. Analysis of the technical data indicated that the safety limit alarm occurred at 2:17:34 and cleared at 2:19:17.[37]

After the alarm, the crew completed the operations necessary to isolate the leak. This isolation did not, however, stop the leak. It was stopped when a maintenance supervisor manually backseated the leaking valve.[38]

Beginning at approximately 2:45 a.m., the crew performed a series of operations to restore the plant to its pre-leak condition. By approximately 3:15 a.m., RBCCW flow had been restored to the drywell and two recirculation loops were again open with their pumps operating.[39]

3. Tearing and disposal of SAR tape

At some point after the alarm had cleared and he had no immediate operations to perform, [VV] went behind the control panel to the Sequence of Alarms Recorder (SAR). This machine recorded sequentially the time and nature of alarms received, and printed the alarm messages on adding machine-sized tape.[40] [VV] tore tape from the machine, threw some of what he had torn in a wastepaper basket, and put the rest in his pockets. These actions were completed prior to 3 a.m., and most likely between 2:24 and 2:32

a.m. Some of the torn tape -- including the portion reflecting the safety limit violation -- was later recovered from trash that had been collected from the control room. The rest, according to [VV], was flushed down a toilet outside the control room between 3:35 and 3:44 a.m.[41]

4. Reporting of violation to higher management and NRC

All of the members of "B" crew except [A], who was out of the control room, witnessed the safety limit alarm and understood its significance. None except [VV], however, witnessed the tearing, removal, or disposal of the SAR tape.[42]

A few minutes after 3 a.m., CRO [ZZ] went to the SAR to obtain the times of the safety limit event for [II] to enter in the control room log. He observed that there was a foot to a foot and one half of paper hanging out of the top of the machine and a few feet piled on the floor. Closer inspection of the tape revealed a gap in recorded alarms from 6:48 p.m. on September 10 to 2:32 a.m. on September 11, a period that included the safety limit violation. [ZZ] concluded that someone had taken the missing tape.[43]

[ZZ] immediately reported this development to [HH], who looked "dumbfounded" but otherwise made no response. [ZZ] then asked every member of the crew then in the control room if he had the tape. All said no.[44]

Between approximately 3:25 and 3:30 a.m., [HH] telephoned his immediate supervisor, [R], at [R]'s home. [HH] told [R] that there had been a leak on the twenty-three foot level and that a worker had been sprayed and was possibly injured. [HH] did not disclose to [R] either the safety limit violation or the fact that SAR tape was missing.[45]

At about the same time that [HH] was calling [R], [ZZ] approached [A] (who had been out of the control room during most of the period between the safety limit violation and [HH]'s 3:25 - 3:30 a.m. call to [R]) and asked to speak to him outside the control room. They exited together at 3:28 a.m., and [ZZ] informed [A] that there had been a safety limit violation and that SAR tape covering the period of the violation was missing.[46]

Shortly after 3:41 a.m., when [HH] returned to the control room after a brief discussion with a health and safety representative concerning the worker sprayed by the leak, [A] asked him whether he had told [R] about the safety limit violation. [HH] indicated that he had not. [A] urged [HH] to report the violation immediately. [HH] agreed and began walking toward his office. Before [HH] reached his office, [R] called back to ask about the status of the recirculation pumps and to remind the crew to keep the valves properly aligned -- i.e., to maintain two open loops. ([R]'s call had been prompted by questions put to

him by Plant Operations Director [N], whom [R] had called after [HH]'s 3:25 - 3:30 a.m. call to [R].) In response to [R], [HH] told [R] about the safety limit violation. [R] told [HH] to make the required NRC and internal notifications. [R] then called [N] and reported what he had learned from [HH]. [N], in turn, notified Oyster Creek Deputy Director [SS].[47]

By approximately 4 a.m., all of the key Operations managers at Oyster Creek had been informed of the safety limit violation, additional notifications were in progress, and plans were being made for briefings and critiques to be conducted later in the morning. However, because [N] and [R] were unsure when the violation had occurred, [R] called back to the control room to obtain this information. [HH] answered [R]'s call but, because he was in the process of making his notification to the NRC (which was later recorded as having been made at 4:05 a.m.), [HH] handed the telephone to [A]. In response to [R]'s question about the time of the event, [A] provided an estimate of 2:24 a.m. that he had obtained by reviewing plant computer data related to reactor water level. Although [A] conveyed the impression that SAR data were unavailable for the time of the event, he did not tell [R] that the tape was missing and that someone had apparently taken it.[48]

On the basis of his conversation with [A], [R] formed the impression that SAR data were unavailable because the

machine had run out of paper. [R] conveyed this impression to [N].[49]

5. Management investigation of missing SAR tape

Between approximately 3:45 a.m. and 4:30 a.m., there were a series of telephone calls among GPUN managers concerning the safety limit violation. During these conversations, plans were made and instructions given for the gathering of information about the event in preparation for briefings and critiques. The NRC was notified of the violation during this period, both formally through the Emergency Notification System (ENS), and informally through the NRC site representative.[50]

The first managers arrived at the plant between 4:30 and 5:00 a.m. [SS], [R], and [MM], [R]'s assistant, went to the control room and spoke to members of "B" crew about the safety limit event. A briefing for GPUN and NRC personnel had been scheduled for 6 a.m., and [MM] was assigned to gather detailed information for it. Shortly before 6 a.m., [MM] inspected the SAR and noticed the same gap in recorded alarms earlier observed by [ZZ]. [MM] left the control room and reported what he had seen to [R], who in turn informed [N].[51]

[MM] reported what he had observed about the condition of the SAR tape just as the 6 a.m. briefing was scheduled to begin. Immediately after the briefing, [N] called a meeting

in his office to inquire into the missing SAR data. During this meeting [HH] was questioned, the crew was asked for additional information, and an experiment was performed to determine whether the SAR's having run out of tape could explain the missing data. It could not.[52]

The experiment and inquiries led the managers to suspect that the crew was concealing information. Apart from the missing SAR tape, this suspicion was fueled by what the managers regarded as [HH]'s inadequate explanation for his delay in reporting the safety limit violation.[53]

At approximately 7:30 a.m., just after "B" crew had been informed that it was being relieved of licensed duties pending the outcome of the safety limit investigation, [VV] admitted to [A] and [HH], and later to [R], that he had torn the SAR tape. He claimed, however, that he had simply let the tape drop on the floor and had not done anything further with it.[54]

Within the following hour, [R] and [N] began to organize a search of the trash in an attempt to locate the missing tape. Between approximately 11:30 a.m. and noon, three SAR tape fragments containing printed alarm messages were recovered from trash that had been collected from the control room. One of these fragments contained messages evidencing the safety limit event.[55]

A short time after this discovery, NRC site representa-

tives were shown the tape fragments and briefed on the circumstances surrounding the apparent destruction, concealment, or disposal of SAR tape. They were also briefed on the results of preliminary analyses of plant data by GPUN technical personnel. These analyses raised the possibility that both of the open recirculation loops had been closed during the safety limit event, and not just one as had been reported to management by members of the crew. Both the removal and disposal of the SAR tape and the analyses indicating the closure of two loops were formally reported to the NRC early on the afternoon of September 11, 1987.[56]

NOTES

A. Organization of Operations Management and "B" Crew at Oyster Creek

1. Oyster Creek Nuclear Generating Station Procedure 101, "Organization and Responsibility," Rev. 16, effective Feb. 21, 1987, Sections 4.11.1 and 4.11.2, pp. 21.0-22.0 (Exhibit 48) [hereinafter cited as "Station Procedure 101"];

Sworn Statement of [ZZ] (Oct. 7, 1987) [hereinafter cited as "[ZZ], 10/7/87"], pp. 16-17.

2. Station Procedure 101, Section 4.11.1, p. 22.0 (Exhibit 48). The GOS was also required to have an SRO license in order to be upgraded to GSS. Ibid., Section 4.11.2, p. 22.0.

3. Appendix A to Provisional Operating License DPR-16, Technical Specifications and Bases for Oyster Creek Nuclear Power Plant Unit No. 1, Ocean County, New Jersey [hereinafter cited as Oyster Creek Technical Specifications], Section 6.2.2(h) (Exhibit 15).

4. Sworn Statement of [R] (Nov. 4, 1987), pp. 7-8 [hereinafter cited as "[R]"].

5. Jersey Central Power & Light Co./IPEW Agreement and supplements, Nov. 1, 1985 - Oct. 31, 1987, pp. 1, 51-52 (Exhibit 49);

[R], pp. 38-39;

Sworn Statement of [N] (Nov. 4, 1987), pp. 7-9 [hereinafter cited as "[N]"].

6. Station Procedure 101, Section 4.11.1, p. 21.0 (Exhibit 48).

7. Memorandum from P.R. Clark, President, GPUN and P. B. Fiedler, Vice President-Director, Oyster Creek, to Oyster Creek GSSs (March 5, 1987), Attachment 11 to Oyster Creek Generating Station Procedure 106, Rev. 45, effective Aug. 8, 1987, pp. E9-1 - E9-2 (Exhibit 16).

See Station Procedure 101, pp. 21-22 (Exhibit 48).

8. Station Procedure 101, Section 7.3, Exhibit 3, p. E3-1 (Exhibit 48).

9. Ibid., Section 4.2-4.3, pp. 4.0-6.0;

Sworn Statement of [SS] (Oct. 29, 1987), pp. 4-6 [hereinafter cited as "[SS]"].

10. [N], pp. 4-8;

Station Procedure 101, Section 4.7, pp. 9.0-13.0 (Exhibit 48).

11. [R], pp. 4-7;

Station Procedure 101, Section 4.7.2, pp. 10.0-11.0 (Exhibit 48).

12. Sworn Statement of [HH] (Oct. 22, 1987), pp. 5-15 [hereinafter cited as "[HH]"].

13. Sworn Statement of [A] (Oct. 27, 1987), pp. 4-7 [hereinafter cited as "[A]"].

14. Sworn Statement of [VV] (Oct. 23, 1987), pp. 5-6 [hereinafter cited as "[VV]"].

15. Sworn Statement of [II] (Oct. 8, 1987), pp. 4-7 [hereinafter cited as "[II], 10/8/87"].

16. [ZZ], 10/7/87, pp. 5-8.

17. Sworn Statement of [I] (Oct. 8, 1987), p. 10 [hereinafter cited as "[I], 10/8/87"].

18. [II], 10/8/87, pp. 9-12.

19. [ZZ], 10/7/87, pp. 18, 30-31;

[VV], p. 28.

20. [ZZ], 10/7/87, p. 14.

21. Sworn Statement of [NN] (Oct. 16, 1987), p. 42 [hereinafter cited as "[NN]"].

B. Sequence of Events

22. Section VI(A);

Taylor Report, Section D-5.

23. Taylor Report, Section B-1.

24. Ibid., Section B-6;

Section V(A);

Oyster Creek Technical Specifications, Section 2.1.E (Exhibit 9A).

25. Section VI(A);

Taylor Report, Sections D-7, B-1.

26. Taylor Report, Section D-6.

27. Ibid.;

NRC Augmented Inspection Team Report No. 50-219/87-29 (Sept. 25, 1987), p. 3 [hereinafter cited as "NRC Augmented Report"] (Exhibit 27).

28. Taylor Report, Section B-5.

29. Sworn Statement of [P] (Oct. 7, 1987), pp. 10-11 [hereinafter cited as "[P]"];

Sworn Statement of [X] (Oct. 6, 1987), pp. 9, 25-27 [hereinafter cited as "[X]"].

30. [X], p. 9.

31. [II], 10/8/87, pp. 38-41;

[A], p. 75.

32. [II], 10/8/87, p. 39;

[A], pp. 75-77;

Sworn Statement of [WW] (Oct. 5, 1987), pp. 18-19 [hereinafter cited as "[WW]"];

Control Room Access Records 10:00 p.m., Sept. 10, 1987 -- 11:30 a.m., Sept. 11, 1987, "Exits" (Exhibit 14B) [hereinafter cited as "Access Records -- Exits"];

Chart showing "B" Crew Control Room Entries and Exits, Sept. 11, 1987 (Exhibit 14C) [hereinafter cited as "Access Chart"].

33. [A], pp. 78-80.

34. Ibid., p. 80;

Taylor Report, Section B-5.

35. Section VI(A).

36. Ibid. The alarm is discussed in Volume I, Section V(B) of this report and in Volume III (Taylor Report), Section B-7.

37. Section V(B). See Volume III (Taylor Report), Section E.

38. Section VI(B).

39. Taylor Report, Section D-12 and Table E-1.

40. Ibid., Sections C-1 B-8;

Section V(C).

41. Section VI(D).

42. Sections VI(B) and (D).

43. Section VI(D).

44. Ibid.

45. Section VI(B).

46. Ibid.

47. Ibid.

48. Section VI(E).

49. Ibid.

50. Sections VI(B), (C), and (E).

51. Section VI(E).

52. Ibid.

53. Ibid.

54. Ibid.

55. Ibid.

56. Sections VI(E) and (F).

III. ISSUES

The remaining sections of Volume I of this report will address and resolve the following issues:

A. Whether the safety limit violation on September 11, 1987, occurred as described by CRO [VV].

B. Whether the safety limit violation was properly reported within the GPUN chain of command.

C. Whether the safety limit violation was properly reported to the NRC.

D. Whether there was intentional destruction, concealment, or disposal of SAR records pertaining to the safety limit violation.

E. Whether the facts concerning the missing SAR records were properly reported within the GPUN chain of command.

F. Whether the facts concerning the missing SAR records were properly reported to the NRC.

IV. CONCLUSIONS

A. Scope of Findings

This investigation has devoted considerable attention to the performance of the "B" shift crew during and following the safety limit event. We have attempted to identify as precisely as possible the duties created by NRC regulations, technical specifications, company procedures, and standard operating practices, and to determine whether the attitude and behavior of individual personnel in performing their jobs were consistent with those duties. Additionally, we have investigated the extent to which management above the "B" crew level participated in or tolerated improper practices.

Certain issues related to the safety limit violation, however, were not within the scope of this investigation. We did not attempt to evaluate the safety significance of the violation, except to the extent that the nature of the violation was relevant to the credibility of witnesses or to an understanding of the actions and motives of key personnel. We also did not attempt to recommend disciplinary or other personnel action, nor did we assess the current fitness for duty of any crew member currently suspended from licensed or control room duties.

In preparing this report, we have drawn inferences that we believe are consistent with the weight of the evidence.

However, we recognize that in some areas the evidence is less conclusive than in others. Where there are factual conflicts concerning the timing and sequence of events or concerning what actually happened, we have attempted to resolve them. Where we could not resolve conflicts in the evidence, we attempted to indicate the most likely inference to be drawn and to assess the significance of the conflict. The record contained in this report is presented not only to show what evidence we believe supports our findings, but also to permit the reader to make an independent judgment concerning those findings.

B. Summary of Findings

Our findings and conclusions are contained in our discussion of each issue in Volume I, Section VI, as well as in our individual discussions of "B" crew and key management personnel in Volume II, and the principal findings are set forth at the end of each section. Those findings are summarized below:

General Findings

Safety Limit Violation[1]

1. [VV] caused the safety limit alarm to be actuated when he moved the "B" recirculation discharge valve control to the closed position in the course of securing the "B" recirculation pump.

2. [VV] made this error because, in a lapse of

concentration, he reacted to GSS [HH]'s order to secure the pumps by following what [VV] termed a "normal shutdown" procedure that was not appropriate for the prevailing plant conditions (i.e., only two loops open) that existed at the time.

3. No one else breached any standard of conduct that contributed to the safety limit violation.

4. [VV] immediately corrected his error by opening the "A" and "D" discharge valves, restoring the plant to compliance with the safety limit within two minutes.

5. The "C" discharge valve remained open throughout the event, and at no time was there a loss of communication between the core and annulus regions of the reactor vessel.

Reporting of Safety Limit Violation Within GPUN Chain of Command[2]

1. There was no agreement among the members of "B" crew to conceal, fail to report, or delay reporting the safety limit violation.

2. The responsibility for reporting the safety limit violation to higher management belonged to GSS [HH].

3. No other member of the crew encouraged [HH] to conceal, not report, or delay reporting the safety limit violation.

4. During the nearly one and one-half hour delay between the safety limit alarm and [HH]'s report of it to higher management, [HH] was preoccupied with matters requiring his attention, such as the leak on the twenty-three foot level, a possibly injured worker, and restoring the plant to pre-leak conditions. These reasons, however, do not fully explain or justify his failure to report the violation earlier.

5. By delaying his report to higher management, [HH] risked violating an NRC reporting deadline and created an appearance that, combined with other events, led to a generalized suspicion by higher managers that the crew had been attempting to conceal the safety limit violation.

Reporting Safety Limit Violation to NRC[3]

1. GPUN management above the crew level did not know about the safety limit violation until approximately 3:45 a.m.

2. Within twenty minutes after management above the crew level learned about the violation, it was reported to the NRC through the ENS telephone line.

3. The report to the NRC made by GSS [HH] at 4:05 a.m. was substantially accurate except for a 13 minute error in the time of the event, which we concluded was unintentional.

4. The 4:05 a.m. report submitted to the NRC by the GSS was timely using the four-hour reporting category.

5. After the 4:05 a.m. ENS report, both [HH] and [N] made informal notifications by telephone to the NRC resident inspector.

6. A detailed briefing was held at 6 a.m., which the NRC resident as well as various GPUN personnel attended, at which information about the safety limit violation was disseminated, comprising a substantially complete and accurate account of what was known about the event at that time.

7. GPUN management above the crew level acted with speed and diligence in reporting the safety limit violation to the NRC after learning about it.

Destruction/Concealment of SAR Tape[4]

1. After the safety limit violation, [VV] tore a quantity of SAR tape from the machine. He later threw some in the wastepaper basket located in the control room kitchen and put most of the torn tape in his pockets. These actions were probably completed prior to 2:32 a.m. and certainly completed prior to a few minutes past 3:00 a.m., when [ZZ] discovered that SAR tape was missing.

2. [VV] carried SAR tape in his pockets until shortly before 3:45 a.m., when he flushed it down a toilet in a

bathroom outside the control room.

3. The tape [VV] flushed down the toilet did not pertain to the safety limit violation, with the possible exception of a fragment of tape that recorded the time of occurrence of the alarm.

4. A portion of the tape thrown in the kitchen wastepaper basket and later recovered recorded the entire safety limit event, from the alarm to the clearing of the alarm less than two minutes later, except for the printed time of the alarm actuation itself, which we were able to establish from other data.

5. [VV] acted alone in tearing and disposing of the SAR tape.

6. No one other than [VV] knew what had happened to the tape [VV] took from the machine until [VV] partially admitted what he had done shortly before the end of the shift.

7. [VV] tore and disposed of the tape out of anger and frustration and not because he intended to conceal evidence of the safety limit violation.

Reporting of Missing SAR Tape Within GPUN Chain of Command[5]

1. CRO [ZZ] was the first person other than [VV] to notice, between approximately 3:00 and 3:10 a.m., that SAR

data were missing for the period of the safety limit event.

2. Between approximately 3:10 and 3:15 a.m., [ZZ] reported to GOS [HH] that SAR data were missing.

3. A short time later, between 3:28 and 3:30 a.m., [ZZ] reported to GOS [A] that SAR data were missing.

4. CRO [ZZ] promptly and accurately reported the condition of the SAR tape to his supervisors, the GSS and the GOS.

5. By 3:30 a.m., every member of "B" crew had been told about the missing SAR data.

6. No member of the crew considered the possibility that the SAR machine had run out of tape to be a plausible explanation for the missing data.

7. GSS [HH], who had the primary responsibility for reporting to higher management, did not make a timely and accurate report concerning the condition of the SAR tape.

8. The first GPUN manager above the crew level to learn about the missing SAR data was Operations Manager [R], who became aware that SAR data were unavailable for the time of the safety limit event during a telephone conversation with GOS [A] between approximately 4:00 and 4:05 a.m.

9. During his telephone conversation with [R], [A] omitted relevant details concerning the condition of the SAR

tape. As a result, [R] formed the impression that the reason SAR data were unavailable was that the machine had run out of paper.

10. [R] conveyed both the information that SAR data were missing and the "ran out of paper" explanation to his immediate superior in the GPUN chain of command, [N].

11. In later conversations with management representatives, neither [HH] nor [A] corrected the impression that the data were missing because the machine had run out of tape. As a result, when a management investigation revealed that explanation to be implausible, the entire crew came under suspicion.

12. The first management representative to see the condition of the SAR tape was [MM], who inspected it shortly before 6 a.m. and, like [ZZ], noticed a gap in the tape.

13. [R] and [N] did not begin to suspect that anyone had destroyed or tampered with the SAR tape until they received [MM]'s report on the condition of the tape just before the 6 a.m. meeting that had been called to discuss the safety limit event.

14. Following the 6 a.m. meeting, between approximately 6:30 and 7:30 a.m., [R], [N], [MM], and others met in [N]'s office to discuss the missing SAR data; [SS], the highest-ranking GPUN official then on the site, was also made aware of the circumstances surrounding the missing data

during this time.

15. Between approximately 6:30 a.m. and noon, the managers above the crew level and various technical, maintenance, and staff personnel were actively investigating the missing SAR tape as well as other aspects of the safety limit event, an investigation which included attempts to reconstruct the event with other data, an experiment to determine whether the machine ran out of paper, questioning of members of the crew, and a search of the trash.

16. Between approximately 11:30 a.m. and noon, three fragments of the missing SAR tape were found as a result of the trash search, one of which evidenced the safety limit violation.

17. Within a short time after the discovery of the tape fragments, the news was conveyed to the top management levels of GPUN and to the local NRC representatives.

18. Management personnel above the crew level acted with reasonable speed and diligence in verifying and reporting possible tampering with the SAR tape.

Reporting of Missing SAR Tape to NRC[6]

1. Between approximately 11:30 a.m. and noon, the apparent destruction and/or concealment of SAR tape was reported to NRC site representatives. This report was accurate within the limits of the information available. It

was made shortly after the recovery of tape fragments during a management-ordered search of the trash.

2. A formal report was submitted to the NRC at approximately 1:20 p.m., which contained information that was accurate within the limits of the information available at the time.

3. The timing of the GPUN reports to the NRC was prompted by the recovery of the SAR tape fragments, which confirmed earlier management suspicions that there had been an intentional concealment or destruction of records.

4. The management investigation of the missing SAR tape was conducted diligently, with the goal of uncovering and reporting the reason for the missing SAR data.

Findings Concerning Individual Responsibility

[HH][7]

[HH] did not contribute to the error that caused the safety limit violation. Having witnessed that violation, however, it was his responsibility as GSS to determine the appropriate reporting category for the event and then to make the required notifications. He did not carry out that responsibility when he waited nearly one and one-half hours before reporting the safety limit violation to his immediate superior in the GPUN chain of command. Fortuitously, this delay did not result in a violation of an NRC reporting

requirement. [HH]'s reports concerning the safety limit violation were accurate within the limits of the information available to him.

Although [HH] did not act in accordance with his responsibilities as a GSS with respect to reporting the safety limit violation, we concluded that he was not motivated by an intention to conceal the violation or evidence of it. Essentially, [HH] did not deal with the safety limit violation during a critical period, while carrying out his other duties in a competent and responsible manner. This pattern of behavior was influenced at least in part by a severe psychological reaction to stress.

[HH] did not take part in the destruction, disposal, or concealment of the SAR tape. Although [HH] claimed not to have heard anything, he was told about the missing SAR tape shortly after 3:00 a.m. He did not make any effort to locate it until after 4:30 a.m., when he asked the crew members if anyone had it, and did not report to higher management personnel that SAR tape was missing until they had independently learned of the tape's condition. [HH]'s failure to report the missing tape appears to have been motivated by a desire to find or reconstruct the missing data before his superiors became aware of the possibility that someone had taken the tape. The result of [HH]'s failure to report the condition of the tape, however, was that his superiors in the GPUN chain of command learned about it themselves. Consequently, they felt that they had

been misled about the SAR tape and became increasingly suspicious of the crew.

[A][8]

[A] did not contribute to the error that caused the safety limit violation and did not know that there had been one until more than an hour after it occurred. When CRO [ZZ] told him about the violation, [A] reacted in a timely and appropriate manner. After learning that the safety limit violation had not been reported to higher management, [A] insisted to GSS [HH] that it be reported immediately. [A]'s later descriptions of the safety limit violation were accurate within the limits of the information available to him.

[A] did not take part in the removal, destruction, concealment, or disposal of the SAR tape. He first learned about the missing tape at the same time that he learned about the safety limit violation. [A] did not report what he knew about the missing tape to higher management in a timely manner. He did not, however, intend to conceal the missing tape indefinitely. Instead, he hoped that the reason for the tape's absence would be explained before it cast an unwarranted suspicion on the crew.

[VV][9]

[VV] caused the safety limit violation when, in a lapse of concentration, he commenced a "normal shutdown" procedure

for taking the "B" and "C" recirculation pumps out of service. This procedure, which involved closing the discharge valves before tripping the pumps, was inappropriate for the existing plant conditions because only two recirculation loops were open, the minimum required by the safety limit. [VV] realized his mistake when, seconds after moving the "B" discharge valve control to the closed position, he saw the green safety limit alarm. He immediately corrected his error by opening the "D" and "A" discharge valves, and the alarm cleared less than two minutes after it had been actuated. The "C" valve remained open throughout the event.

Because the safety limit alarm was witnessed by the GSS and other members of the crew, [VV] did not have to report that it occurred. Later, however, he was called upon to describe how it occurred, and the sequence of events he described was for the most part consistent with the technical analyses and other evidence. To the extent that [VV]'s account could not be reconciled with the technical data, we concluded that [VV] erred in his recollection. The evidence did not support a conclusion that the inaccuracies in his description were intentional.

At some point after the safety limit alarm cleared, and probably between 2:24 and 2:32 a.m., [VV] went to the SAR machine and tore tape away from it, including the portions of tape reflecting the safety limit violation. He threw

some of this tape -- including the portion relevant to the violation -- into a wastepaper basket, and later flushed the rest down a toilet. We concluded that [VV]'s tearing and disposal of the tape resulted from self-directed anger and frustration, and not from an intention to conceal evidence.

[VV] did not report to [HH] or anyone else what he had done with the tape until approximately 7:30 a.m., when he admitted tearing it from the machine but denied doing anything further with it. He did not admit that he also disposed of the tape until late afternoon on September 11. We concluded that [VV] delayed reporting what he had done with the tape because of embarrassment and the possibility of additional punishment, and not because he hoped to conceal the safety limit violation or data pertaining to it.

[II][10]

[II] did not contribute to the operator error that caused the safety limit violation. Because GSS [HH] witnessed the safety limit alarm, [II] was not responsible for reporting its occurrence to higher management or to the NRC. As the designated "lead" CRO, however, he was responsible for making an appropriate log entry concerning the violation. The entry he made, styled a "late entry" because it was out of sequence with other entries in the log book, contained internal inconsistencies and factual errors. These, we concluded, were inadvertent, resulting from carelessness, reliance on assumptions, and lack of

assistance from other members of the crew.

[II] took no part in the destruction, concealment, or disposal of the SAR tape. He learned about the missing tape when, in [II]'s presence, [ZZ] reported it to [HH]. Because [HH], and shortly thereafter [A], knew about the missing tape, [II] incurred no immediate responsibility to report it to higher management or the NRC. Later, when asked about the tape by a critique panel, he rendered an accurate account of what he knew. He did not make an entry in the control room log about the tape because he believed that it was not the kind of event that should be entered on the log.

[ZZ][11]

[ZZ] did not contribute to the operator error that caused the safety limit violation and, under the circumstances, was not responsible for reporting that violation. He nevertheless took the initiative of reporting it to [A], resulting in [A]'s insistence that [HH] report the violation immediately to higher management. [ZZ] took no part in the destruction, concealment, or disposal of the SAR tape, and acted in a timely and appropriate manner when he learned that tape was missing. Apart from [VV], he was the first member of the crew to notice that tape was missing, which he immediately reported to [HH] and, shortly thereafter, to [A].

[I][12]

[I] did not contribute to the operator error that caused the safety limit violation. Because higher-ranking crew members, including the GSS, witnessed the violation, [I] was not responsible for reporting it to higher management or to the NRC. [I] did not take part in the destruction, concealment, or disposal of the SAR tape, and, under the circumstances, had no reporting responsibilities with respect to the missing SAR tape.

[R][13]

[R] did not contribute to the operator error that caused the safety limit violation. He reacted quickly and appropriately when he learned about the violation, reporting it immediately to his superior in the GPUN chain of command and ordering the GSS to notify the NRC. His reports were accurate within the limits of the information available to him. [R] had no role in the destruction, concealment, or disposal of the SAR tape. [R] did not receive a complete and accurate report from the crew about the condition of the SAR tape and, as a result, formed the impression that the SAR had run out of tape. When information was brought to [R]'s attention casting doubt on the "ran out of tape" explanation for the missing SAR data, [R] helped conduct a management investigation of the missing tape. He was diligent in conducting this investigation, the results of which were disclosed in a timely manner to upper GPUN

management and the NRC.

[N][14]

[N] had no role in the commission of the safety limit violation. His alert questioning about plant conditions and the details of crew actions in response to the leak prompted [R]'s call to the control room at approximately 3:45 a.m. During that call, [R] learned about the safety limit violation for the first time and immediately reported the event to [N] who, in turn, immediately reported it to [SS]. A short time later, [N] also reported the incident to the NRC resident inspector. [N]'s reporting of the safety limit violation was timely and appropriate, and was accurate within the limits of the information available to him. He had no role in the destruction, concealment or disposal of the SAR tape. When he learned that SAR tape was missing, he supervised an investigation into the matter, the results of which he reported to [SS] and the NRC.

[SS][15]

[SS] did not contribute to the operator error that caused the safety limit violation. He reacted in a timely and appropriate manner after the violation was brought to his attention, by which time [R] and [N] had set in motion the required notification procedures. [SS] notified his superiors in the GPUN chain of command and presided over a 6:00 a.m. briefing at which he described the safety limit

event to GPUN and NRC personnel. The briefing he provided was accurate within the limits of the information available to him. [SS] had no role in the destruction, concealment, or disposal of the SAR tape. He had only a limited role in the investigation of the missing SAR tape, but he lent his support and authority to that investigation and reported its results to his superior in the GPUN chain of command.

NOTES

1. Volume I, Section VI(A).

2. Volume I, Section VI(B).

3. Volume I, Section VI(C).

4. Volume I, Section VI(D).

5. Volume I, Section VI(E).

6. Volume I, Section VI(F).

7. Volume II, individual section pertaining to [HH].

8. Volume II, individual section pertaining to [A].

9. Volume II, individual section pertaining to [VV].

10. Volume II, individual section pertaining to [II].

11. Volume II, individual section pertaining to [ZZ].

12. Volume II, individual section pertaining to [I].

13. Volume II, individual section pertaining to [R].

14. Volume II, individual section pertaining to [N].

15. Volume II, individual section pertaining to [SS].

V. BACKGROUND

A. History of Safety Limit

The safety limit that was violated on September 11, 1987, was defined as follows:[1]

> During all modes of operation except when the reactor head is off and the reactor is flooded to a level above the main steam nozzles, at least two [2] recirculation loop suction valves and their associated discharge valves will be in the full open position.

This safety limit was incorporated into the station's technical specifications because of an event that occurred on May 2, 1979. On that date, all five reactor recirculation pumps -- the pumps that keep water flowing between the annulus region of the reactor[2] and the core -- were shut down ("tripped").[3] The pumps were part of the five recirculation "loops" that maintain communication between the core and annulus. Such communication is essential because it enables the operators to monitor water levels in the core.[4] Each recirculation loop, in addition to a pump, has a suction valve, a discharge valve, and a smaller (two-inch) discharge bypass valve.[5]

In the May 2, 1979 event, all five discharge valves were closed after the pumps tripped, with only the bypass valves left open.[6] It was believed then that keeping these smaller valves open was enough to maintain adequate communication between the core and annulus regions.[7] The communication was not adequate, however, and water began boiling

off above the core faster than it was flowing back through the bypass valves. At the same time, because of the inadequate communication, the operators' instruments which measure water level in the annulus region were indicating that the core water level was high, when in fact it was becoming dangerously low, resulting in a triple low level alarm in the core region. The event ended when discharge valves were reopened and the water levels in the two regions were equalized.[8]

A later analysis of the May 2, 1979 event showed that the core had not been uncovered. The low water level, however, had violated a safety limit. Accordingly, the plant was shut down and needed NRC permission to start up again. Plant management was required to submit an acceptable plan of corrective action to the NRC, stating what steps would be taken to prevent a repetition of the May 2 incident. One of those steps was a proposal to require that two RBCCW loops be kept fully open at all times.[9]

In discussions with the NRC concerning the proposed corrective actions, plant management argued that the two loops requirement should be a Limiting Condition for Operation (LCO), rather than a safety limit. One open loop was sufficient to maintain adequate communication, it was argued, so a two-loop requirement would not be a true safety limit; instead, it would be a warning that a safety limit was being approached. The NRC, however, rejected these

arguments and took the position that the two-loop requirement had to be designated a safety limit before the plant could restart.[10] The result was the safety limit that was violated -- apparently for the first time -- on September 11, 1987.

Unlike other safety limits, the requirement that at least two loops be kept open was not based upon a quantifiable point, such as a water level, beyond which there existed a threat to plant safety. Rather, it was designed to prevent operators from taking an additional step that, if taken, might create a safety problem.[11] As discussed below, this unique aspect of the less-than-two-loops safety limit affected the design of the alarm system that was eventually installed.

B. History of the Less-Than-Two-Loops Alarm

As explained in Section V(A), safety limit 2.1.E was added by the NRC to the Oyster Creek Technical Specifications following the May 2, 1979 event to ensure that there would always be an adequate flow path between the core and downcomer regions of the reactor, so that the downcomer level instrumentation could be relied upon as an indication of the water level in the core region.[12] This safety limit was basically an administrative technical specification, and was unique in that violation of the limit (i.e., closing a fourth loop) did not in itself pose any safety question,[13] but simply raised the possibility that a

fifth loop might be isolated, thereby rendering the downcomer level instrumentation unreliable.

When the safety limit was first imposed in 1979, there was no instrumentation installed to ensure that the requirements of the safety limit would always be satisfied, and there was no alarm installed to warn the operators either that the safety limit was being approached or that it had been violated. Instead, various administrative steps were taken in an attempt to ensure that the safety limit was not violated. "Caution" statements were added to those plant procedures dealing with recirculation pump and valve operation,[14] and operator training was updated to include the new safety limit.[15] Hinged plastic covers were installed over the pump suction and discharge valve control switches to discourage inadvertent operation,[16] and warning labels were added to these covers.[17]

During the Oyster Creek 1979/1980 refueling outage, the low-low-low-level alarm instrumentation in the core region of the reactor vessel was greatly enhanced by the addition of level indication and recording capabilities. This "fuel zone level monitoring system" was designed to be activated whenever all five recirculation pumps were shut down.[18]

During 1980, as a direct result of the Three Mile Island accident during which the core was uncovered and fuel damage occurred, the NRC promulgated requirements for boiling water reactor (BWR) plants such as Oyster Creek for

interlocks to be installed to positively ensure that at least two recirculation loops would always be open.[19] This would have effectively replaced the administrative safety limit with an instrumented one. GPUN began engineering work for this interlock modification in 1981,[20] but internal review of this proposal by the GPUN Human Factors Section resulted in the interlock scheme being changed to an "alarm only" installation,[21] and a "Preliminary Engineering Design Review" (PEDR) meeting to review the alarm system design was scheduled for August 8, 1985.[22]

Despite some disagreement with the idea of an alarm from some members of the Oyster Creek Operations Group,[23] design of the alarm system continued,[24] and it was decided at the PEDR meeting to add a "reflash" capability to the alarm to cause a second alarm upon isolation of the fifth loop.[25] Burns and Roe performed the detailed system design, which is embodied in the GPUN "System Design Description for the Recirculation Valve Interlock Modification." This design document describes the essential function of the alarm:[26]

> The occurrence of an alarm will alert the operator that the plant is operating below the requirements of the Plant Technical Specifications.

Thus, the alarm was not designed to warn operators of an impending safety limit violation, but instead to advise them that one had already occurred. This feature of the "Less Than Two Loops Open" alarm made it unique, since other

alarms were designed to annunciate before a violation or unsafe condition occurred. For this reason, many of the operators, supervisors and others at the Oyster Creek Station opposed it, labeling it the "death alarm."[27]

However, as noted above, it was decided to install the alarm as designed despite the opposition. The alternative of activating the alarm when the third loop was closed, i.e., before a safety limit violation had occurred, was rejected because it was not uncommon for three loops to be closed when the reactor was in shutdown condition, in which case the alarm would be continuously lit and therefore ineffective as a warning.[28]

The unique "death alarm" feature of the "Less Than Two Loops Open" alarm is closely related to the peculiarity of the safety limit itself. In essence, the alarm was designed to prevent the threat to plant safety that could result from loss of communication between the core and annulus regions of the reactor vessel -- i.e., all recirculation loops closed -- but was not designed either to prevent or warn of an impending safety limit violation.[29] This seemingly anomalous feature of the alarm was made possible only because the unique definition of the safety limit itself allowed it to be violated by a condition, i.e., only one loop open, that did not in itself constitute a threat to plant safety.[30]

Between September 1985 and July 1986, the downgrading

of the recirculation valve interlock originally mandated by the NRC to an "alarm only" installation was the subject of discussions and correspondence between GPUN and the NRC.[31] These discussions eventually resulted in the NRC approving the alarm installation, largely on the basis that the fuel zone level monitoring system had already been installed and that the proposed interlock system with its attendant indication and bypass requirements would be unnecessarily complicated.[32] Although the reduction in scope from an interlock system to an alarm only installation reduced the costs of the project from $2,500,000 to $586,000,[33] cost was apparently not a factor in the decision, at least at the plant level.[34]

The alarm system design was finally completed in October 1985, and the system was installed during the 1986 refueling outage. The initial intention had been to remove the hinged covers over the recirculation valve controls as part of the alarm installation because the warning labels on the covers tended to obscure the valve position indicating lights.[35] Later, it was decided to leave the covers in place,[36] and to relocate the warning labels to a position adjacent to each set of recirculation valve controls.[37] The alarm system was finally turned over to plant operations in July 1986.[38]

(or from an alarm back to a normal state), the SAR prints a three line message consisting of the alarm point identification and time of occurrence (hour:minute:second:millisecond), an "alarm" or "normal" message, and a brief description of the alarm itself.[48] If no further alarms have occurred, a time and date message is then printed.[49] However, if further alarms occur while the first alarm is being printed out, the time and date message will not be printed until after all of the alarm messages have been printed and the SAR memory has been emptied.[50]

Once an alarm has been printed out, it is cleared from the SAR memory, and the printed paper output is therefore the only record produced or retained by the SAR of a particular alarm occurrence. Despite the fact that many alarm points are also separately monitored and recorded by the plant computer, the "Less Than Two Loops Open" alarm is not one of them. Although the SAR is equipped with an interface for transmittal of alarm information to a remote device such as a recorder or printer,[51] this option was not utilized at Oyster Creek.

The vendor's manual lists the printing time for a single three line alarm message as six seconds;[52] however, an analysis conducted as part of this investigation showed that for the Oyster Creek SAR, this printing time is closer to four seconds.[53] Once every 24 hours, the SAR automatically scans all of the inputs and prints out a summary of

points, with the ability to discriminate between alarms occurring within two milliseconds of each other, and to print out a message consisting of the alarm point number, time of occurrence, and a brief description. It was to have a memory capacity sufficient to handle a backlog of at least 341 alarms, together with their times of occurrence.[43]

The SAR installed at Oyster Creek was specified to meet these functional requirements. It was supplied by Dranetz Technologies, Inc., and consists of a microprocessor-based solid state event processor capable of monitoring the status of up to 1024 devices such as electromechanical or solid state relays, with a time resolution of one millisecond.[44]

The SAR memory is capable of storing a maximum of 1052 individual events, or a lesser number (but at least 398) depending on whether optional software functions are programmed.[45] Should the events being monitored exceed the memory capacity, the SAR ceases monitoring further changes in input signal status until all of the events stored in the memory have been printed out, at which point normal monitoring is resumed.[46] This may occur, for example, if the SAR printer runs out of paper. This condition causes a "Printer Paper Low" message to be printed, and inhibits further alarm printing (but not event monitoring or storage in the SAR memory up to the memory capacity) until the paper is replaced.[47]

When an input changes from a normal to an alarm state

alarm that had been lost by the paper being torn and discarded could be printed out from the memory.[63] [HH] did not know the capacity of the SAR memory,[64] but felt that it would hold everything in its memory for at least a limited period of time.[65]

"B" crew personnel also had different views as to the SAR's reliability. [A] felt that it functioned properly most of the time, but on occasion ran out of paper during a shift.[66] [II] did not consider the SAR reliable in terms of printing out alarms.[67]

[ZZ] felt that the machine had given the crew a lot of problems in the past, particularly with respect to the takeup reel malfunctioning.[68] On September 11, 1987, however, [ZZ] observed the machine to be working properly when he saw it between midnight and 2:00 a.m.[69]

Among the operators, there was some resentment towards the SAR machine. It was often referred to as the "white rat." Many of the operators had Navy backgrounds, and the term "white rat" was a term used in the Navy to describe a listening device by which officers could listen to engineers. The control room operators viewed the SAR as a similar device which permitted management to monitor their activities.[70]

those inputs which are in an alarm state at the time of the scan.[54]

The alarm information is printed out on a roll of tape which exits the machine at the top right-hand corner.[55] A motor-driven paper takeup reel (which can accommodate several rolls of output paper) is provided to collect the paper output from the SAR, and is located on the floor near the foot of the SAR.[56] The SAR itself is installed between panels 16R and 11XR at the rear of the control room behind the main panel, out of sight of the normal operating area.[57]

2. Operator understandings of SAR capabilities and operation

The members of "B" crew understood that the SAR had a memory, but their individual perceptions differed as to its capacity. [A] felt that the SAR had a limited capacity for alarms and that the machine did not print the alarms fast enough. He believed that alarms were lost on an average of once a week because they exceeded the SAR's memory capacity.[58] [A] also believed (correctly) that once the SAR printed an alarm there would be no memory of that alarm.[59] [VV] was also aware that the SAR had a memory. He had no idea, however, whether the SAR would retain the memory of an alarm if the paper was removed.[60] [ZZ] had heard that the SAR only had a memory of approximately thirty minutes.[61] [II] was also aware that the SAR machine had a memory,[62] and was unaware of any time limitation on it. He thought that the

3. History of Less-Than-Two-Loops Alarm

12. Letter from D.L. Ziemann (NRC) to I.R. Finfrock, Jr. (JCP&L) (May 30, 1979), enclosing Amendment 36 to Operating License DPR-16, revised Technical Specification, page 2.1-4a (Exhibit 36).

13. [N], p. 31.

14. See, e.g., Oyster Creek Generating Station Procedure 301, "Nuclear Steam Supply System," Rev. 39, 3/29/87 [hereinafter cited as "Station Procedure 301"], Sections 4.2.2, 5.2.5, 7.2.2, 7.3.4, 12.2.1 pp. 16.0, 22.0, 31.0, 35.0, and 43.0 (Exhibit 17);

Oyster Creek Generating Station Procedure 2000-ABN-3200.02, "Recirculation Pump Trip," Rev. 3, 9/1/86 [hereinafter cited as "Station Procedure 2000-ABN-3200.02"], p. 8.0 (Exhibit 32).

15. [N], p. 32.

16. Letter from I. R. Finfrock, Jr. (JCP&L), to the NRC (May, 12, 1979), attached report on 5/2/79 incident, p. 3.D-1 (Exhibit 31).

17. [N], p. 32.

18. Letter from R. F. Wilson (GPUN) to J. A. Zwolinski (NRC) (Sept. 19, 1985), p. 2 (Exhibit 39).

19. NUREG-0737, "Clarification of TMI Action Plan Requirements," Item II.K.3.19, Nov. 1980 (Exhibit 46).

20. GPUN Budget Activity Authorization No. 402207, Rev. 1 (Aug. 19, 1981), Rev. 2 (Dec. 17, 1981), and Rev. 3 (Feb. 17, 1982) (Exhibit 42).

21. Memorandum from GGGGGG to ZZZZZZ (Mar. 21, 1985) (Exhibit 51).

22. Memorandum from EEEEEEEE to Distribution (July 23, 1985) (Exhibit 52).

NOTES

A. History of Safety Limit

1. Oyster Creek Technical Specifications, Section 2.1.E (Exhibit 9A).

2. The annulus is the region immediately surrounding but physically separated from the core. See Volume III (Taylor Report), Section B-1 and Figure B-1; [ZZ], 10/7/87, p. 53; Diagram of dry well cooling system (Exhibit 2A) and Diagram of typical recirc loop (Exhibit 2B).

3. [N], pp. 27-28.

4. [ZZ], 10/7/87, pp. 52-55.

5. Ibid., p. 52;

   Diagram of a typical recirc loop (Exhibit 2B).

   Volume III (Taylor Report), Section B-1.

6. [N], pp. 27-28;

   Sworn Statement of [O] (Oct. 15, 1987), pp. 6-9 [hereinafter cited as "[O]"].

7. [N], p. 28.

8. Ibid. For a detailed description of the May 2, 1979 event, see Letter from I. R. Finfrock to NRC, 5/12/79, with attachment (JCP&L Report on the May 1979 Transient at the Oyster Creek Nuclear Generating System) (Exhibit 31).

9. [N], pp. 28-30.

10. Ibid., pp. 30-32.

11. Ibid., pp. 31-32. See Section V(A) of this report.

32. Letter from J. N. Donohew, Jr. (NRC), to P. B. Fiedler (GPUN) (July 15, 1986), Attached Safety Evaluation, p. 2 (Exhibit 41).

33. GPUN "Request for Project Approval," for "Recirc Valve Interlock Modification," Rev. 4 (Feb. 14, 1986) B/A 402207 (Exhibit 42).

34. [N], p. 35.

35. Memorandum from GGGGGG to ZZZZZZ (Mar. 21, 1985) (Exhibit 51).

Division I Interlock Modification (Aug. 30, 1985), p. 4 (Exhibit 38).

36. Memorandum from GGGGGG to ZZZZZZ, "Hinged Covers Removal (B/A 402207)" (Jan. 28, 1986) (Exhibit 57).

37. Letter from R. F. Wilson (GPUN) to J. A. Zwolinski (NRC) (Jan. 30, 1986), p. 2 (Exhibit 39).

38. GPUN "Turnover Notification" for the Recirculation Valve Interlock (July 17, 1986) (Exhibit 43).

C. <u>Sequence of Alarms Recorder (SAR)</u>

39. JCP&L Modification Proposal 224-7-3, "Oyster Creek Control Room Alarms," Rev. 6, 7/10/84, Section 2, p. 1 [hereinafter cited as "Modification Proposal"] (Exhibit 33).

40. <u>Ibid</u>., Section 2, pp. 1, 2.

41. <u>Ibid</u>., Section 1, p. 1.

42. [R], p. 55.

43. Modification Proposal, Section 3.11, p. 4 (Exhibit 33).

23. Memorandum from mm to GGGGGG (July 25, 1985) (Exhibit 53).

24. Memorandum from GGGGGG to mm (Aug. 1, 1985) (Exhibit 54).

25. Preliminary Engineering Design Review of the Recirculation Valve Interlock Modification, Conference Notes (Aug. 8, 1985), p. 3 (Exhibit 55).

26. GPUN Division I System Design Description for the Oyster Creek Nuclear Generating Station Recirculation Valve Interlock Modification, Rev 0 (Aug. 30, 1985), p. 6 (Exhibit 38) [hereinafter cited as "Division I Interlock Modification"].

27. [HH], pp. 75-76;

[R], pp. 52-55;

[VV], p. 85.

28. [N], p. 39;

Letter from P. R. Clark (GPUN) to Dr. T. E. Murley (NRC) (Sept. 20, 1987), Attachment II, p. 5 (Exhibit 47).

29. Letter from P. R. Clark (GPUN) to Dr. T. E. Murley (NRC) (Sept. 20, 1987), Attachment II, p. 5 (Exhibit 47).

30. Ibid., Attachment II, pp. 7-9 (Exhibit 47).

Letter from R. F. Wilson (GPUN) to J. A. Zwolinski (NRC) (Jan. 30, 1986), p. 1 (Exhibit 39).

31. Letter from R. F. Wilson (GPUN) to J. A. Zwolinski (NRC) (Sept. 19, 1985) (Exhibit 37);

Letter from R. F. Wilson (GPUN) to J. A. Zwolinski (NRC) (Jan. 30, 1986) (Exhibit 39);

Letter from J. A. Zwolinski (NRC) to P. B. Fiedler (GPUN) (April 16, 1986) (Exhibit 40).

60. [VV], p. 184.

61. [ZZ], 10/7/87, p. 190.

62. [II], 10/8/87, p. 137.

63. Ibid., pp. 137-38.

64. [HH], p. 265.

65. Ibid., p. 81.

66. [A], pp. 50-52.

67. [II], 10/8/87, pp. 33-34.

68. [ZZ], 10/7/87, p. 114.

69. Ibid., p. 113.

70. [HH], pp. 78-79;

[II], 10/8/87, pp. 30-36;

Sworn Statement of [QQ] (Oct. 16, 1987), pp. 29-31 [hereinafter cited as "[QQ]"];

Sworn Statement of [TT] (Oct. 2, 1987), pp. 24-25 [hereinafter cited as "[TT]"];

[ZZ], 10/7/87, p. 117.

44. Dranetz Technologies, Inc., System 22 Sequence of Events Recorder, TM-103700, Operation Manual, 3/1/84, Section 1.1, p. 1-1 (Exhibit 45) [hereinafter cited as "Dranetz SER Manual"]

45. Ibid., Section 1.6.1, pp. 1-9.

46. Ibid., Section 1.6.2, pp. 1-10.

47. Ibid., Section 2.9, pp. 2-16; Table 1-6, pp. 1-23.

48. See, e.g., Fragments of SAR Tape Found 9/11/87 (Exhibit 13)

49. Ibid.

50. Dranetz SER Manual, Section 2.9, pp. 2-16 (Exhibit 45).

51. Dranetz SER Manual, Volume I, 3/1/84, Section 1.2, p. 1-1; Section 1.6.11, pp. 1-12 (Exhibit 45).

52. Ibid., Section 1.6.13, pp. 1-13.

53. Volume III (Taylor Report), Appendix 6.

54. Dranetz SER Manual, Volume I, 3/1/84, Section 1.2, pp. 1-1 (Exhibit 45).

55. Ibid. Figure 2-8, pp. 2-17;

Photograph of SAR (Exhibit 5D).

56. Photograph of SAR (Exhibit 5E).

57. See Diagram of Control Room (Exhibit 1).

58. [A], p. 51.

59. Ibid., p. 126.

1. Standards of conduct

The requirement that two recirculation loops be kept fully open at all times was clearly set forth in the Oyster Creek Technical Specifications (Section II.B), and was well known to the operators and supervisors of "B" crew. Reminders of this safety limit were prominently displayed next to the controls for each recirculation loop,[3] and plastic covers were placed over the valve controls themselves as a further reminder to operators to pause and think before closing a valve.[4] Additionally, the safety limit was covered in operator training and "cautions" against closing more than three loops were conspicuously placed in written procedures.[5]

The licensed members of "B" crew, including the CRO whose actions caused the alarm, confirmed in their testimony that they understood prior to the September 11 violation what conduct was required to avoid violating the less-than-two-loops safety limit.[6]

It was also clear from training, written procedures, and commonly understood operating practices that the proper sequence of steps for taking recirculation pumps out of service varied according to plant conditions. Station Procedure 301, for example, contains a section (7.0) that specifies the sequence of steps for what [VV] termed a "normal shutdown."[7] It was this sequence, as discussed below, that [VV] testified he was following when the safety

VI. DISCUSSION OF ISSUES

A. The Crew and Management Accounts of the Cause and Nature of the Safety Limit Violation

Apart from whether the safety limit violation was reported in a timely fashion, there is an issue as to whether it was reported accurately. In order to evaluate this issue, it is necessary to discuss certain aspects of the violation itself.

CRO [VV], who actuated the safety limit alarm and who later, according to his testimony, tore and disposed of the SAR tape, described in detail what he did both before and after the alarm. The credibility of his testimony concerning his post-alarm actions depends in part on how accurately he described what he did to actuate the alarm. This is particularly true because what [VV] did prior to the alarm can suggest either the presence or absence of a motive to conceal evidence.

For example, certain log entries and technical analyses suggested that possibly two discharge valves rather than one were closed during the safety limit event.[1] If this were true it would contradict the testimony of [VV], who said he closed only one valve, and, as discussed in detail below, would suggest a possible motive for destroying or concealing evidence -- i.e., to conceal the fact that all five recirculation loops had been closed.[2]

assisted [HH] and [ZZ] in attempting to determine the source of the leak.[13] [A], who was at the site of the spill, reported back through the intercom that the water was purple, confirming that the leak was in the RBCCW system.[14] [VV], [HH] and [I] then examined diagrams of the RBCCW system to identify the valves that needed to be closed in order to isolate the leak.[15] The isolation was to be accomplished by closing valves upstream and downstream from the leaking valve; one valve could be closed electronically from the control room while the other had to be closed manually. Closing the valves would have the effect of stopping RBCCW flow through the drywell.[16]

[VV] and [HH] then discussed whether the recirculation pumps could be run without RBCCW flow through the drywell.[17] Written operating procedures specified that the pumps could not be run under those conditions, but they had been run without RBCCW under a special procedure during a previous outage.[18] [VV] showed [HH] the current procedure, which indicated that the special procedure allowing the recirculation pumps to run without RBCCW flow through the drywell had apparently expired.[19] [HH] agreed that the pumps would have to be "secured" -- i.e., taken out of service -- and he ordered this done.[20]

An order to "secure" a pump meant taking the pump out of service in a manner appropriate to plant conditions, which might or might not involve shutting a discharge

limit alarm occurred. In that same section, however, there is the following highlighted warning:[8]

CAUTION

> The suction and main discharge valves of at least two (2) recirculation loops must remain open.

A similar caution appeared at the beginning of the section on removing recirculation pumps from service, and elsewhere in Procedure 301.[9]

A station procedure designed for abnormal operating conditions entitled "RBCCW Failure Response"[10] provides instructions for dealing with various types of failures in the RBCCW system, including leaks in the system, the situation confronting the crew on September 11, 1987. Section 3.1.2 of that procedure states:

> Trip all operating recirculation pumps, and confirm that all recirculation pump suction and discharge valves are open.[11]

The crew members testified that this procedure was the proper one for securing the pumps after it was decided to isolate RBCCW flow from the drywell.[12]

2. [VV]'s account of how the safety limit violation occurred

[VV] gave the following account of his actions during the events leading up to and immediately following the safety limit violation:

When news of the spill on the twenty-three foot level reached the control room at approximately 2:10 a.m., [VV]

speed of the pump and reduce flow;

4. shut the discharge valve; and

5. switch off the pump's motor generator (MG) set, thereby shutting off ("tripping") the pump.

[VV] testified that, in accordance with this "normal shutdown" procedure, he positioned himself in front of panel 3F where the controls for the five recirculation loops are located, and began the sequence of events to secure "B" pump. He intended to secure the "B" pump first, then the "C" pump.[26] [VV] said that his first step was either to balance the "B" potentiometer (the control that adjusts the manual speed setting) to make it equal to the master control setting by placing it in a neutral position or to check to see that it was already balanced; he was not sure, but he thought it was already in neutral.[27] Next, according to [VV], he switched the "B" pump control to manual and turned the potentiometer to decrease pump speed -- and therefore recirculation flow -- to the point where he would begin to get reverse flow.[28] He estimated that this procedure may have taken 10-30 seconds.[29] He did not recall doing anything with the "C" loop controls during this period, but said it was possible that he balanced "C" pump (or checked to see that it was already balanced) and took it to manual before proceeding to the next step in the shutdown procedure for "B" pump.[30]

valve.[21] [VV] was aware from the turnover briefing he had received at the beginning of the shift that only the pumps on the "B" and "C" recirculation loops were running. Indeed, "B" crew had reduced the number of operating loops to two the previous day, when they initiated the reactor shutdown process.[22] The "A," "D," and "E" pumps were out of service, and [VV] knew that their corresponding discharge valves would be closed.[23] Thus, [HH]'s order to secure the pumps applied only to "B" and "C" pumps, the only ones in service at the time. Securing these pumps in a manner appropriate to plant conditions meant tripping the pumps without closing any discharge valves, because only two loops were open, the minimum permitted by the safety limit. (Alternatively, [VV] could have opened two of the closed discharge valves before closing the two open ones, "B" and "C.")

[VV], however, interpreted the order to secure the pumps as if [HH] had said "do a normal shutdown of the pumps."[24] A "normal shutdown" in this context meant taking the following steps in the sequence indicated:[25]

1. balance the pump speed master and local controller signals using the deviation meter on the local speed controller;

2. switch the controller to manual;

3. lower the speed set point in manual to decrease the

discharge valve to move to the fully open or fully closed position after the control switch activates the process. As explained in Volume III of this report,[37] the stroke times for the five discharge valves varied.) [VV] said that he knew "D" valve, not "A," reached the fully open position when he heard the bell indicating that the safety limit alarm had cleared. He heard this bell before the "B" valve reached the fully closed position.[38]

[VV] testified that when the alarm cleared and the valve strokes on all three discharge valves (i.e., "B," "A," and "D") were complete, he tripped the "B" pump MG set and then, 15-20 seconds later, tripped the "C" pump.[39] This completed the securing of the "B" and "C" pumps, as ordered by [HH].

[VV] could not explain why he forgot that only two loops were open when he commenced what he described as a "normal shutdown" procedure -- which involves closing the discharge valve -- rather than simply tripping the pumps without closing valves which, as he acknowledged, was the appropriate procedure given the plant conditions that existed on September 11.[40] He stated that the safety limit "never crossed my mind" until the alarm came in,[41] and concluded that it was "my lapse of recollection that caused me to violate the safety limit."[42]

After reducing the flow on "B" loop, [VV] flipped up the plastic cover on the "B" discharge valve control and moved the switch to the "closed" position.[31] He held the switch in that position until he got a double light indication (confirming that the valve was responding to the switch and was closing),[32] at which point the alarm signifying the safety limit violation occurred. (As explained in Volume III (Taylor Report), Section D-10.1, the time it would have taken to get the double light indication after [VV] first moved the valve control to the closed position was approximately seven seconds.) Seeing that the alarm was green, [VV] instantly knew that it was the less-than-two-loops alarm and realized that he had erred by closing the "B" discharge valve. He immediately reached over with his right hand and moved the "D" loop discharge valve control switch to the open position; a second or two later he reached the "A" loop discharge valve control switch with his left hand and opened that valve as well.[33]

[VV] was certain that he did not close the "C" discharge valve.[34] He explained that, although he had closed only one discharge valve ("B") to bring in the alarm, he opened two ("A" and "D") "to be conservative":[35]

> I opened two knowing that having two valves going open would, or should, compensate for the one discharge valve going closed.

After opening "A" and "D" valves, [VV] watched to see "which ones cycled first."[36] (He was referring to the approximately two minute stroke cycle required for a

control panel and did not actually see [VV] handle the controls.[48] [ZZ] stated that he was at another part of the control panel preparing to raise reactor water level and he did not see what [VV] did to cause the alarm.[49] Only [I] was watching [VV] directly, but he was behind him and could only see arm and shoulder movements.[50] [I] had the impression that [VV] was handling the "B" loop controls because he was using his left hand, the one nearest those controls.[51]

After the alarm, when their attention was drawn to what [VV] was doing, [HH], [II], [ZZ], and [I] all saw him attempt to compensate for his error by opening two discharge valves.[52]

Thus, [VV]'s testimony that he reacted to the alarm by immediately opening two discharge valves is strongly corroborated by the other crew members who witnessed his actions. The specifics of what he did prior to the alarm, however, were not observed by the others.

Certain technical data and entries in the control room log appeared to conflict with [VV]'s account of his pre-alarm actions. The most important of these conflicts concerned [VV]'s testimony that he closed only the "B" discharge valve, meaning that the "C" loop remained open at all times. The control room log maintained by CRO [II] contained the following "late" entry about the safety limit violation:[53]

3. Comparison of [VV]'s account with other evidence

In addition to [VV], five persons were in the control room when the safety limit alarm came in. Four -- [HH], [II], [ZZ] and [I] -- were members of "B" crew. The fifth, [PP], was an instrument technician who had entered the control room at 1:30 a.m. to do preventive maintenance work.[43] Just prior to [PP]'s exit from the control room at 2:17 a.m., he observed the green safety limit alarm flash.[44] The alarm had not cleared when [PP] left the control room.[45]

All of the crew members were in the immediate vicinity of the control panel at the time of the alarm and all of them confirmed that the alarm came in immediately after [VV] performed certain operations at the controls following [HH]'s order to secure the pumps. [PP] was not aware of [HH]'s order, but he also observed [VV] standing in front of panel 3F, where the recirculation controls are located, and noticed that he was manipulating the controls.[46]

None of the witnesses to the event, however, observed [VV] closely enough to determine either the specific controls he was handling or the exact sequence of his actions. Until the alarm, most of the crew's attention was directed elsewhere. [HH] testified that he was looking at a diagram of the RBCCW system until the alarm drew his attention.[47] [II] was seated at the desk in front of the

testimony was based upon an assumption by its author, CRO [II], who conceded that he did not know whether one valve or two had been closed.[57]

[VV] explained a key basis for [II]'s assumption; i.e., why he opened two discharge valves even though he had only closed one. He wanted the total area of open valves to equal or exceed the area that was going closed.[58] [VV] related this action to the theory behind the safety limit, which was to maintain communication between the core and annulus regions:[59]

> While [the "A" and "D" valves] were stroking open, they would be getting more and more flow and communication from the annulus to the core while the one was going closed and they should more than compensate for it.

We found this explanation to be a plausible rebuttal to [II]'s inference that [VV] had closed two valves because he later opened two. Indeed, [VV]'s idea of creating a "total open area" that would equal or exceed the area of two fully open discharge valves later occurred independently to [NN], the Oyster Creek Licensing Manager. [NN] briefly considered the possibility that having a total "effective area" open that equaled or exceeded two open valves might mean that the safety limit had not been violated.[60] (A later review of the technical specifications convinced [NN] that this was not a viable interpretation of the safety limit.)[61]

[II]'s log entry, however, was not the only evidence in apparent conflict with [VV]'s testimony that he closed only

> During the leak incident on 23' R.B., while tripping off B&D RCP's due to isolating the RBCCW to the drywell, discharge vv's were closed on these pumps. At this time A, D, E pp's were off w/discharge vv's closed. The alarm E-4-B came in, less than 2 loops open, which violates tech spec safety limit. While B&D RCP's disch. vv's were going close, two other loops disch vv's were being opened. The time with less than 2 loops open was very short.

The statement in this entry that "discharge vv's [valves] were closing on these pumps" appears to contradict [VV]'s statement that he closed only one valve. There is, however, an obvious error in the statement that the valves were closed while "B&D" pumps were being tripped. [VV] was preparing to trip "B" and "C" pumps, not "B" and "D." As reflected elsewhere in the same log entry, the "D" pump had been shut down since the beginning of the shift. [II] acknowledged this error[54] and explained the basis for his statement that more than one valve was closed during the safety limit event. He did not see [VV] close two discharge valves, nor did [VV] or anyone else inform him that two valves had been closed.[55] [II] simply assumed that two valves were closed because (a) he knew the intention had been to trip both "B" and "C" pumps; (b) the alarm made it obvious that [VV] had made the mistake of closing the discharge valve on at least one pump and the procedure he was following would be the same for both loops; and (c) [VV]'s post-alarm reaction of <u>opening</u> two discharge valves suggested to [II] that he had <u>closed</u> two valves.[56]

In short, the log entry's apparent conflict with [VV]'s

resolve some of the major questions regarding the sequence of events. We attempted to reconstruct from those data the sequence of events surrounding the safety limit violation. As explained more fully in Volume III of this report, the technical data analysis confirmed [VV]'s testimony that he closed only the "B" discharge valve, and that the "C" loop remained open throughout the event. The flow reduction to zero in the "B" and "C" loops, which management and NRC investigators believed resulted in part from the closure of both the "B" and "C" discharge valves, actually resulted solely from the tripping of "B" and "C" pumps. This was confirmed by our detailed technical analysis which relied in part on test data not available during the earlier management and NRC analyses.[66]

The data analysis also confirmed the immediate opening of the "A" and "D" valves in response to the alarm, and the fact that the alarm cleared when "D" valve reached the fully open position, which was two seconds before "B" valve went fully closed.[67]

We examined all of the evidence carefully in an attempt to resolve whether [VV] closed one valve or two in the course of activating the safety limit alarm. Apart from [VV]'s testimony and the technical analysis set forth in Volume III, the evidence was inconclusive. We concluded that the technical analysis was the best available evidence on this issue and that it established the accuracy of [VV]'s

the "B" discharge valve. During the management investigation of the event, which began early on the morning of September 11, recirculation flow data were retrieved from the computer which showed the flow through the "B" and "C" loops decreasing at approximately the same time, at nearly identical rates.[62] This suggested to the management investigators that two loops had been closed, instead of one as reported by the crew,[63] and helped fuel their suspicion that the missing SAR tape was part of a coverup effort by the crew.[64] Plant Operations Manager [R] explained a possible motivation to destroy evidence or otherwise conceal the closure of a fifth loop, even though the safety limit violation was complete upon closure of the fourth loop:[65]

> . . . [M]y hypothesis at the time was that they possibly isolated all five loops, which, as I said, was a little more significant. The one loop remaining open actually satisfied the basis of the safety limit itself.
>
> I thought maybe that they had done that, isolated all loops and were, although they felt it would give notice, they had to report the safety limit violation, it would look a lot better for them to say they got the alarm and acted responsibly and properly by opening other loops up and recovering the situation.

Because the issue of whether [VV] closed one or two discharge valves had important implications both for the accuracy of his testimony and the existence of a motive to destroy or conceal evidence, we conducted an extensive analysis not only of the available technical data from the event itself, but also data obtained from plant tests run specifically for the purposes of this report to try to

position, but before the alarm came in.[69] The same analysis also indicated that the speed reduction on the "C" pump occurred just before [VV] turned the "B" discharge valve control switch to "closed."[70] The above-described sequence suggested by the data differs from [VV]'s account in that he recalled reducing the "B" pump speed prior to closing the "B" discharge valve, and did not recall changing the "C" pump speed at all.[71]

4. Conclusions

The evidence supports the following conclusions:

a. [VV] caused the safety limit alarm to be actuated when he moved the "B" recirculation discharge valve control to the closed position in the course of securing the "B" pump.

b. [VV] made this error because, in a lapse of concentration, he reacted to GSS [HH]'s order to secure the pumps by following what [VV] termed a "normal shutdown" procedure that was not appropriate for the prevailing plant conditions (i.e., only two loops open) that existed at the time.

c. No one else breached any standard of conduct that contributed to the safety limit violation.

d. [VV] immediately corrected his error by opening the "A" and "D" discharge valves, restoring the

testimony on this point.

Two discrepancies between the data and [VV]'s testimony remained. The first related to the post-alarm sequence of actions he described. The technical analysis squarely contradicted [VV]'s assertion that he tripped the "B" and "C" pumps after the safety limit alarm cleared. As explained in Volume III (Section D-9), the "B" and "C" pumps were tripped about one minute <u>before</u> the alarm cleared, within a few seconds after the RBCCW isolation. Confronted with this discrepancy, [VV] had no explanation except to reiterate his firm recollection that he tripped the pumps after the alarm had cleared.[68] We concluded that the technical analysis was accurate on this point.

The above-described discrepancies between the technical data and [VV]'s testimony, however, did not give rise to any serious implications for his overall honesty and credibility, such as would have been present if the evidence had shown that he closed two loops instead of one. In the context of all the evidence, we could discern no plausible reason why [VV] would intentionally misrepresent the order in which he performed certain post-alarm actions, such as tripping the "B" and "C" pumps.

Our analysis of the data also strongly suggested, although it did not establish conclusively, that [VV] reduced the "B" pump speed (using its individual controller) after moving the discharge valve control to the closed

the GSS (unless the person knows that the GSS has already been informed)."[74]

A safety limit violation is not a separate event category under Procedure 126. However, from the description of reporting categories in Procedure 126 -- many of which are tied to NRC regulatory requirements -- it is clear that such violations, depending upon their nature and the prevailing plant conditions, are reportable to the NRC under one of the time categories (one hour, four hour, etc.). For example, among the events requiring a report to the NRC within one hour are "those events for which Technical Specifications require the initiation of reactor shutdown."[75] The September 11, 1987 safety limit violation fits at least part of this description because the Technical Specifications did require the reactor to be brought to a cold shutdown condition in the event of such a violation.[76] On the other hand, because the reactor already was in a cold shutdown condition when the violation occurred, no "initiation" was required to bring it into that condition. In that sense, the September 11 event did not fit the description of a one-hour reportable event.

Among the events requiring a four-hour notification to the NRC is the following:[77]

> Any event, found while the reactor is shut down, that, had it been found while the reactor was in operation, would have resulted in the nuclear power plant, including its principal safety barriers, being seriously degraded or being in an unanalyzed condition

plant to compliance with the safety limit within two minutes.

e. The "C" discharge valve remained oper throughout the event, and at no time was there a loss of communication between the core and annulus regions of the reactor vessel.

B. Reporting of Safety Limit Violation Within GPUN Chain of Command

1. Standards of conduct

The Oyster Creek Technical Specifications, Section 6.7.1(b), require that a safety limit violation be reported to "the Vice President and Director Oyster Creek," as well as to the NRC.[72] The Technical Specifications do not, however, specify the timing, procedures, and responsibilities for internal reports. These and other standards for internal reporting are found in Oyster Creek Station Procedure 126 (Procedure for Notification of Station Events), as well as in commonly understood practices and procedures.

Section 5.2 of Procedure 126 makes the GSS responsible [illegible] determining the category of an event and, depending upon [illegible] making the appropriate notifications to [illegible] ent, the Public Affairs office and the [illegible] rn, any person discovering certain categories of [illegible] quiring notifications "shall immediately inform

requires the GSS to make internal notifications, in addition to notifying the NRC.[80] Moreover, even if a safety limit violation did not fall within one of the NRC reportable time categories, it would fall within the category of "Reportable Events (Potential Government or Public Interest)."[81] This category includes: "events of potential public interest," such as (emphasis in original):[82]

> plant conditions . . . that are in progress or have occurred which . . . may be construed by the public to be detrimental to the environment or the health and safety of the public or plant personnel.

The GSS must report events falling within this category "promptly" to higher management (the Plant Operations Director or Manager of Plant Operations) and to the Public Affairs Office, "so that the required notifications can be made to local, state or corporate officials and to the NRC, if necessary."[83] The rationale behind requiring prompt reporting of "Category VI" events is instructive:[84]

> In regard to the need and timeliness of making notifications for each of the following events, many of which may have only very minor actual significance, it must be borne in mind that:
>
> A. Experience has shown that when rumors reach the news media in the absence of official notification, very minor events may be reported by the media in a manner entirely out of proportion to the actual significance of the event.
>
> B. Local, state, and NRC officials are placed at a great disadvantage when they hear of events from the media about which they have not been provided facts by the licensee.
>
> C. Such circumstances can lead to:

that significantly compromises plant safety. Like the one-hour event description referred to above, this description of a four-hour reportable event covers at least some aspects of the September 11 event, while in other respects it arguably does not describe that event.

Ultimately, GPUN management determined that the September 11 safety limit violation was a four-hour reportable event, and the NRC inspection team that investigated the incident concurred in that judgment.[78] We did not make an independent determination of whether the safety limit violation was properly categorized as a four-hour reportable event. As the wording of the above-quoted provisions makes clear, however, categorizing an event for reporting purposes requires analysis of language that is not always free of ambiguity. Recognizing this, Station Procedure 126 requires the GSS to begin this analysis promptly and to enlist the aid of others in GPUN management and staff positions:[79]

> The GSS, in addition to taking action in accordance with other procedures to correct the event and/or mitigate its consequences, shall promptly evaluate the event against the six Categories defined in Section 3.0, starting with Category I and proceeding through the other Categories in numerical sequence, until the correct Category for the event, if any apply, has been determined. The GSS shall consult with the Plant Operations Director, Manager Plant Operations, Shift Technical Advisor, or others, as he considers necessary in determining the correct Category.

Each of the categories of NRC-reportable events

Station Procedure 126, Section 6.1, that any person discovering certain categories of reportable events immediately inform the GSS "unless the person knows the GSS has already been informed."

The safety limit alarm occurred at 2:17:34 and cleared at 2:19:17.[86] [HH] reported the violation to [R] at approximately 3:45 a.m., nearly an hour and a half later.[87] He had two basic explanations for his failure to report the event sooner: first, that he had other priorities, such as arranging help for a maintenance worker who had been splashed with water from the leak in the RBCCW system and restoring the plant to its pre-leak conditions; and second, that his memory and behavior were affected by a severe psychological reaction to stress.

[HH], like all of the other members of "B" crew, denied any intention to conceal or delay reporting the safety limit violation, whether individually or in combination with others.

A more detailed discussion of [HH]'s psychological state and individual behavior appears in Volume II. This section will focus on his and the crew's testimony that there was never any intention, conspiratorial or otherwise, to conceal the safety limit violation from higher management.

1) Improperly raising anxiety of the public, and sometimes company employees and contractors, concerning their safety.

2) Extensive follow-up efforts having to be expended to put the event in proper perspective and to explain why notifications were not made in a timely manner (or not made at all).

3) Raising suspicions on the part of government officials and/or the media that the licensee is not forthright.

In addition to the requirements of Procedure 126, the Station Procedure that specifies the proper operator responses for each alarm on the control panel includes the corrective actions for the "less-than-two loops open" alarm. The corrective actions mandated for that alarm include the following: "Immediately notifying the NRC and Operations Department."[85]

2. Crew reporting to higher management

Because the entire crew simultaneously witnessed the safety limit alarm (except for GOS [A], who was at the site of the leak on the twenty-three foot level), there was no immediate issue of reporting within the crew. GSS [HH], whose responsibility it was to report the safety limit violation to the next level of management, was present when the alarm occurred, and the rest of the crew could plainly see that he was as aware of the violation as they were. Thus, the members of the crew satisfied the requirement of

his own personal role in the violation. He cited as an example an incident involving another GSS who was given one week off for tying off a vacuum breaker, and assumed he would be even more severely disciplined for a safety limit violation that occurred on his shift.[96] The operators generally felt there would be discipline even for an honest mistake.[97]

Although the crew immediately understood the seriousness of the safety limit alarm, there were a number of other matters to attend to in the alarm's immediate aftermath.[98] In the control room, [ZZ] was raising the reactor water level. The reactor level had to be increased to 185 inches in order to promote natural circulation.[99] He estimated that it took ten to fifteen minutes to raise the reactor water level sufficiently.[100]

While the reactor water level was being raised, [HH] and [II] were talking about the mechanic who had been sprayed with RBCCW water, which was thought to be slightly radioactive.[101]

Meanwhile, outside the control room the effort to isolate the leak at V-5-167 had resulted in a slowing of the leak, but water was still leaking out heavily.[102] [A] discussed the matter with [P], a maintenance supervisor, and [P] volunteered to climb up and backseat the valve.[103] After [P] did this, the leak appeared to stop.[104] [A] called for electricians to check things out because there

a. Crew account of post-alarm events

The following account of the events that occurred between the alarm and the first report of the safety limit violation to higher management is based upon the testimony of the various crew members.

In the control room the "less-than-two-loops" alarm was greeted with a hush and, in the case of one crew member, an expletive.[88] The members of "B" crew who were present knew that a safety limit violation had occurred because the alarm -- which the operators referred to as the "death alarm" -- had a distinctive green color.[89]

The CROs understood that the safety limit violation meant the plant would have to remain shut down until the NRC permitted it to start again.[90] They also assumed that the individual responsible for the safety limit violation would be disciplined, although there were differences of opinion over how severe that discipline would be.[91] Although management personnel testified that no specific discipline was called for by the commission of a safety limit violation,[92] [VV] perceived that such discipline would be more severe than for other types of violations.[93] [VV] thought he would be suspended for at least a week.[94] The other control room operators also thought that [VV] would face punishment but of a lesser degree.[95] For his part, [HH] thought he would be disciplined because as a GSS he would be held responsible for [VV]'s actions regardless of

about time to call [R] and tell him what was going on.[113] [A], still unaware of the safety limit violation, assumed [HH] was referring to the leak and the water sprayed on C .[114] As [HH] was dialing [R], CRO [ZZ] came to the doorway of the GSS's office and asked [A] to talk outside in the hallway.[115] [A] and [ZZ] left the control room at 3:28 a.m.[116] [A] then learned about the safety limit for the first time. [ZZ] also told [A] that the SAR tape was gone and apparently had been ripped out.[117] [ZZ] said that he had asked [HH], [II], and [VV] if they had the tape, and they said they did not have it.[118] [A] asked if [HH] knew everything, and [ZZ] confirmed that [HH] was standing next to [VV] when [VV] shut the valve and the alarm came in.[119]

[ZZ] testified that he did not know, prior to his discovery of the missing SAR tape, whether the safety limit violation had been reported to higher management.[120] There had been no discussion of withholding the information that there had been a safety limit alarm, and [ZZ] had no intention of withholding such information.[121] He told [A] about the alarm and the missing tape because "I wanted to make sure he knew as fast as possible, because [[HH]] was on the phone and I [didn't] know how long he was going to be on the phone or who he was talking to."[122]

[HH] called [R]'s home between approximately 3:25 and 3:30 a.m. The call awakened [R]. [HH] informed [R] of the leak, and of the injured worker, but did not disclose either

were many electrical components in the area getting wet, which might cause them to malfunction.[105] [A] also called for station helpers to clean up the pool of water which had formed from the leak.[106] He then started to return to the control room. On the way, he realized that RBCCW was still isolated to the drywell, and that the backseating, not the isolation, had stopped the leak. Therefore, he thought there was a good possibility RBCCW flow could be restored to the drywell. [A] contacted the control room and suggested this possibility to the control room crew. They agreed, and [A] supervised the opening of the manual valve that had been closed during the isolation process.[107]

When [A] finally returned to the control room at 3:03 a.m., after a 52 minute absence,[108] he found [HH] working hard trying to determine which chemicals were in the corrosion inhibitor that had sprayed [C], the maintenance worker, in the face. Up to this point, [A] had no knowledge that a safety limit violation had occurred.[109]

[A] then left the control room at 3:09 a.m. and went to the fifty-one foot elevation to look at a drum containing the chemical that was the corrosion inhibitor in the RBCCW.[110] [A] returned to the control room at 3:15 a.m. and spoke with a health and safety representative, [G].[111] He then reported to [HH] that the health and safety representative was looking into first aid for [C].[112]

At this point, according to [A], [HH] said that it was

The second [HH]-[R] conversation, as noted above, was initiated by [R] from his home to [HH]'s office. After [HH]'s first call, [R] had phoned Operations Director [N]. As a result of his conversation with [N], [R] called [HH] to ask about the recirculation pumps. This questioning prompted [HH] to reveal that they had actuated the safety limit alarm.[131] Upon learning of the safety limit violation, [R] instructed [HH] to notify the NRC.[132] [HH] did notify the NRC at approximately 4:05 a.m.[133]

The third telephone contact between [HH] and [R] occurred shortly after 4 a.m., while [HH] was in his office with [A]. When the [R] call came in, [HH] answered the phone but handed it to [A] because [HH] was in the process of contacting the NRC.[134] [A] took the phone from [HH] and had a brief conversation with [R]. [R] wanted to know when the event occurred. [A] recollected telling [R] that "from the computer, it looks like 2:24."[135] [R] also wanted to know why it took [HH] so long to tell him about the safety limit violation. [A] expressed the belief that [HH] was just about to call [R] when [R] called.[136]

b. <u>Comparison of crew account with other evidence</u>

During the nearly one and one-half hour period between the safety limit alarm and the notification to higher management, ten persons other than the "B" crew members who witnessed the safety limit violation entered the control

the safety limit violation or the fact that the SAR tape was missing.[123]

[A] was shocked by [ZZ]' revelations concerning the safety limit and the missing tape.[124] When he reentered the control room after his discussion with [ZZ], he intended to hear what [HH] was telling [R]. [A]'s recollection was that as soon as he reentered the control room, [HH] left quickly with a red binder containing a list of hazardous substances.[125]

When he got back into the control room after speaking with [ZZ], [A] questioned [II] about the safety limit violation and missing SAR paper. [II] confirmed what [ZZ] had said.[126]

[HH] then returned to the control room. (According to the computerized records this occurred at 3:41 a.m.)[127] [A] asked [HH] if he had told [R] about the safety limit violation. [HH] said no. [A] said that they had to tell people about this. [HH] agreed and began walking towards his office, presumably to call [R].[128]

As [HH] was walking towards his office, [R] called back.[129] [HH] reported that [R] had asked if they had violated the safety limit, and [HH] had disclosed that they had.[130] ([R], as described below, testified that he called to ask about the status of the recirculation pumps and to remind the crew to keep the valves properly aligned.)

As can be seen from the pattern of entries and exits, after 2:33 a.m., persons other than the "B" crew members who witnessed the alarm were in the control room almost continuously. The only substantial period during which no "outsiders" -- i.e., persons who had not witnessed the alarm -- were in the control room was between 2:17 and 2:33 a.m.

None of the persons listed above who entered the control room during this period were told about the safety limit violation and none noticed anything out of the ordinary[141] except [PP], who recalled that on his 3:28 - 3:32 a.m. trip to the control room the atmosphere was "formal" and [VV] seemed "shaken."[142]

Several witnesses confirmed that [HH] was concerned about the leak and the possibly injured maintenance worker.[143] [H] discussed these subjects with [HH] between 2:35 a.m. and 2:52 a.m.[144] [P], who was in the control room from 3:00 to 3:27 a.m., discussed the leak and the possible injury with [HH], and found him "concerned" about the effect of the chemicals in the water that had splashed on the worker.[145] When [P] left at 3:27 a.m., he was under the impression that [HH] was telephoning [R] concerning the leak.[146]

The analysis of technical data confirmed that in the hour following the safety limit alarm, the crew performed a series of operations related to the leak and to restoring the plant to its pre-leak condition.[147] This process had

room. One of these, of course, was GOS [A], whose account of events during this period is summarized above and in the individual section pertaining to [A] in Volume II.

The entry and exit times of the other nine are summarized below:[137]

[D]	2:33-2:35
[H]	2:35-2:52
[AAA]	2:36-2:38; 2:39-2:58
[RR]	2:37-2:41; 3:03-3:22
[WW]	2:38-2:40
[P]	3:00-3:27
[PP]	3:28-3:32
[E]	3:35-3:56
[XX]	____-3:35

In addition to the entries and exits shown above, [G], a health and safety representative, attempted to enter the control room at 3:33 and 3:34 a.m. with an invalid access card. This attracted the attention of a security guard, [E], who entered the control room at 3:35 a.m.[138] During this brief period, [XX], a plant engineer who had accompanied [G] to the control room, entered the control room to ask GSS [HH] to step outside so that [G] could speak to him.[139] (The computer did not register [XX]'s entry into the control room, only his exit at 3:35 a.m.) [XX] and [G] confirmed that they had a discussion with [HH] outside the control room about the maintenance worker splashed with RBCCW.[140]

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The analysis of technical data confirmed that in the hour following the safety limit alarm, the crew performed a series of operations related to the leak and to restoring the plant to its pre-leak condition.[147] This process had

been completed shortly before [HH]'s first telephone call to [R].[148]

In summary, there was substantial support in the testimony and technical data for the conclusion that [HH]'s and the crew's time and attention were occupied by matters other than the safety limit violation. Moreover, as discussed below, there was no substantial evidence to support a conclusion that the crew, or any subset of the crew, engaged in a conspiracy to delay or avoid reporting the safety limit violation. (The individual actions and motives of the crew members are discussed in Volume II of this report.)

First, even if an inclination not to report the incident is assumed, the crew had no reasonable expectation that the violation would be kept secret. Only if all crew members who witnessed the alarm (plus [PP], a non-crew member who saw it just before he exited the control room at 2:17 a.m.) agreed to silence, and the ensuing critiques of the leak incident failed to uncover evidence of it, could such a conspiracy succeed. If even one crew member broke ranks, not only would the violation become known, so would the attempt to conceal it, an action the crew knew carried far greater potential consequences.[149]

We explored in great detail the possible motivations the crew, and each individual member of it, might have to intentionally cover up or fail to report the safety limit

violation. The most obvious motive would be an attempt to avoid punishment for the violation itself. Lending additional credence to this possible motive was evidence that discipline had become more strict in the period prior to September 11, and that there was a perception among Operations personnel at the crew level that discipline was imposed unfairly.[150]

[VV] testified that he expected to be suspended without pay for at least a week, and that he might receive additional punishment. The others, however, thought [VV] would receive less discipline than that. Apart from [VV], only [HH] testified that he expected to be disciplined for the safety limit violation.[151]

There were no exceptionally close social relationships among the crew members, or other circumstances suggesting that those who were at virtually no risk themselves would agree to cover up the violation for [VV]'s sake, even if it were assumed that [VV] would want them to do so. We concluded that fear of discipline was not a plausible motive for a conspiracy to conceal or fail to report the safety limit violation.

Strengthening this conclusion was [ZZ]' notification to [A], which the computerized records indicate occurred between 3:28 and 3:30 a.m., and which was followed only fifteen minutes later by [HH]'s disclosure of the violation to [R].

We also found it unlikely that the crew could have formulated even a crude agreement to conceal the safety limit violation given the other activities that were in progress at the time and the number of people coming in and out of the control room. [HH], in particular, was frequently observed by "outsiders" during this time. In addition to members of the crew, he had conversations with [D], [H], [R], [P], [XX], and [G] between 2:33 and 3:41 a.m. After approximately 3:45 a.m., of course, any plan to conceal the violation from higher management became moot because [R] was made aware of it.

In short, the weight of the evidence indicated that there was no conspiracy by the crew to conceal the safety limit violation from higher management. Responsibility for reporting the violation clearly rested with GSS [HH]. The evidence did not indicate that, prior to [A]'s questioning of [HH] at approximately 3:45 a.m., any other member of the crew even knew that [HH] had not yet reported the violation -- much less did it show that anyone encouraged [HH] to delay or not make his report.

With respect to [HH]'s asserted reasons for the one hour twenty-five minute delay in notifying higher management of the safety limit violation, we found that he was substantially occupied during much of that time with matters related to the leak, the injured worker, and restoring the plant to pre-leak conditions. These distractions, however,

did not sufficiently explain or justify his failure to notify higher management sooner than he did. In particular, [HH] found the time to telephone [R] at approximately 3:30 a.m. to tell him about the leak, but did not mention the safety limit violation. Only after [A] confronted him with the necessity of disclosing it did [HH] prepare to call [R] about the safety limit violation, by which time [R] had called back with questions of his own.

Because [HH] did not report the safety limit violation to [R] or otherwise take steps to analyze the appropriate reporting categories and ensure compliance with them, by the time upper management personnel found out about the violation it was already too late to make a one-hour report, had one been required. Moreover, as discussed later in this report [Section VI(E)], the delay in reporting combined with other circumstances to cast a general suspicion on the crew.

3. Reporting within management above crew level

As discussed above, [R], the GPUN manager immediately above the crew level, learned about the safety limit violation from GSS [HH] at approximately 3:45 a.m. [R] immediately notified Plant Operations Director [N] who, within minutes after speaking to [R], notified Deputy Director [SS].[152] [SS] was then the highest ranking GPUN manager at Oyster Creek, Director Peter Fiedler having been on vacation at the time. [SS], in turn, notified GPUN top management officials in Parsippany; this was done between

approximately 5 a.m. and 6 a.m.[153]

There was no substantial conflict in the evidence concerning the sequence and timing of notifications within upper GPUN management. By 4 a.m. -- approximately fifteen minutes after the first notification to management above the crew level -- the highest ranking manager at Oyster Creek knew about the violation. The Public Affairs Office was notified at 4:36 a.m.[154] By 6 a.m., corporate management at Parsippany had been notified and a briefing was in progress, attended by a variety of GPUN personnel as well as an NRC representative.

4. Conclusions

The evidence supported the following conclusions:

(a) There was no agreement among the members of "B" crew to conceal, fail to report, or delay reporting the safety limit violation.

(b) The responsibility for reporting the safety limit violation to higher management belonged to GSS [HH].

(c) No other member of the crew encouraged [HH] to conceal, not report, or delay reporting the safety limit violation.

(d) During the nearly one and one-half hour delay between the safety limit alarm and [HH]'s report of it to higher management, [HH] was preoccupied with matters

requiring his attention, such as the leak on the twenty-three foot level, a possibly injured worker, and restoring the plant to pre-leak conditions. These reasons, however, do not fully explain or justify his failure to report the violation earlier.

(e) By delaying his report to higher management, [HH] risked violating an NRC reporting deadline and created an appearance that, combined with other events, led to a generalized suspicion by higher managers that the crew had been attempting to conceal the safety limit violation.

C. Reporting Safety Limit Violation to NRC

1. Standards of conduct

The Oyster Creek Technical Specifications, Section 6.7.1(b), require that a safety limit violation be reported "to the [NRC] and the Vice President and Director Oyster Creek."[155] The Technical Specifications additionally require that a written report describing the violation, its effects, and corrective action taken be submitted to the NRC within 10 days of the violation.[156] Apart from the 10-day requirement, the Technical Specifications do not by themselves set a time limit for initial reports of safety limit violations to the NRC.

NRC regulations establish time limits for reporting various categories of events.[157] The time limit for reporting the September 11 safety limit violation depended upon which category the event fit into under the regulations.

Categorizing the September 11 event presented certain difficulties, chiefly in determining whether the safety limit violation required a report to the NRC within one hour pursuant to 10 C.F.R. § 50.72(b)(1), or within four hours pursuant to 10 C.F.R. § 50.72(b)(2). As discussed in the immediately preceding section of this report, determining the proper category required analysis and judgment concerning possible ambiguities in the language of the

appropriate reporting provisions. GSS [HH], who made the initial report to the NRC at 4:05 a.m., categorized the safety limit violation as a one-hour reportable event.[158] He had been instructed to do this by [R].[159] [R]'s assistant, [MM], also initially assumed that the safety limit violation required a one-hour report. As he explained: "You call on a one hour for violating an LCO [limiting condition of operation]. . . . I would be surprised if it wasn't the same thing."[160]

Based upon their later review of the NRC regulations, however, both GPUN management and the NRC inspection team that investigated the violation concluded that it was a four-hour reportable event.[161] As stated earlier in this report, we did not address the legal issue of the proper interpretation of the NRC reporting regulations and, accordingly, we assumed the four-hour standard to be the appropriate one for purposes of this report.

Oyster Creek Station Procedure 126 (Procedure for Notification of Station Events) makes the GSS responsible for determining the category of an event[162] and, in the case of one-hour and four-hour reportable events, notifying the NRC and making the appropriate internal notifications.[163] As discussed in the previous section, the GSS is expected to seek the assistance of higher management and staff personnel when necessary to determine the appropriate reporting category.

Additionally, as discussed in Section VI(B) of this report, the Station Procedure specifying responses to alarms on the control panel contained a directive that violations of the safety limit be reported "immediately" to the NRC, as well as to Operations Management.

2. Crew reporting to NRC

As discussed above, in a telephone conversation at approximately 3:45 a.m., GSS [HH] notified Plant Operations Manager [R] that the less-than-two-loops alarm had been activated. [R] instructed [HH] to report the event as a safety limit violation and to categorize it as a one-hour reportable event.[164] [HH] called the NRC's Emergency Notification System (ENS) at 4:04 a.m., later reducing the notification to writing in an Event Notification Form.[165] In that form, [HH] described the event as follows:[166]

> RBCCW leak from V-5-167, B&C recirc pumps in operation, shut discharge valve on "B" pump. Received "less than 2 loop open alarm." Immediately opened D&A recirc loop discharge valves. Alarm cleared before "B" discharge shut. Violation of Safety Limit 2.1(E).

He listed the time of the event as 2:30 a.m., the cause as "personnel error," and the time of his notification to [R] as 3:30 a.m.[167] The evidence showed that these times were inaccurate by approximately 13 and 15 minutes, respectively. However, we did not find that these errors were evidence of intentional misreporting because of the unavailability of the SAR data at the time (or any other precise measurement of the time of the event), and the

difficulties many of the witnesses had fixing the precise times of telephone calls. [R], for example, estimated that his first conversation with [HH] was at 3:15 a.m.; the evidence showed that it was between approximately 3:25 and 3:30 a.m.[168]

The NRC later confirmed having received [HH]'s notification.[169]

Following his ENS notification at 4:05 a.m., [HH] telephoned William Bateman, the NRC Resident Inspector, and told him about the safety limit violation.[170] (As discussed below, Plant Operations Director [N] also told Bateman about the event.)

[HH] provided the NRC with information about the safety limit violation that was timely (using the four hour standard) and substantially complete and accurate within the limits of the information then available. However, by waiting nearly an hour and a half before reporting the safety limit violation to [R] or taking any other action relating to it, [HH] did not carry out his responsibility as GSS to review and determine the proper category of an event. Moreover, as discussed above in connection with internal GPUN reporting, [HH] made it impossible for higher management to determine the proper reporting category for the safety limit event until more than an hour had passed. Thus, if analysis of NRC regulations had disclosed that the one hour standard was applicable to the event, it would have

been too late to provide a timely notification.

3. Management reporting to NRC

Plant Operations Director [N], who learned about the safety limit violation from [R] shortly before 4 a.m., telephoned NRC resident Bateman and told him what he knew about the event.[171] Bateman later attended a 6 a.m. briefing on the incident, which was led by [N] and Deputy Director [SS].[172] A tape recording of that briefing showed that the GPUN managers gave a substantially complete and accurate account of what they knew about the violation at that time.[173]

Later in the day, following the discovery of SAR tape fragments in the trash, GPUN management submitted an updated report to the NRC which, in addition to reporting the apparent disposal of SAR tape, stated:[174]

> Licensee and NRC review of the circumstances surrounding the event has revealed that both of the in-service recirculation discharge valves were started closed. . . .

As discussed in more detail in Section VI(A) of this report, management and NRC personnel who examined the technical data on the morning of September 11 concluded that, contrary to the version of events given by CRO [VV] and reflected in [HH]'s 4:05 a.m. NRC notification, [VV] had closed both the "B" and "C" discharge valves. Our technical analysis, however, led us to conclude that the "C" valve in fact remained open at all times,[175] until it was closed at

3:19 a.m., after recirculation flow had been reestablished by the startup of the "A" and "D" pumps.[176]

Later on September 11, after the discovery of pieces of SAR tape in the trash, GPUN management made an updated report to the NRC through the ENS. (The circumstances leading up to that notification are discussed in Sections VI(E) and (F) of this report.)

The updated notification contained information that we have concluded was inaccurate -- i.e., that two recirculation discharge valves were going closed during the safety limit event. However, as discussed in Section VI(A) of this report, both GPUN and NRC personnel who examined the data available on the morning and afternoon of September 11 agreed that the evidence indicated that two discharge valves had been moved to the closed position, and there was support in the data for this conclusion. We reached a contrary conclusion only after extensive re-analysis of the technical data and with the benefit of test results that were not available on September 11.[177]

In summary, the evidence clearly established that GPUN management above the crew level reported the safety limit violation to the NRC in a timely manner. Using the four hour report category, the 4:05 a.m. notification was obviously timely, because the violation occurred shortly after 2:17 a.m. If the violation had been reportable under the one hour standard, the 4:05 a.m. report would have been

late. This lateness, however, could not have been attributed to managers above the crew level, because they acted with speed and diligence after they learned about the violation.

We also concluded that GPUN managers above the crew level provided the NRC with information about the safety limit violation that was complete and accurate based upon the data available at the time.

4. Conclusions

The evidence supports the following conclusions:

(a) GPUN management above the crew level did not know about the safety limit violation until approximately 3:45 a.m.

(b) Within twenty minutes after management above the crew level learned about the violation, it was reported to the NRC through the ENS telephone line.

(c) The report to the NRC made by GSS [HH] at approximately 4:05 a.m. was substantially accurate except for an approximately 13 minute error in the time of the event, which we concluded was unintentional.

(d) The 4:05 a.m. report submitted to the NRC by GSS [HH] was timely using the four-hour reporting category.

(e) After the 4:05 a.m. ENS report, both [HH] and [N] made informal notifications by telephone to the NRC resident inspector.

(f) A detailed briefing was held at 6 a.m., attended by the NRC resident as well as various GPUN personnel, at which information about the safety limit violation was disseminated, comprising a substantially complete and accurate account of what was known about the event at that time.

(g) GPUN management above the crew level acted with speed and diligence in reporting the safety limit violation to the NRC after learning about it.

D. Destruction/Concealment of SAR Tape

Because CRO [VV] admitted tearing the tape from the SAR and later disposing of it, the investigation attempted to verify the particulars of his account and address two principal issues: (a) whether he acted alone; and (b) what motivated his conduct, particularly whether he intended to conceal the safety limit violation or any event related to it.

We questioned [VV] in great detail about his actions with respect to the SAR tape and compared his story with evidence from other witnesses, documents, and the inferences that could reasonably be drawn from all of the circumstances. In many respects [VV]'s account was

corroborated. There remained certain discrepancies between his testimony and other evidence, the significance of which is discussed below.

1. Standards of conduct

The SAR, as discussed previously in this report,[178] was installed at the initiative of GPUN management to provide a sequential and automatic recording of alarms. One of its original purposes was to assist operators in the handling of emergencies.[179] It was used by management to help reconstruct events when necessary, such as in the preparation of transient analysis reports (TARs).[180]

Neither the SAR itself nor the printed records it produced (in the form of adding machine-sized tape) were specifically required by NRC regulations, the Oyster Creek Technical Specifications, or internal administrative procedures.[181] SAR tape is, however, arguably covered by written GPUN document retention policies[182] and is in practice retained by the company to assist in the investigation and reconstruction of, among other kinds of transient events, the kind that occurred on September 11, 1987.[183]

Because of their role in the investigation and reconstruction of events, records produced by the SAR play a part in the reporting of those events, both internally and to the NRC.[184] Thus, the standards of conduct applicable to the

destruction, concealment, alteration, or disposal of SAR tape are closely linked to those previously discussed with respect to reporting requirements. In particular, the seriousness of any tampering with SAR tape depends to a large extent on what motivated such an action -- e.g., whether it was done in furtherance of a plan to conceal a reportable event from management and/or the NRC.[185]

To the extent that the destruction, concealment, or disposal of documents is done with intent to conceal the information contained in them, it violates internal policies mandating complete and truthful reporting to government agencies and management.[186] Disciplinary guidelines specifically warn that the consequences of attempting to conceal an occurrence "could far outweigh [the] potential consequences of the occurrence itself,"[187] and there was evidence that members of "B" crew understood this.[188]

Apart from any motive to conceal, the intentional destruction or other tampering with SAR tape can violate internal GPUN standards of conduct and professional behavior applicable to employees in general and licensed personnel in particular.[189]

2. <u>[VV]'s account of the tearing and disposal of SAR tape</u>

As related by [VV], the tearing and disposal of the tape occurred in three stages. First, [VV] walked back to the SAR to check the tape as soon as plant conditions were

stable enough to permit him to do so -- he estimated that this occurred five to ten minutes after the alarm.[190] He was extremely irritated with himself and wanted to see his error confirmed on the tape.[191] When he saw the alarm indication, he reached up in anger and tore the tape.[192] He did not know where the tape tore -- near the top, middle, or bottom -- but thought it tore in only one place.[193] [VV] let the bottom portion fall to the floor and returned to the area in front of the control panel.[194]

The second stage began when [VV] again left the front of the control room and went to the kitchen to get a cup of coffee. The kitchen is only a few feet away from the SAR, and [VV] testified that he passed the SAR on his way to get coffee, once again became angry, tore off the portion of tape hanging out of the machine, wadded it up, and threw it into the wastepaper basket in the kitchen. After getting his coffee, [VV] again passed the SAR, gathered up the SAR tape lying on the floor, tearing it in one or more places in the process, wadded it up, and put it in his pockets.[195] He then returned to the front of the control room.[196]

[VV] had no precise time estimate for his second visit to the SAR, saying only that it was within an hour of the safety limit alarm.[197] Other evidence suggests that [VV] had completed the tearing and removal of the tape by 3:00 a.m., and probably by 2:32 a.m. CRO [ZZ] discovered the tape missing shortly after 3:00 a.m., and observed that a

portion of tape was hanging out of the machine.[198] The earliest time recorded on that portion was 2:32:54.[199] [VV] recalled that on his second trip to the SAR, he tore the tape near the top where it comes out of the machine.[200] If that part of his testimony is accurate, the 2:32:54 alarm message was probably printed after the tape was torn.[201]

[VV] then carried portions of the SAR tape in his pockets for approximately an hour. He testified that he did not discuss tearing or disposing of the tape with the others (until, late in the shift, he made a partial admission of what he had done), and that so far as he was aware, no one observed what he did.[202]

The third and final stage of his actions regarding the tape occurred between 3:35 and 3:44 a.m., when he went to a lavatory outside the control room.[203] [VV] testified that he took the SAR tape he had been carrying in his pocket and flushed it down a toilet.[204] He reiterated that he did this out of anger and frustration, and not because he hoped to conceal the violation:[205]

> I sat down in the bathroom to go to the bathroom, and while I was sitting there, I was berating myself and I took the balls of paper out of my pocket from the SAR and I stared at them and I was angry at them and I threw them into the toilet, and when I got done, I flushed the toilet and they were gone.

[VV] further testified that he disposed of the SAR tape without regard to its contents:[206]

> Q. Do you know whether [the SAR tape

flushed down the toilet] pertained to any portion of the sequence of events leading up to or following the alarm?

A. I have no idea.

Q. You didn't care?

A. It didn't matter. The balls of paper were a reminder that I had screwed up and everybody in the world knew that I had done so and I never screwed up like that before. I didn't care what was on them. I just threw them in.

[VV] returned to the control room at 3:44 a.m., about the same time that [HH] reported the safety limit violation to [R]. He testified, however, that when he disposed of the SAR tape he thought [HH] had already reported the violation.[207]

3. Comparison of [VV]'s account with other evidence

None of the other members of "B" crew testified that they saw [VV] tear, dispose of, or otherwise tamper with the SAR tape. On the contrary, the crew members all testified that they did not know [VV] had done any of these things until he made a partial admission of his actions just before the end of the shift.[208] We also questioned everyone who was in the control room during the relevant period and no one saw [VV] do anything with the SAR tape.[209]

The absence of eyewitnesses is plausible given the actions [VV] described. Tearing the tape from the SAR, throwing a piece in the trash, and putting the rest in his pockets all could be accomplished in a very short time --

possibly a minute or less. Because of the SAR's location, [VV] would have been shielded from the view of crew members who were in the area in front of the control panels, or who were in the GSS's office.[210] The absence of witnesses to [VV]'s flushing tape down the toilet also was not surprising because that happened in the privacy of a bathroom stall outside the control room.

According to the testimony of the crew members, the first person other than [VV] to know that anything out of the ordinary had occurred with respect to the SAR tape was CRO [ZZ]. He testified that "slightly after" 3 a.m. -- estimated at between 3 a.m. and 3:10 a.m. -- he went behind the main control panels to take the regular three o'clock logs.[211] While in that area he had also intended to get the times of the safety limit event from the SAR for the control room log.[212] Previously, [ZZ] had been to the SAR machine during the MSIV full closure surveillance between 12:00 a.m. and 2:00 a.m., and had found it in normal operating condition.[213]

On his post-3 a.m. visit to the SAR, [ZZ] observed that there was about a foot to a foot and a half of paper hanging out of the top of the SAR and a few feet piled on the floor.[214] The end of the piece of paper hanging out of the machine contained an alarm message for the isolation condenser alarm. [ZZ] identified this alarm as the same one [MM] later saw, which occurred a few seconds before 2:32:54

a.m.[215] Realizing that this alarm had occurred after the main part of the safety limit event, [ZZ] searched the tape on the floor for the alarms reflecting the safety limit violation.[216] He discovered that the next most recent alarm prior to the isolation condenser alarm had occurred on the previous shift -- a time he identified from the tape later removed from the SAR as 18:48:31 (6:48 p.m.) on September 10.[217]

When [ZZ] observed that SAR tape was missing for a period extending from the previous shift until after the safety limit event, he immediately went to GSS [HH]'s office.[218] [HH] was there and CRO [II] was either in the doorway or was walking into the office at the time.[219] [ZZ] asked [HH] if he had taken the paper from the SAR; [HH] did not reply, but had a "dumbfounded" expression on his face, as if to register surprise that it was gone.[220] [ZZ] then told [HH] that the SAR tape was missing for the time of the safety limit event.[221] He also asked [II] if he had the tape, and [II] said no.[222]

According to [ZZ], he then left [HH]'s office, went to the area in front of the control panels, told [I] and [VV] about the missing SAR tape, and asked if they had taken it. Both denied that they had.[223] A short time later, [ZZ] looked in a wastepaper basket that was located a few feet away from the SAR, thinking that "it could have been a mistake that somebody might have thrown it away."[224] This

was the only wastepaper basket that he searched.[225] He did not conduct a "real thorough look," however, because "I believed at this time if it was an inadvertent mistake there would have been a large piece of paper laying near the top of that trash can."[226] [ZZ] saw SAR tape in the trash can he searched, but it was blank.[227] He explained that the blank tape could have gotten into the trash as a result of the machine binding up or in the course of installing a new roll, although he did not know whether either of those events had occurred prior to his search.[228]

[ZZ] estimated that about ten minutes elapsed between the time he discovered the missing SAR tape and the time he finished questioning the other crew members and searching the trash.[229] Thus, according to [ZZ]' account, by approximately 3:20 a.m. all of the crew except [A] had been made aware that the SAR tape was missing. [VV], according to his testimony, was at this point carrying most of the ripped tape in his pockets, having thrown a small portion into the kitchen wastepaper basket.

We found [ZZ]' account of his discovery of the missing SAR tape and the actions he took in response to that discovery to be credible. Making allowances for understandable difficulties in recalling exact times, words used, and other details, his testimony was, on the whole, internally consistent, supported by the weight of other testimonial, documentary, and circumstantial evidence, and was inherently

plausible.

The most significant discrepancy with [ZZ]' account was [HH]'s testimony that he could not recall being told by [ZZ] that SAR tape was missing. As discussed in more detail in Volume II, however, [HH]'s testimony must be evaluated in the context of his contention that, due to severe psychological stress, he was unable to recall or explain his behavior with respect to this and other events occurring after the safety limit alarm. Accordingly, we did not find that [HH]'s lack of recollection on this point undermined the credibility of [ZZ]' testimony.

A second discrepancy with [ZZ]' account was [P]'s testimony that he remained in [HH]'s office from 3 a.m. to 3:27 a.m., and recalled only [HH], [A], and RR being in the office during that time.[230] [ZZ], in turn, did not see [P] in the office -- he said that only [HH] and [II] were present when he told [HH] about the missing tape.[231]

However, [P], who testified that he was sitting in a chair against the far wall of the office,[232] could not recall other details of what was occurring in the office during that period,[233] and we concluded that he did not recall [ZZ]' brief appearance, during which there was no actual conversation between [ZZ] and [HH]. For purposes of evaluating [VV]'s story, therefore, we accepted as substantially accurate the foregoing sequence of events described by [ZZ].

We also found to be accurate [ZZ]' testimony that he told GOS [A] about the safety limit violation and the missing SAR tape, with one minor exception concerning the timing of [A]'s return to the control room. [ZZ] testified that he approached [A] after noticing that [A] had re-entered the control room for "the first time . . . since he left when the leak started."[234] He asked [A] to step outside the control room and there told him that there had been a safety limit violation and that SAR tape relating to the violation was missing.[235] [A] confirmed this conversation.[236]

The computerized record of control room entries and exits shows that both [ZZ] and [A] exited the control room at 3:28 a.m., the only time after the safety limit alarm that both men left the control room during the same minute,[237] and we concluded that this was the time of the [A]-[ZZ] conversation. [A] had returned to the control room at 3:03 a.m., after a lengthy absence attending to the spill, twenty-five minutes before his conversation with [ZZ].[238] That was approximately when [ZZ] began his 3 a.m. surveillance, leading to the discovery of the missing tape, and it is likely that he was behind the control panels and unable to see [A] come in. [A] exited again six minutes later, at 3:09 a.m., to obtain information about the chemicals that had splashed on the maintenance worker, remaining out until 3:15 a.m.[239] We concluded that [ZZ]' notification to [HH] and [II] that SAR tape was missing

occurred shortly after [A]'s 3:09 a.m. exit, and that when [A] re-entered at 3:15 a.m., [ZZ] assumed this was the first time he had been back since the spill.

Thus, by the time [VV] exited the control room at 3:35 a.m. to go to the bathroom -- the time during which he testified he flushed down the toilet the tape he was carrying around in his pockets -- every member of the crew knew about both the safety limit violation and the missing SAR tape. By approximately the time [VV] returned to the control room at 3:44 a.m., the safety limit violation (although not the missing tape) had been reported to higher management, thereby eliminating any possibility that [VV] could have concealed the violation by disposing of SAR tape.

The testimony and circumstances outlined above, while not directly corroborating [VV]'s account of how he tore and disposed of the tape, are consistent with it. There are, however, inconsistencies between some of the details of [VV]'s account and other evidence.

One discrepancy involves [VV]'s testimony that he wadded up a piece of SAR tape he had torn from the machine and threw it into the wastepaper basket in the control room kitchen. [HH], [A], [I], and [ZZ] all testified that they searched trash in the control room looking for the missing SAR tape, but did not find any of it.[240] Yet, pieces of tape were later found in trash collected from the control room during the search ordered by management, and these

included the section evidencing the safety limit violation.[241] On first impression, the failure of the crew to find any SAR tape is troublesome because it suggests either that [VV] did not throw it in the trash when and where he said he did, or that he or someone else removed the tape from the trash and later replaced it in time for the management searchers to find it later in the morning.

However, of the four crew members who testified that they searched the trash, only two, [HH] and [A], testified that their search included the kitchen wastepaper basket. [A] described his search of that receptacle as superficial, recalling that there was "a dump of coffee grounds on top and a little box of a T.V. dinner or something," discouraging him from conducting a thorough search.[242] Only [HH] was firm in his testimony that he searched every scrap of paper in the control room wastepaper baskets and found no missing SAR tape.[243] However, [HH]'s recollection of events, as well as his ability to find small scraps of paper others missed, must be regarded as suspect given his self-described memory lapses and other stress-related symptoms on September 11.[244] We concluded that the crew could easily have missed small, wadded up scraps of tape, especially if they were buried under coffee grounds or other moist garbage, as the recovered pieces apparently had been.[245]

There is also an inconsistency arising from the number of SAR tape fragments recovered. Although [VV] was adamant

that he ripped one piece of tape from the machine, wadded it up, and threw it in the trash without making additional tears,[246] the SAR tape ultimately recovered from the control room trash was in three pieces. [VV] suggested a possible explanation for this; i.e., that stains from coffee grounds or other substances in the trash might have caused the wadded-up tape to tear when unfolded.[247] That explanation is plausible for two of the three recovered SAR fragments, which pertain to the period surrounding the safety limit violation. These two pieces fit together; combined, they covered the period from 2:17:45 -- a few seconds after the time of the safety limit alarm -- to 2:24:35, which was well after the clearing of the alarm.[248] Additionally, as noted above, they did give evidence of having been stained by coffee grounds or other moist substances.[249]

The third piece, however, could not have been part of the SAR tape [VV] ripped from the machine on his second trip to the SAR, when he went back to get coffee. It contained alarms that occurred on September 10, hours before the safety limit alarm. Together with a short piece of blank tape (wadded up but not stained) which was also recovered from the control room trash, it matched the end of the section of September 10 tape recovered from the machine.[250] If, as he testified, [VV] tore the SAR tape and let it drop to the floor on his first trip to the SAR, these September 10 fragments must have been among the tape lying on the floor when [VV] made his second trip. [VV] did not

testify to having picked up any of the tape on the floor and throwing it in the trash -- the only tape he recalled throwing in the trash was the tape he saw hanging out of the machine on his second trip.[251] The presence of these two pieces in the trash that were recovered from the control room, therefore, is unaccounted for by [VV]'s version of events.

We found, nevertheless, that these unexplained pieces of SAR tape did not seriously undermine [VV]'s testimony with respect to whether he acted alone or whether his actions were motivated by an intent to conceal or destroy evidence. The SAR tape fragment itself, which records alarms that occurred on September 10 during the previous shift, is irrelevant to the safety limit event and its separation from the rest of the tape is generally consistent with the tearing and ripping [VV] described when he gathered up the tape and put it in his pockets. Although [VV] could not explain how the September 10 pieces got into the trash, he had no apparent motive for treating them any differently than the other irrelevant portions of SAR tape.[252]

We also found it troublesome on first impression that of only three pieces of missing tape recovered which contained printed alarms, two pertained to the safety limit violation and its immediate aftermath. The tape removed from the machine covered a period of just over seven hours,

forty-four minutes; i.e., between 6:48 p.m. on September 10 and 2:32 a.m. on September 11. The three recovered fragments with printed alarms spanned an aggregate period of just over one hour, six minutes, nearly an hour of which was on the September 10 fragment, leaving a period of just under six hours, thirty-eight minutes unaccounted for. Because there was a long period on September 10 with no alarms, the actual gap comprised by the tape that was removed and never recovered was just under five hours, thirty-nine minutes.[253] Both of the two September 11 fragments that were recovered pertain to the period surrounding the safety limit violation. Indeed, one of the fragments brackets the violation almost perfectly, from the actuation of the less-than-two-loops alarm to the clearing of that alarm.[254] This seemed to be a remarkable coincidence in light of [VV]'s testimony that he acted randomly when he tore and disposed of the tape, without regard to the relevance of the tape to the safety limit violation.[255]

One can extract from [VV]'s testimony an explanation of how such an apparent coincidence could have occurred. He stated that his first trip to the SAR was for the specific purpose of confirming that the safety limit violation had been recorded.[256] Thus, he focused on that portion of the tape, which he recalled being near the top of the machine.[257] After seeing the alarm, he tore the tape in anger, not recalling where the tear occurred. Only if the tear occurred just <u>below</u> the point where the actuation of

the safety limit alarm was recorded, however, could the rest of [VV]'s account be accurate. Otherwise, the part hanging out of the machine during [VV]'s second trip to the SAR -- the part he said he wadded up and threw in the trash and, therefore, the part that was later recovered -- would not have contained the safety limit alarm actuation and clearing messages.

The evidence is not inconsistent with an inference that [VV] did tear the tape below the part evidencing the safety limit event. As can be seen from the fragment with the time/date stamp "02:24:35 09/11/87," there is a blank space of approximately two inches after that point and before the next alarm at 02:32:54.[258] This is consistent with [VV]'s having grasped the tape just below the safety limit alarm message and yanked on it at some point between those times.[259] The "give" of the tape at the point it exits the machine could then have prevented it from tearing there, resulting in a tear where [VV] was holding the tape -- which, given his purpose in going to the SAR, could logically have been near the point where the safety limit alarm actuation message was printed. We found this explanation sufficiently plausible to conclude that [VV]'s testimony that he "randomly" disposed of the SAR tape without regard to what was on it was neither inherently improbable nor contradicted by the physical and circumstantial evidence.

In summary, the weight of the evidence does not

contradict [VV]'s contention that his tearing and disposal of the SAR tape was primarily motivated by anger at himself for having caused the safety limit violation, and not by an intention to conceal that violation. ([VV]'s motivations are further discussed in the individual section pertaining to him in Volume II of this report.)

The evidence also supported [VV]'s testimony on the closely related issue of whether he acted alone in tearing and disposing of the tape. To the extent that [VV]'s actions were an emotional reaction to his earlier mistake, the others had little reason to encourage or assist him. As discussed in Section VI(B) of this report, they had no plausible motive powerful enough to entice them into a conspiracy to conceal the safety limit violation itself. Absent such a conspiracy, it would have made even less sense for any of the others to join [VV] in tearing or disposing of SAR tape. Thus, regardless of what [VV]'s personal motivations were, the evidence did not indicate they were shared by the other crew members.

Whatever his motives, [VV]'s tearing and disposal of the SAR tape, coupled with his failure to report these actions, caused substantial time and energy to be expended on reconstructing the sequence of events during and after the safety limit violation and attempting to account for the missing evidence. More important, the missing tape and the absence of a timely explanation for it caused management

suspicion to extend to the entire crew and magnified the apparent significance of other errors and omissions, such as [II]'s inaccurate log entries and [HH]'s delay in reporting the violation.

4. Conclusions

The evidence supported the following conclusions:

a. After the safety limit violation, [VV] tore a quantity of SAR tape from the machine. He later threw some in the wastepaper basket located in the control room kitchen and put most of the torn tape in his pockets. These actions were probably completed prior to 2:32 a.m. and certainly completed prior to a few minutes past 3:00 a.m., when [ZZ] discovered that SAR tape was missing.

b. [VV] carried SAR tape in his pockets until shortly before 3:45 a.m., when he flushed it down a toilet in a bathroom outside the control room.

c. The tape [VV] flushed down the toilet did not pertain to the safety limit violation, with the possible exception of a fragment of tape that recorded the time of occurrence of the alarm.

d. A portion of the tape thrown in the kitchen wastepaper basket and later recovered recorded the entire safety limit event, from the alarm to the clearing of the alarm less than two minutes later, except for the printed

time of the alarm actuation itself, which we were able to establish from other data.

e. [VV] acted alone in tearing and disposing of the SAR tape.

f. No one other than [VV] knew what had happened to the tape [VV] took from the machine until [VV] partially admitted what he had done shortly before the end of the shift.

g. [VV] tore and disposed of the tape out of anger and frustration and not because he intended to conceal evidence of the safety limit violation.

E. Reporting of Missing SAR Tape Within GPUN Chain of Command

As discussed above, [VV] did not reveal to anyone what he had done with the SAR tape until approximately 7:30 a.m., when he approached [A] and told him that he had torn the tape and let it drop on the floor. [VV] did not reveal that he had also disposed of the tape until late in the afternoon of September 11, when he returned to the plant and spoke to [R] and [SS].

Prior to [VV]'s admissions, the other members of the crew and management learned about the missing tape in various ways and at different times. This section will focus on their responses to the information they received about the SAR tape, particularly the extent to which accurate and timely information about the missing tape was passed up the chain of command.

1. Standards of conduct

There are no specific written standards governing the internal reporting of missing SAR tape comparable to the requirements for reporting safety limit violations and other categories of reportable events. As discussed in the previous section of this report, the standards applicable to the destruction, concealment, or disposal of SAR tape depends upon the context in which it occurred, particularly whether such actions were intended to conceal a reportable event. Likewise, the standards applicable to reporting

missing SAR tape depend to a great extent on how the tape came to be missing and its relation to a reportable event.

The SAR tape that was torn and disposed of on September 11, 1987, was related to the safety limit violation on that date in two important ways. First, some of the tape contained information directly relevant to the violation itself (including the exact time), to the sequence of events, and to the question of how many recirculation loops were closed during the event. Some of this information was unavailable from other sources. Thus, the SAR was necessary to improve the accuracy of internal and external reports concerning the safety limit violation.

Second, as set forth in Section VI(B) of this report, Station Procedure 126 requires that GPUN management personnel be advised promptly of certain categories of events. Most of these categories correspond to NRC reportable event categories contained in the appropriate federal regulations. Category VI, however, makes reportable a broader group of events having "potential government or public interest," including events having "only very minor actual significance."[260] If not reported by the company, "very minor events may be reported by the news media in a manner entirely out of proportion to the significance of the events," resulting in "suspicions on the part of government officials and/or the media that the licensee is not forthright."[261]

That rationale is especially pertinent to the internal reporting of the missing SAR tape. Particularly in the context of an event as serious as a safety limit violation, the apparent destruction or concealment of relevant documents was certainly an event "of potential public interest"[262] within the spirit, if not the letter, of Procedure 126, Category VI. Events covered by that procedure were to be reported "promptly" to various GPUN management personnel so that they could decide what further reports, if any, were required.[263]

2. Crew knowledge of missing tape

With one significant exception, the testimony of the crew members was in agreement about when and how they became aware that SAR data were missing. As set forth in detail in Section VI(D), [ZZ] was the first crew member other than [VV] to notice that SAR data for the period of the safety limit event was missing. This occurred between 3:00 a.m. and 3:10 a.m., approximately forty to fifty minutes after the alarm. Within the next five to ten minutes, [ZZ] notified [HH], [II], and [I] of his discovery and asked each of them if he had taken the missing tape. [II] and [I] said they had not. [HH] made no reply, but had a "dumbfounded" expression on his face which [ZZ] took to mean that he was surprised to hear that the tape was missing. [ZZ] also asked [VV] if he had taken the tape. [VV], according to his own testimony, was carrying some of it in his pockets at the

time. Nevertheless, he also denied having taken the tape. All the crew members except [HH] corroborated [ZZ]' testimony about this sequence of events.[264]

[HH] gave a much different account of how he became aware of the missing SAR tape. He testified that after he completed his written and telephone notifications to the NRC and the GPUN Public Affairs Office, he went back to the SAR to collect data about the event and noticed, for the first time, that tape was missing.[265] [HH] said this occurred just after he spoke to the Public Affairs representative and just before [MM] arrived in the control room[266] -- a period the documentary evidence indicates was between 4:36 a.m. and 4:49 a.m.[267]

[HH] did not recall being told that the tape was missing shortly after 3 a.m., as described by [ZZ]. He did recall that while he was sitting at his desk looking at the "red chemical book" -- which he had obtained during his brief exit from the control room between 3:04 and 3:06 a.m. -- he looked up and saw someone standing by the door, after which he looked at the book again.[268] He estimated that this occurred "around three o'clock."[269]

Although [HH] testified that he could not recall [ZZ] telling him about the missing tape, he did not dispute [ZZ]' testimony on this point. Indeed, [HH] partially corroborated [ZZ]' account by testifying that he saw someone (he could not recall who) standing near the door to his

office around 3 a.m., while [HH] was looking at the red chemical book. Computerized records showed that [HH] was out of the control room between 3:04 and 3:06 a.m.,[270] and that is when [HH] said he obtained the chemical book from a nearby office.[271] For reasons set forth above,[272] we concluded that [ZZ]' notification to [HH] and [II] that SAR tape was missing occurred between 3:09 and 3:15 a.m. Thus, to the extent that [HH] recalled seeing someone standing in the door "around 3 a.m.," and after he had obtained the chemical book, his testimony is consistent with [ZZ]' and with the other testimonial and documentary evidence.

With respect to his inability to recall [ZZ] (or anyone else) saying anything to him about the SAR tape during this period, [HH] raised the possibility that a psychological reaction to stress resulted in memory lapses and other symptoms. This psychological explanation is discussed in detail elsewhere in the report.[273] For the purpose of this section it is sufficient to state that in resolving the apparent conflict between [HH]'s testimony and [ZZ]', [HH]'s self-described psychological state weighed heavily in favor of crediting [ZZ]' version of events. Thus, we concluded that [HH] was told about the missing SAR tape shortly after 3 a.m., the most likely time being between 3:09 and 3:15. This was approximately 15-20 minutes before the first of [HH]'s three telephone conversations with [R].

The final member of the crew to learn about the missing

tape was GOS [A]. He and [ZZ] agreed in their testimony that [A] learned about the missing tape at the same time he learned about the safety limit violation; i.e., during the [A]-[ZZ] conversation that took place outside the control room between 3:28 and 3:30 a.m.[274] There was some variance in their recollections of when [A] actually saw the SAR after being told the tape was missing. [ZZ] testified that when he returned to the control room after speaking to [A] he took him back to the SAR and showed him its condition.[275] [A] recalled looking at the SAR, but couldn't recall when. He did not think that he had seen it prior to his 4 a.m. telephone conversation with [R],[276] and did not recall anyone being with him when he saw the SAR.[277] [ZZ]' testimony on this point was not inconsistent with [A]'s but was more specific, and we concluded from it that [A] probably viewed the SAR between approximately 3:36 a.m., when [ZZ] returned to the control room, and 3:45 a.m., the approximate time of [A]'s conversation with [HH] regarding whether he had reported the safety limit violation to [R].

Thus, by 3:30 a.m. the entire crew had been told about the missing SAR tape, although only [VV] knew exactly what had happened to it. Moreover, at least one member of the crew, [ZZ], suspected by then that [VV] had taken the tape:[278]

> [VV] made the mistake that violated the safety limit. He has a reputation of being very good and not making any mistakes, and I thought that if anybody was going to do something like that, it was going to be him,

> because nobody else would have had a reason to try and cover things up.

[A], in contrast, testified that he believed that there was an innocent explanation for the missing tape:[279]

> . . . I assumed the SAR paper was missing, it was lost somewhere and it was completely innocent. I thought that somebody just haphazardly threw it away or somehow something happened to it that was totally innocent, and I really didn't believe that somebody did something wrong.

One possible "innocent" explanation--that the SAR machine simply ran out of tape and for that reason did not record the safety limit violation--did not occur to the crew members as plausible, given the condition of the tape when it was found.[280] As discussed below, management personnel above the crew level formed the impression that there was such an innocent explanation for the missing data after telephone conversations with [HH] and [A]. Both [HH] and [A] testified that they did not advance this "ran-out-of-tape" possibility as a hypothesis to explain the missing SAR data.[281]

3. Crew reporting of missing tape to higher management

The testimony was in general agreement about when management above the crew level became aware that SAR data were missing. There were significant differences, however, concerning what the crew told management about this subject.

As discussed above in connection with the reporting of the safety limit violation, between approximately 3:25 a.m.

and 4:05 a.m., there were three telephone conversations between the crew and Plant Operations Manager [R], the GPUN manager immediately above the crew level in the chain of command. The first of these calls occurred between 3:25 a.m. and 3:30 a.m., when GSS [HH] called [R] at home to tell him about the leak in the RBCCW system and the worker splashed with chemicals. Both [R] and [HH] testified that there was no mention of either the safety limit violation or the missing SAR tape during this conversation.[282]

The next conversation took place at approximately 3:45 a.m. when [R], having spoken to Plant Operations Director [N] after his first conversation with [HH], called back to obtain more information about the injured worker and to convey to the crew [N]'s admonition to keep two recirculation loops open when putting the pumps back in service. It was during this conversation that [R] first learned about the safety limit violation. [R] allowed for the possibility that [HH] mentioned something about the SAR tape during this conversation,[283] but said it was more likely that there was no mention of the SAR until the third conversation.[284] [HH], who testified that he did not even become aware of the missing SAR tape until after 4:30 a.m., was for that reason certain he did not mention it to [R] during the second conversation.[285] Most of the other evidence supports the view of [R] and [HH] that there was no mention of the SAR during the second conversation. [A], for example, acknowledged responding to [R]'s question about the

time of the safety limit event during the <u>third</u> conversation.[286] This was the question [R] said elicited the information that SAR data were missing.[287]

The only evidence suggesting that there was mention of the SAR or missing tape during [R]'s 3:45 a.m. conversation with [HH] was [N]'s recollection that he learned about the missing SAR data during his <u>second</u> conversation with [R], which occurred right after [R]'s second conversation with [HH].[288] [N] recalled having only two telephone conversations with [R] prior to arriving at the plant.[289] If [R] did tell [N] about the missing SAR during the second conversation, he could only have learned about it from [HH] during the 3:45 a.m. call he made to the control room.

We concluded, however, that [N] was mistaken in his recollection that he had only two telephone calls from [R]. [N] was not completely sure when he received the information about the missing tape,[290] an uncertainty that was understandable under the circumstances -- he had been awakened at 3:30 a.m. and during the next hour had telephone conversations with [SS], Bateman, and [NN], in addition to his calls from [R]. In contrast, [R] specifically recalled telephoning [N] a third time to convey the results of his 4 a.m. call to the control room.[291] That call had been prompted by [N]'s question to [R] about the time of the event,[292] making it likely that [R] would call back after obtaining the information [N] had requested. Thus, the

evidence strongly indicated that the first time the SAR was mentioned to management above the crew level was during [R]'s third telephone conversation with the control room, which took place between approximately 4 a.m. and 4:05 a.m.[293]

[R]'s recollection of that conversation was that he spoke to [A], who told him that [HH] was on the red emergency notification telephone reporting the safety limit violation to the NRC.[294] He asked [A] about the time of the safety limit alarm, and [A]'s reply made it clear to [R] for the first time that the alarm had occurred "a long time ago when they were taking the pumps out of service."[295] [R] also testified that there was "some information transferred to me that the SAR paper was not available for this event."[296] [R] was certain that neither [HH] nor [A] told him that the reason for the unavailability of SAR data was that the tape was missing, apparently because it had been removed from the machine.[297] He was also sure that, after his third telephone conversation with the control room, he was left with the impression that the reason for the unavailability of SAR data was that the machine had run out of tape.[298] [R] was less certain, however, exactly what [A] or [HH] said to him that created that impression:[299]

> I don't recall what words were used. The information as I understood it was yes, that the tape had [run] out of paper, and was from direct discussion with, I think, [A], and it possibly could have been [HH], that the SAR was out of paper.

[R] was "maybe 90 percent certain" that there had been some specific mention by [HH] or [A] that the SAR had run out of paper.[300]

Both [HH] and [A], however, denied telling [R] or anyone else that the SAR had run out of paper.[301] [HH], as noted above, maintained that he did not even become aware of the missing tape until long after his telephone conversation with [R].[302] [HH] recalled [R] telling him, during the third conversation, to make a one-hour notification to the NRC, after which [HH] handed the telephone to [A], telling him to complete the conversation with [R] while [HH] set about making his notifications.[303]

[A] confirmed that [HH] handed him the phone and told him to speak to [R].[304] He testified that he had a brief conversation with [R] in which [R] wanted to know what time the safety limit event occurred. [A] recalled saying that, from the computer, it looked like 2:24 a.m.[305] [R] also wanted to know why [HH] had taken so long to call [R], to which [A] replied that [HH] was about to call [R] when [R] called him instead.[306] According to [A], [R] did not ask anything specifically about the SAR tape and [A], in turn, did not volunteer anything on the subject.[307] [A] explained as follows why he did not mention the missing tape to [R]:[308]

> . . . [T]he general method of determining when something like that [i.e., the safety limit violation] happened would be to look on the SAR. So, when he asked me that,

> immediately I thought of the SAR. I thought, well, we have a missing document. I didn't want to . . . all of a sudden tell him look, I can't find the SAR paper, I can't figure out where it went, because it might raise concerns unnecessarily and it might get people very excited, when I didn't think at that time there was any reason to be excited.

Thus, while [HH]'s and [A]'s testimony conflicted with [R]'s on whether either man told [R] that the SAR had run out of tape, they confirmed that [R] was not informed about the actual condition of the SAR tape at that time -- i.e., that it was missing under circumstances suggesting that it had been deliberately removed. Moreover, [A] acknowledged that this omission was intentional, because disclosing the condition of the tape "might raise concerns unnecessarily and it might get people very excited . . . ."[309]

[A]'s testimony that he intentionally did not mention the missing SAR to [R] to avoid raising unnecessary concerns suggests the possibility that he went a step further and, in order to offer an innocent explanation for the missing data, told [R] the SAR had run out of paper. We found, however, that although the evidence supported [R]'s testimony that he received the impression that the SAR had run out of paper, it is inconclusive on whether [A] specifically told him that. [R] was less than completely certain that [A] had used those words, and could not even be entirely sure whether it was [A] or [HH] who had mentioned the SAR running out of paper, or whether it occurred during the second or third telephone conversation. Moreover, some of [R]'s other

recollections of what was told to whom during this sequence of conversations were in conflict with other evidence. For example, [R] believed that he told his assistant, [MM], about a problem with the SAR when he called [MM] at about 3:50 a.m.[310] ([MM] estimated this call to have occurred at 3:45 a.m.)[311] [MM] did not recall being told about the SAR during this conversation,[312] and the probable sequence of the [R]-[MM] conversation -- i.e., prior to [R]'s conversation with [A] -- conflicts with when [R] believes he first learned about a problem with SAR data.

These difficulties in recalling precise details were to be expected given the context of [R]'s conversations with [HH] and [A]. Like the other managers above the crew level, [R] had been awakened in the middle of the night and was given a partial account of a complex series of events transpiring at the plant. The conversation with [A] occurred in the midst of a lengthy sequence of telephone calls back and forth among [R], [HH], [N], and [MM]. The primary focus of attention during these calls was the safety limit event, not the SAR.

Because there was doubt concerning the exact statements made to [R] by [A] or [HH], we did not find that either man affirmatively misled [R] by telling him that the SAR had run out of tape. There was at least a substantial possibility that [R] formed this impression based more on what was not said under the circumstances rather than what was,

especially because [R] was aware of a previous transient during which, he recalled, the SAR had apparently run out of paper and failed to record data.[313]

Moreover, other witnesses recalled later discussions about the possibility that the SAR ran out of tape that were not prompted by [A] or [HH]. During the meeting [R] attended in [N]'s office after the 6 a.m. briefing, [NN] did not remember [HH] (who was present at the meeting) making any suggestion that the SAR machine had run out of tape. Indeed [NN], in response to the accusatory tone of the investigation [R] was helping to conduct, urged using more caution. [NN] suggested that it was possible that there was an innocent explanation such as the machine running out of tape.[314] [NN]'s recollection was supported by [O], the plant engineering director, who also attended the meeting. At one point, [O] recalled there was a discussion about the possibility that someone had been changing the tape because it had run out of paper, and that this was the explanation for the missing tape. [O] said this suggestion (which fits the description of the suggestion [NN] said he made) was thrown out for discussion as a hypothesis.[315]

It was clear from the evidence, however, that the failure of [HH] and [A] to give [R] a complete and accurate account of the condition of the SAR tape helped generate a spurious "ran out of tape" theory as the explanation for the missing SAR data.

It was also clear that CRO [ZZ] promptly and accurately reported the condition of the SAR tape to his supervisors, [HH] and [A]. [ZZ] also shared this information with the other members of the crew, and we found no substantial evidence of a generalized conspiracy to conceal, misrepresent, or fail to report the condition of the SAR tape.

The behavior of the two supervisors in response to information about the missing tape was more problematical. By 3:30 a.m., both [HH] and [A] had received information from which they knew, or should have known, that substantial portions of the SAR tape were missing, including the parts relevant to the safety limit violation. The only information indicating the absence of an SAR record of the event was conveyed to R after he called the control room twice with specific questions, and even then the suspicious condition of the tape was not revealed to him. As a result, [R] was allowed to believe in an innocent explanation for the missing tape -- that it had run out of paper -- that no one on the crew who had seen the tape believed.

This pattern of behavior persisted when [MM], [R], and [SS] entered the control room later in the morning. Neither [HH] nor [A] showed them the SAR or otherwise called their attention to the circumstances indicating that tape had been removed. As a result, the erroneous impression created earlier -- i.e., the spurious "ran out of tape" explanation

-- was allowed to continue. When [MM] saw the SAR and immediately noticed the suspicious gap, the crew's prior silence on the subject was bound to fuel management suspicions of a coverup.

Thus, while the evidence weighed against a conclusion tht either [HH] or [A] affirmatively misled [R] by specifically advancing the "ran out of tape" explanation, they were content to leave him with incomplete information concerning the condition of the tape which allowed him to believe in that theory until the management investigation disproved it. [HH], as GSS, was primarily responsible for reporting the condition of the tape to higher management. Indeed, had [HH] reported both the safety limit violation and the missing tape in a timely manner, it would not have been necessary for [A] to be involved in this reporting.

As discussed more fully in the individual sections on [HH] and [A], we did not conclude that either man intended to conceal, much less destroy, the SAR tape. On the contrary, the evidence supported their testimony that they did not know where the tape was and sincerely hoped that they would be able to find it. In essence, each of them held back from fully disclosing the condition of the SAR tape in order to buy time, hoping that it would turn up before its absence became a major issue.[316] By so delaying, however, they created the very impression they sought to avoid and thereby contributed to the management suspicion of the entire crew.

4. Reporting of missing tape within higher management

The "ran out of tape" theory was passed along by [R] to [N], [R]'s immediate superior in the GPUN chain of command.[317] [N], in turn, notified Deputy Director [SS] that SAR data were missing, although it is not entirely clear when this occurred. [N] thought he mentioned this to [SS] when he called at around 4 a.m. to tell [SS] about the safety limit violation, although he was not certain of this.[318] [SS] said he did not learn about the missing data at that time.[319] The first time [SS] recalled hearing about missing data was after the 6 a.m. meeting, possibly between 7 and 8 a.m., when [SS] thought that [N] called and told him about missing SAR tape.[320] [SS] then went to [N]'s office, where the details were explained to him.[321] At some point [SS] also heard the "ran out of tape" explanation for the missing data, but he could not recall when or from whom he heard this.[322]

Both [R] and [N] testified that until they arrived at the plant, and for some time thereafter, they did not have the impression that anything suspicious had happened in connection with the SAR tape, although both were annoyed that the machine had been allowed to run out of paper.[323] Discussion among the managers centered around other topics during this period, such as gathering information about the safety limit violation, making notifications, and preparing for a meeting that had been scheduled for 6 a.m.[324] [N] did not enter the control room during the period prior to the 6

a.m. meeting.[325] [SS] and [R] did enter the control room, at 4:43 and 4:58 a.m., respectively.[326] They spoke to [HH] and [VV] about the safety limit violation and [R] asked [HH] why he had not reported it earlier. According to [R], [HH] replied that he had been caught up with the spill.[327] No one volunteered any additional information about missing SAR data.[328]

The next information the managers received about missing data came from [MM]. He had entered the control room at 4:49 a.m. and had first spoken to GSS [HH], who did not tell him anything about missing SAR tape.[329] [MM] also spoke to GOS [A], who asked him whether the safety limit alarm was recorded on the plant's computer.[330] In the course of this conversation, [A] said something that left [MM] with the impression that the SAR had failed to record the event because it had run out of tape.[331] However, neither [A] nor [HH] actually used those words:[332]

> They didn't say to me that somebody took the tape and threw it out or ripped it or any thing. But they didn't say it was out of paper, either.

[MM] exited the control room at 5:24 a.m. without having seen the SAR.[333] He returned at 5:39 a.m., having been instructed by [R] and [N] to get a statement from the crew regarding the safety limit event. During this visit, [MM] went back to see the SAR for the first time.[334] He noticed that the tape coming out of the machine was separated from the tape on the takeup reel, and that there

was a gap of some seven hours in the recorded alarms.[335] This caused [MM] to feel that "something looked totally fishy."[336] He left the control room at 5:52 a.m. and reported what he had seen to [R].[337]

When [R] and [N] heard [MM]'s observation of the condition of the SAR tape they began to doubt the "ran out of paper" theory they had until then assumed was the explanation for the missing data.[338] Because [MM]'s news arrived just before the 6 a.m. meeting, however, no action was taken until after that meeting, when [N] told [R] and others to meet in his office to discuss the SAR tape.[339]

During the ensuing discussions among [N], [R], [SS], [MM], and others who were in the process of gathering and analyzing information concerning the safety limit event, suspicion grew that the crew had been engaging in a coverup. [HH] was unable to give satisfactory explanations for either his delay in reporting the safety limit violation or the whereabouts of the SAR tape, and the "ran out of paper" theory was beginning to look dubious, suggesting that it had been contrived to assist in a coverup.[340]

To test whether the missing data could have been caused by the machine having run out of paper, [MM] was sent back to the control room to retrieve the remainder of the roll then in the machine. When brought to [N]'s office, at approximately 7:10 a.m.,[341] this roll was compared to a new roll of SAR tape. The experiment showed that a substantial

amount of tape was missing from the roll that had been on the machine, thereby disproving the "ran out of paper" explanation.[342]

Later, other data and circumstances fueled management suspicion of the crew. The analysis of the technical data seemed to contradict the crew's report that only the "B" discharge valve had been closed, and [II]'s "late" log entry, which itself seemed suspicious, also indicated that two valves had been closed.[343]

Between approximately 7:00 and 7:20 a.m., [SS] decided to suspend the members of "B" crew from licensed duties pending the outcome of the investigation into the safety limit event. This decision had been discussed with Edwin Kintner, Executive Vice President of GPUN, and was relayed through [N] and [R] to [HH], who advised the crew of the decision when he reentered the control room at 7:21 a.m.[344]

Shortly afterwards, at 7:35 a.m., [R] entered the control room and was advised by [HH] that [VV] had something to tell him.[345] [VV] then revealed to [R] that he had torn the SAR tape and dropped it on the floor, although he continued to deny that he had done anything further with it.[346] [R] informed [N] of this development, and conducted a cursory search of the control room wastepaper baskets.[347] He exited the control room at 7:51 a.m. and shortly afterwards -- estimated by [R] to have been between 8:15 to 8:30 a.m. -- he and [N] decided to organize a

collection and search of trash from around the site, particularly the control room and main office building area.[348] [SS] was advised of this decision.[349] According to [R], it took an hour or so to organize the search.[350] They also, at about this time, requested the security office to provide data evidencing who had entered and left the control room during the relevant period.[351]

The testimony of the maintenance personnel and Shift Technical Assistants who organized and conducted the trash search confirmed that they were instructed to conduct a comprehensive search that initially included the trash compactor, where trash from various points is dumped after collection.[352] The search of the compactor, which had consumed more than an hour, was suspended when [R] learned that no trash had been placed there since the previous evening. The searchers were told at around 11 a.m. to redirect their efforts toward the control room and its immediate environs.[353]

Between 11:13 and 11:28 a.m., maintenance worker [U] emptied all the trash in the control room into a single bag, labelled it, and brought it to where other members of the search team were sifting through the trash.[354] They soon found pieces of SAR tape, one of which had the notation "less than 2 loops normal" on it.[355] This tape fragment was balled up, with ragged edges, and had coffee stains on it when found.[356] Between approximately

11:30 a.m. and noon, three pieces of SAR tape with alarms recorded on them were brought to [N]'s office.[357] One appeared to contain most, if not all, of the alarms pertaining to the safety limit event.[358]

The discovery of the tape fragments indicated to [R], [N] and the other management personnel investigating the event that someone had deliberately taken the tape. As [R] explained:[359]

> [S]omebody had taken the tape, had torn it up and thrown it in a trash receptacle, and because there was very little of this tape left in the trash receptacle, apparently somebody had removed it . . . and put it somewhere else.

Within a short time after [R] and [N] became aware of the recovered SAR fragments, [SS] was notified; he, in turn, notified Kintner and Clark in Parsippany.[360] Concurrently, as discussed in the next section of this report, the NRC site representative was advised of this development, and by 1:20 p.m. an official notification had been made to the NRC in Washington.

Based upon the above-described sequence of events, we concluded that the managers above the crew level, beginning with [R], acted with reasonable speed and diligence in verifying and reporting possible tampering with the SAR tape. There was a gap of approximately eight hours -- from 4 a.m. until noon -- between [R]'s first information that SAR data were unavailable and notification to the highest levels of GPUN (and to NRC representatives) that there was

evidence of concealment or destruction of SAR tape. However, prior to [MM]'s inspection of the tape just prior to 6 a.m., the management personnel had no reason to suspect any deliberate tampering. The investigation they began after the 6 a.m. meeting led to increased suspicion, but the managers did not believe they had a clear indication of intentional destruction or concealment until the tape fragments were found. From the great weight of the evidence it was clear that there was no intention on the part of these managers to conceal or ignore the problem of the missing SAR tape.

5. Conclusions

The evidence supports the following conclusions:

a. CRO [ZZ] was the first person other than [VV] to notice, between approximately 3:00 and 3:10 a.m., that SAR data were missing for the period of the safety limit event.

b. Between approximately 3:10 and 3:15 a.m., [ZZ] reported to GSS [HH] that SAR data were missing.

c. A short time later, between 3:28 and 3:30 a.m., [ZZ] reported to GOS [A] that SAR data were missing.

d. CRO [ZZ] promptly and accurately reported the condition of the SAR tape to his supervisors,

the GSS and the GOS.

e. By 3:30 a.m., every member of "B" crew had been told about the missing SAR data.

f. No member of the crew considered the possibility that the SAR machine had run out of tape to be a plausible explanation for the missing data.

g. GSS [HH], who had the primary responsibility for reporting to higher management, did not make a timely and accurate report concerning the condition of the SAR tape.

h. The first GPUN manager above the crew level to learn about the missing SAR data was Operations Manager [R], who became aware that SAR data were unavailable for the time of the safety limit event during a telephone conversation with GOS [A] between approximately 4:00 and 4:05 a.m.

i. During his telephone conversation with [R], [A] omitted relevant details concerning the condition of the SAR tape. As a result, [R] received the impression that the reason SAR data were unavailable was that the machine had run out of paper.

j. [R] conveyed both the information that SAR data were missing and the "ran out of paper" explanation to his immediate superior in the GPUN chain of command, [N].

k. In later conversations with management representatives, neither [HH] nor [A] corrected the impression that the data were missing because the machine had run out of tape. As a result, when a management investigation revealed that explanation to be implausible, the entire crew came under suspicion.

l. The first management representative to see the condition of the SAR tape was [MM], who inspected it shortly before 6 a.m. and, like [ZZ], noticed a gap in the tape.

m. [R] and [N] did not begin to suspect that anyone had destroyed or tampered with the SAR tape until they received [MM]'s report on the condition of the tape just before the 6 a.m. meeting that had been called to discuss the safety limit event.

n. Following the 6 a.m. meeting, between approximately 6:30 and 7:30 a.m., [R], [N], [MM], and others met in [N]'s office to discuss the missing SAR data; [SS], the highest-ranking GPUN official then on the site, was also made aware of the circumstances surrounding the missing data during this time.

o. Between approximately 6:30 a.m. and noon, the managers above the crew level and various technical, maintenance, and staff personnel were actively investigating the missing SAR tape as well as other aspects

of the safety limit event, an investigation which included attempts to reconstruct the event with other data, an experiment to determine whether the machine ran out of paper, questioning of members of the crew, and a search of the trash.

p. Between approximately 11:30 a.m. and noon, three fragments of the missing SAR tape were found as a result of the trash search, one of which evidenced the safety limit violation.

q. Within a short time after the discovery of the tape fragments, the news was conveyed to the top management levels of GPUN and to the local NRC representatives.

r. Management personnel above the crew level acted with reasonable speed and diligence in verifying and reporting possible tampering with the SAR tape.

F. Reporting of Missing SAR Tape to NRC

1. Standards of conduct

The destruction, concealment, or disposal of SAR tape does not clearly fall within any of the categories of reportable events contained in NRC regulations or in the Oyster Creek Technical Specifications. Its reportability to the NRC depends upon the extent to which it is related to another reportable event -- in this case, the safety limit

violation that occurred on September 11, 1987.

As discussed in the immediately preceding section of this report,[361] the SAR tape was necessary for accurate reporting of certain details concerning the safety limit violation, such as exact times, sequences and other information not retrievable from other sources. SAR data were not necessary for initial telephone notifications to the NRC that a safety limit violation had occurred. Both NRC regulations and company procedures, however, contemplate followup reporting, some formal and some informal.[362] Although arguably not required to be included in such followup reports, the missing SAR tape was a circumstance that could explain the absence of data that normally would be included in such reports. Similarly, the later discovery of portions of SAR tape that had been thrown in the trash affected the accuracy of reports to the NRC to the extent that the recovered tape supplied additional data concerning the safety limit violation, or corrected information previously reported.[363]

Apart from formal reporting requirements, in practice GPUN and NRC personnel exchanged information on an informal basis.[364] This informal sharing of information reflected the prudential concerns set forth in Station Procedure 126, Category VI, portions of which were quoted and discussed in other sections of this report.[365] Thus, an additional standard was whether the circumstances surrounding the

missing SAR tape warranted disclosure pursuant to the normal considerations that induce the company to report informally to the NRC.

The most relevant of these considerations to the events of September 11 is the above-referenced section from Procedure 126, which expresses a concern for the undermining of confidence resulting from the NRC's learning about certain kinds of events from sources other than management.[366] As discussed in the preceding section of this report, the apparent destruction or concealment of SAR tape relevant to a safety limit violation falls within the rationale of this category, apart from whether it was reportable for any other reason.

2. Management version of events

The removal and disposal of SAR tape was officially reported to the NRC through the Emergency Notification System (ENS) at approximately 1:20 p.m. on September 11, 1987.[367] This was characterized as an update of the company's previous notification of the safety limit violation.[368]

Prior to the official ENS notification, the NRC resident inspectors were told about the removal and disposal of SAR tape. This occurred, according to one management estimate, between approximately 11:30 a.m. and noon.[369] The event that prompted the notification to the NRC inspectors

was the recovery of fragments of SAR tape during the trash search.[370] At that point the GPUN managers had what they regarded as clear evidence that some SAR records had been intentionally removed.[371] The recovered pieces of SAR tape were shown to the NRC inspectors.[372]

After the NRC inspectors were briefed about the removal and disposal of the tape, they and GPUN management representatives discussed whether an official ENS notification was necessary and, if so, how the notification should be phrased.[373] The result of the discussion was the 1:20 p.m. ENS notification.[374]

3. Comparison of management account with other evidence

The time of the formal notification to the NRC -- i.e., in the area of 1:20-1:30 p.m. -- was documented in [R]'s diary note.[375] This telephone call resulted in the written NRC preliminary notification that was later issued.[376] To the extent that the NRC document reflected the substance of [R]'s 1:20 p.m. notification, he gave the NRC an accurate report of what was known to GPUN management at that time.[377]

While the precise time of the earlier notification to the NRC resident inspectors could not be established, all witnesses agreed that it was shortly after the tape fragments were recovered from the trash.[378] Allowing for the time it took the NRC inspectors to arrive and inspect the tape, discuss it and the other evidence with GPUN

management, and the time consumed in debating the wording of the formal notification that was made at 1:20 p.m., [R]'s estimate of 11:30 a.m. to noon -- which was the period during which the fragments were recovered and shown to management -- provides a reasonably accurate estimate of when the first informal notification to the NRC occurred.[379]

Because the evidence was clear that NRC representatives were promptly shown the SAR tape fragments found in the trash, and were at that time fully briefed on the reasons to suspect destruction of records (the NRC representative who attended the 6 a.m. briefing had already been advised that SAR data for the event were unavailable[380]), the remaining issue is whether GPUN managers should have notified the NRC earlier that SAR tape was missing under suspicious circumstances. Absent a clear standard requiring that the NRC be notified of management suspicions at a particular time -- and there was no such standard applicable to these circumstances -- the timing of such a notification was a matter of judgment and discretion. The evidence indicated that GPUN managers exercised this judgment in a responsible manner, consistent with the policy considerations set forth in Procedure 126.

The sequence of steps by which management personnel became aware of the missing tape and their reporting of this information within the GPUN chain of command has been detailed in the preceding section of this report. As we

concluded there, the evidence strongly supported the managers' testimony concerning how their initial impression that the SAR had run out of tape changed to a suspicion that the crew was engaging in a coverup. The evidence also corroborated the managers' accounts of the efforts they made to investigate the circumstances surrounding the missing SAR data, culminating in the discovery of the tape fragments. It was that discovery that convinced them that there was solid evidence of intentional destruction of records.

In short, the evidence showed that during the period before the NRC was told about the apparent destruction of tape, the management personnel were diligently attempting to find the tape and explain its disappearance. When their suspicions ripened into certainty, they promptly and accurately informed the NRC about the evidence of record destruction.

4. Conclusions

The evidence discussed above and in the preceding section on reporting of the missing SAR tape within the GPUN chain of command supports the following conclusions:

a. Between approximately 11:30 a.m. and noon, the apparent destruction and/or concealment of SAR tape was reported to NRC site representatives. This report was accurate within the limits of the information available. It was made shortly after the recovery of tape frag-

ments during a management-ordered search of the trash.

b. A formal report was submitted to the NRC at approximately 1:20 p.m., which contained information that was accurate within the limits of the information available at the time.

c. The timing of GPUN reports to the NRC was prompted by the recovery of the SAR tape fragments, which confirmed earlier management suspicions that there had been an intentional concealment or destruction of records.

d. The management investigation of the missing SAR tape was conducted diligently, with the goal of uncovering and reporting the reason for the missing SAR data.

NOTES

A. The Crew and Management Accounts of the Cause and Nature of the Safety Limit Violation

1. GPU Nuclear Oyster Creek Station Control Room Log, September 11, 1987, midnight to 8 a.m. shift (Exhibit 6);

NRC Augmented Inspection Team Report No. 50-219/87-29 (Sept. 28, 1987), p. 4 (Exhibit 27);

NRC Preliminary Notification of event or Unusual Occurrence -- PNO-I-87-86A (Sept. 11, 1987 -- 16:00) [hereinaiter cited as "NRC Notification Form," 16:00] (Exhibit 30);

Notes, [R] (Exhibit 12C);

[R], pp. 124-25;

[O], pp. 26-27, 38-42.

2. Section VI(D).

3. Photograph of Recirculation Pump C Controls (Exhibit 5A).

4. JCP&L Report to NRC (May 12, 1979), p. 3.D-1 (attachment to Exhibit 31);

[N], pp. 28-29;

[R], pp. 45-46.

5. E.g., Station Procedure 301, Section 7, pp. 31.0, 35.0 (Exhibit 17);

Station Procedure 2000-ABN-3200.02, p. 8.0 (Exhibit 32);

See also: Technical Specifications-Safety Limits, Section 2 (Exhibit 9A);

[N], pp. 26-30;

[R], pp. 45-46.

6. E.g., [VV], pp. 37, 82-83;

[A], pp. 28-29;

[ZZ], 10/7/87, pp. 78, 91-93.

7. [VV], pp. 36-45;

Station Procedure 301, pp. 31-35 (Exhibit 17).

8. Station Procedure 301, Section 7.3, p. 35 (Exhibit 17). The warning appeared in the same written step, but after the direction to close the valve. It was, however, displayed prominently with borders so as to attract attention.

9. Station Procedure 301, pp. 16.0, 22.0, 31.0, 43.0 (Exhibit 17).

10. Oyster Creek Nuclear Generating Station Procedure 2000-ABN-3200.19, "RBCCW Failure Response," Rev. 3, (effective Aug. 31, 1986) (Exhibit 26) [hereinafter cited as "Station Procedure 2000-ABN-3200.19"]

11. Ibid., p. 4.0. The language in this procedure appears to apply to full operating conditions. As applied to the shutdown conditions that existed on September 11, we interpreted the reference in this procedure to keeping "all" valves open to pertain to the valves in the loops that were operating, and not to impose a specific requirement that additional loops (beyond two) be opened.

12. E.g., [ZZ], 10/7/87, pp. 68-69;

[A], pp. 93-94;

[II], 10/8/87, pp. 57-59.

13. [VV], p. 29.

14. Ibid;

[A], pp. 76-77;

[HH], pp. 101-04.

15. [VV], pp. 30-31;

[HH], p. 104;

[I], 10/8/87, pp. 47-48.

16. [VV], p. 32;

see Volume III (Taylor Report), Sections B-5 and D-6.

17. [VV], p. 33;

[HH], pp. 107-09.

18. Ibid. The written procedure specifying that recirculation pumps could not be run without RBCCW flow through the drywell was Station Procedure 301, Section 5.2.3.6, p. 20.0 (Exhibit 17).

19. [VV], p. 33.

20. Ibid., pp. 33-34;

[HH], p. 109.

21. [VV], pp. 33-36.

22. Ibid., pp. 21-22;

see Volume III (Taylor Report), Section D-5.

23. [VV], pp. 22-24.

24. Ibid., p. 36.

25. See Station Procedure 301, Section 7, pp. 34-35 (Exhibit 17);

see Volume III (Taylor Report), Section B-2.

26. [VV], pp. 56, 63.

27. [VV], p. 56.

28. Ibid.

29. Ibid., pp. 60-61.

30. Ibid., p. 61.

31. Ibid., pp. 65-66, 69.

32. See Volume III (Taylor Report), Section B-2 (Explaining double light indication).

33. [VV], pp. 69-70.

34. Ibid., pp. 74, 79.

35. Ibid., p. 76.

36. Ibid., pp. 72-73.

37. Volume III (Taylor Report), Appendix 1.

38. [VV], pp. 73-74;

see Volume III (Taylor Report), Section D-10.3 and Section E.

39. [VV], pp. 74-75, 79-80.

40. Ibid., pp. 81-82

41. Ibid., p. 81.

42. Ibid., p. 198.

43. Sworn Statement of [PP] (Oct. 5, 1987), pp. 13-18 [hereinafter cited as "[PP]"];

Control Room Access Records ("entries"), 10:00 p.m., 9/10/87 - 11:30 a.m., 9/11/87 (Exhibit 14A).

44. [PP], p. 18.

45. Ibid., p. 33.

46. Ibid., p. 28.

47. [HH], pp. 114-15.

48. [II], 10/8/87, pp. 52, 55.

49. [ZZ], 10/7/87, pp. 71; 95-97.

50. [I], 10/8/87, p. 54.

51. Ibid., p. 55.

52. [HH], pp. 116-20;

[II], 10/8/87, pp. 66-67;

[ZZ], 10/7/87, pp. 94-95;

[I], 10/8/87, p. 57.

53. Control Room Log, September 11, 1987, midnight to 8 a.m. shift (Exhibit 6).

54. [II], 10/8/87, p. 113.

55. Ibid., pp. 113-16.

56. Ibid., pp. 113-26.

57. Ibid., p. 124.

58. [VV], p. 76.

59. Ibid.

60. [NN], pp. 7-8. See Volume III (Taylor Report), Section E, which illustrates the effect of [VV]'s opening of two valves.

61. [NN], p. 21.

62. [O], pp. 37-38.

63. Ibid., p. 38.

64. [R], p. 110.

65. Ibid., pp. 109-10.

66. Volume III (Taylor Report), Section D-9.

67. Ibid., Section D-10.3.

68. [VV], pp. 74-75, 79-80.

69. Volume III (Taylor Report), Section D-11. As discussed in that section of the Taylor Report, it was physically impossible for [VV] to have used the master controller and also to have performed the "B," "D," and "A" valve manipulations within the time period that these events occurred.

70. Ibid.

71. [VV], pp. 67-69.

B. Reporting of Safety Limit Violation Within GPUN Chain of Command

72. Oyster Creek Technical Specifications, Section 6.7 (Exhibit 9C).

73. Oyster Creek Nuclear Generating Station Procedure 126, "Procedure for Notification of Station events," Rev. 7 (effective Mar. 28, 1987), Section 5.2, p. 7.0 (Exhibit 25) [hereinafter cited as "Station Procedure 126"]

74. Ibid., Section 6.1, pp. 9.0-10.0.

75. Ibid., Enclosure 1 at E2-1.

76. Oyster Creek Technical Specifications, Section 2.1(C) (Exhibit 9A).

77. Station Procedure 126, Enclosure 2 at E3-1 (Exhibit 25).

78. NRC Augmented Inspection Team Report No. 50-219/87-29 (Sept. 28, 1987), p. 18 (Exhibit 27);

[NN], pp. 21-25.

79. Station Procedure 126, Section 6.2 at 9.0-10.0 (Exhibit 25).

80. E.g., ibid., Enclosure 2 at E3-1 (requiring GSS to notify GPUN personnel in the case of four-hour reportable events).

81. Ibid., pp. E6-1 - E6-4.

82. Ibid., pp. E6-3, E6-4.

83. Ibid., p. E6-1.

84. Ibid., pp. E6-1, E6-2.

85. Oyster Creek Nuclear Generating Station Procedure 2000-RAP-3024.01, "NSS Annuniciator Response Procedures," Rev. 22 (effective July 12, 1987), Section E-4-b, p. 1 of 2 (Exhibit 3).

86. Volume III (Taylor Report); Section D-10.3 and Section E.

87. Although [R] estimated this call to have occurred at 3:30 a.m., the 3:45 a.m. estimate is based upon the great weight of evidence showing the time and sequence of certain events. All witnesses agreed that [HH] told [R] about the safety limit violation when [R] called back to the control room after his first conversation with [HH]. [HH], [A], and other crew members testified that this occurred just after [A] had urged [HH] to call [R]; that event, in turn, occurred shortly after [HH] came back into the control room at 3:41 a.m., after speaking with the health and safety representative. See Access Chart (Exhibit 14C).

Further evidence that [R]'s second telephone conversation with [HH] occurred at approximately 3:45 a.m. was supplied by [N], who testified that [R] first called him at 3:35 a.m. ([N], pp. 56-57). It was this conversation with [N] that prompted [R] to call the control room and ask the question that elicited disclosure of the safety limit violation.

88. [ZZ], 10/7/87, pp. 94-95.

89. Ibid., pp. 74-76;

[II], 10/8/87, pp. 149-50;

[A], pp. 34-36;

[I], 10/8/87, pp. 57-59;

Volume III (Taylor Report), Section B-7.

90. [ZZ], 10/7/87, p. 79.

91. Ibid., pp. 79-83;

[HH], p. 152.

92. [SS], pp. 17-18.

93. [VV], pp. 86-87.

94. Ibid., pp. 110-11, 136-37.

95. [ZZ], 10/7/87, p. 79.

[II], 10/8/87, p. 155.

[I], 10/8/87, p. 87.

96. [HH], pp. 152-55.

97. [VV], p. 89;

[ZZ], 10/7/87, pp. 85-86;

[A], p. 47.

98. [I], 10/8/87, pp. 65-66.

99. [ZZ], 10/7/87, p. 66,

[I], 10/8/87, pp. 65-66;

Station Procedure 301, Section 7, p. 33.0-34.0 (Exhibit 17).

100. [ZZ], 10/7/87, p. 97.

The technical data showed that it took approximately 23 minutes to raise the reactor water level to 185 inches. Volume III (Taylor Report), Table E-1.

101. [ZZ], 10/7/87, p. 100.

102. [A], p. 83.

103. [P], pp. 14-15.

104. Ibid., p. 15;

[A], pp. 84-85.

105. [A], p. 85.

106. Ibid., p. 86.

107. Ibid., pp. 88-90.

108. Access Chart (Exhibit 14C).

109. [A], pp. 90-92.

110. Ibid., pp. 98-99.

111. Ibid., pp. 101-02.

112. Ibid., pp. 100-02;

Access Chart (Exhibit 14C).

113. [A], pp. 102, 108-09.

114. Ibid., pp. 108-09.

115. Ibid., p. 110.

116. [A], pp. 102-03;

Access Chart (Exhibit 14C).

117. [A], pp. 102-05.

118. [A], p. 103;

[ZZ], 10/7/87, pp. 136-37.

119. Ibid., p. 104.

120. *Ibid.*, pp. 132-33.

121. *Ibid.*, p. 132.

122. *Ibid.*, p. 137.

123. [R], p. 73;
[HH], pp. 163-65.

124. [ZZ], 10/7/87, p. 137;
[A], p. 103.

125. [A], pp. 105-06.

126. *Ibid.*, p. 111.

127. Access Chart (Exhibit 14C).

128. [A], pp. 112-13;
[ZZ], 10/7/87, pp. 147-49.

129. [A], p. 113;
[ZZ], 10/7/87, p. 149.

130. [A], pp. 113-14;
[ZZ], 10/7/87, p. 149.

131. [HH], p. 184;
[R], pp. 81-83.

132. [R], p. 83.

133. [A], pp. 121-22;

Oyster Creek Technical Specifications, Section 6.7 (Exhibit 9C).

134. [KH], p. 195;

[A], pp. 128-30.

135. [A], p. 129.

136. Ibid.

137. Access Records - Entries and Exits (Exhibits 14A, 14B).

138. Access Records - Entries (Exhibit 14A);

Sworn Statement of [E] (Oct. 13, 1987), p. 9 [hereinafter cited as "[E]"].

139. Sworn Statement of [XX] (Oct. 1, 1987), pp. 11-14 [hereinafter cited as "[XX]"].

140. Sworn Statement of [G] (Oct. 2, 1987), p. 13 [hereinafter cited as "[G]"];

[XX], pp. 14-15.

141. Sworn Statement of [D] (Oct. 2, 1987), pp. 25-26 [hereinafter cited as "[D]"];

Sworn Statement of [AAA] (Oct. 13, 1987), p. 26 [hereinafter cited as "[AAA]"];

[WW], p. 38.

142. [PP], pp. 58-60. [PP], as discussed in Section VI(A), was the only person not a member of "B" crew who had seen the safety limit alarm flash, just prior to his exit from the control room at 2:17 a.m.

143. [A], pp. 97-98.

144. Sworn Statement of [H] (Oct. 1, 1987), p. 18 [hereinafter cited as "[H]"].

145. [P], pp. 24-25.

146. Ibid., p. 31.

147. See Volume III (Taylor Report), Section D-12 and Table E-1.

148. Ibid.

149. E.g., [ZZ], 10/7/87, p. 83;

[I] 10/8/87, pp. 103, 105-08.

150. E.g., [HH], pp. 68-69;

[VV], pp. 87-93;

[R], pp. 26-27;

[A] pp. 44, 56.

151. There were substantial differences in the perceptions of the crew and management over the fairness and severity of discipline. [N], the GPUN manager most involved in setting disciplinary standards at Oyster Creek, indicated that, depending on the circumstances, violation of a safety limit would not necessarily result in any discipline at all. [N], pp. 7, 46-47.

152. [N], pp. 64-67;

[SS], pp. 21-22.

153. [SS], p. 25.

154. Oyster Creek Duty Notifications, Public Information and Affairs (9/11/87-4:36 a.m.) (Exhibit 9B).

C. Reporting Safety Limit Violation to NRC

155. Oyster Creek Technical Specifications, Section 6.7, pp. 6-14 (Exhibit 9C).

156. Ibid., Sections 6.7.1(c) and (d).

157. 10 C.F.R. § 50.72 (Exhibit 28).

158. Event Notification Form (Exhibit 8).

159. [HH], p. 195;

[R], p. 83.

160. Sworn Statement of [MM] (Oct. 14, 1987), p. 72 [hereinafter cited as "[MM]"].

161. NRC Augmented Inspection Team Report No. 50-219/87-29 (Sept. 28, 1987), p. 6 (Exhibit 27).

[NN], pp. 21-25.

162. Station Procedure 126, Section 5.2.1 (Exhibit 25).

163. Ibid., Section 5.2.2; Enclosures 1-5.

164. [HH], p. 195.

165. Exhibit 8.

166. Ibid.

167. Ibid.

168. [R], p. 73; see note 87, Section VI.

NRC Augmented Inspection Team Report, pp. 1, 16 (Exhibit 27);

NRC Preliminary Notification of Event or Unusual Occurrence, PNO-I-87-86 (Sept. 11, 1987--10:20) (Exhibit 29) [hereinafter NRC Notification Form, 10:20].

169. Event Notification Form (from Station Procedure 126) (Exhibit 8).

170. [HH], p. 197.

171. [N], pp. 68-69.

172. [SS], 33-34.

173. Transcript of 6 a.m. meeting (Sept. 11, 1987) (Exhibit 21).

174. NRC Notification Form, 16:00 (Exhibit 30).

175. See Volume III (Taylor Report) Section D-10.3.

176. Ibid., Section D-12.

177. Ibid., Sections D-9 and D-10.

D. Destruction/Concealment of SAR Tape

178. Section II(C).

179. JCP&L Modification Proposal 224-7-3, "Oyster Creek Control Room Alarms," Rev. 6 (July 10, 1984), Section 1, p. 1 (Exhibit 33).

180. [R], p. 55.

181. Control room and GSS logs, for example, are specifically required by Station Procedure 106, Section 4.4.3 (Exhibit 33).

182. Station Procedure 106 sets forth procedures for handling "strip charts" and "recorder charts" (Section 4.4.2, pp. 21.0-23.0), requiring that such charts "are to remain intact when removed and brought to the GSS office for filing in the Document Control Center," p. 23.0 (Exhibit 16).

The GPUN Records Retention Policy (No. 1000-POL-1210.02, effective Aug. 29, 1984) specifies that "Recording instrument charts" are to be retained for one year, "except where the basic chart information is transferred to another record," in which case the chart is to be retained for six months, "provided the record containing the basic data is retained one year," p. E1-15 (Exhibit 34).

183. E.g., [N], pp. 76-77;

[R], pp. 55-60.

184. E.g., [R], pp. 62-63.

185. We have not attempted to determine whether federal or state criminal laws were violated. There are, however, federal and state criminal provisions that arguably would apply to the September 11 event, assuming there were an intention to conceal the safety limit violation. See 18 U.S.C. § 1001 (making false statements in matter within jurisdiction of federal agency); N.J.S. 2C:28-6 (tampering with or fabricating physical evidence).

186. E.g., GPUN Corporate Policy 1000-POL-2002.00 "Standards of Conduct" (effective May 15, 1986), pp. 1.0-2.0 (Exhibit 58).

187. GPUN Corporate Policy 1000-ADM-2130.01 "Disciplinary Guidelines" (effective May 2, 1986), pp. 4.0-6.0 (Exhibit 59).

188. [ZZ], 10/7/87, p. 83;

[II], 10/8/87, pp. 155-56.

189. E.g., Station Procedure 106, Section 4.2.7, p. 14.0 (Exhibit 16).

Section 4.4.1, p. 20.0: "all shift personnel shall conduct themselves in a safe and professional manner at all times." (Exhibit 16).

190. [VV], pp. 112-13.

191. Ibid., p. 127.

192. Ibid.

193. Ibid., pp. 131-34.

194. Ibid., p. 134.

195. Ibid., pp. 147-49.

196. Ibid., p. 155.

197. Ibid., pp. 146-47.

198. [ZZ], 10/7/87, pp. 110-11; 120-21.

199. Ibid., pp. 121, 144;

[MM], p. 128;

Notes - [MM] (Exhibit 12A).

Volume III (Taylor Report), Section C-1. For the purpose of discussing the crew's actions, we cite times as they were printed on the SAR tape, and ignore the approximately seven-second time difference between SAR and real time. (Taylor Report, Section D-8). Although this time difference proved to be important to the technical analysis and determination of the sequence of events, it is not critical to our discussion of the actions of the crew members in this section of the report.

200. [VV], p. 149.

201. See Volume III (Taylor Report), Section C-1.

202. [VV], pp. 126; 142-43; 160-61; 174-76.

203. Ibid., pp. 159-60;

Chart (Exhibit 14C).

204. [VV], pp. 157-59.

205. Ibid., p. 157.

206. Ibid., pp. 158-59.

207. Ibid., p. 230.

208. [HH], pp. 195-97; 212-17, 227-32;

[A], pp. 130-31, 157-58;

[II], 10/8/87, pp. 103-09, 132-33;

[ZZ], 10/7/87, pp. 113-32, 180-81;

[I], 10/8/87, pp. 76-79, 83, 93.

209. We questioned under oath everyone who entered or left the control room between 2 a.m. and 7 a.m. The persons who were in the control room during the first hour and a half after the alarm -- the period during which [VV] completed his tearing and disposal of the tape -- are listed and their testimony discussed in Section VI(B) of this report.

210. Diagram of control room marked by [VV] (Exhibit 1B);

[ZZ], 10/7/87, p. 111.

211. [ZZ], 10/7/87, pp. 110-11.

212. Ibid., p. 110.

213. Ibid., pp. 110-15; 119.

214. Ibid., p. 120.

215. Ibid., pp. 144-45;
Notes - [MM] Exhibit 12A);
Fragments of SAR Tape (Exhibit 13C);
Volume III (Taylor Report), Section C-1.

216. [ZZ], 10/7/87, p. 121.

217. Ibid., pp. 144-45;
Notes - [MM] Exhibit 12A);
Fragments of SAR Tape (Exhibit 13C);
Volume III (Taylor Report), Section C-1.

218. [ZZ], 10/7/87, p. 123.

219. Ibid.

220. Ibid., p. 124.

221. Ibid.

222. Ibid., p. 125.

223. Ibid.

224. Ibid., p. 126.

225. Ibid., 129.

226. Ibid., p. 127.

227. Ibid.

228. Ibid., p. 128.

229. Ibid., p. 135.

230. [P], pp. 22-23;

Control Room Access Records (Exhibits 14A, 14B).

231. [ZZ], 10/7/87, p. 123.

232. [P], pp. 19-20.

233. For example, [P] recalled [HH] talking about "something" with EO [RR] ([P], p. 23).

234. [ZZ], 10/7/87, p. 135.

235. Ibid., p. 137.

236. [A], pp. 102-05.

237. Control Room Access Records and Chart (Exhibits 14A-C). The computer recorded [A]'s re-entry as having occurred at 3:30 a.m., and [ZZ]' at 3:36 a.m.

238. Ibid.

239. Ibid. See Section VI(B).

240. [HH], pp. 233-35;

[A], p. 162;

[I], 10/8/87, pp. 80-82;

[ZZ], 10/7/87, pp. 126-27.

241. See Section VI(E);

Volume III (Taylor Report), Section C-1.

242. [A], p. 162.

243. [HH], pp. 233-35.

244. See Volume II, individual section pertaining to [HH].

245. Our visual inspection of the original tape fragments confirmed the testimony of those who found it that it appeared to have been stained with coffee grounds or other food substance. See Volume III (Taylor Report), Section C-1.

246. [VV], pp. 223-25.

247. Ibid., pp. 222-23.

248. See Volume III Taylor Report, Sections 5 C-1 and E.

249. Ibid., Section C-1.

250. Ibid.

251. [VV], pp. 216; 219-20.

252. We tested all plausible explanations for the presence of the September 10 fragments in the trash, including the possibility that [VV] carried both them and the other two fragments in his pocket and disposed of them just before exiting the control room. There was insufficient evidence to support any of these explanations.

253. See Volume III (Taylor Report), Section C-1.

254. Ibid.

255. [VV], pp. 213-14.

256. Ibid., p. 127.

257. Ibid., p. 128.

258. Fragments of SAR Tape (Exhibit 13A);

see Volume III (Taylor Report), Section C-1.

259. Volume III Taylor Report, Section C-1.

E. Reporting of Missing SAR Tape Within GPUN Chain of Command

260. Station Procedure 126, Enclosure 5, p. E6-1 (Exhibit 25).

261. Ibid., p. E6-2.

262. Ibid., p. E6-3.

263. Ibid., p. E6-1.

264. [I], 10/8/87, pp. 81-83;

[II] 10/8/87, pp. 101-03;

[VV], pp. 144-45.

265. [HH], pp. 171-74.

266. Ibid., p. 175.

267. Oyster Creek Duty Notification Form (Exhibit 9B);

Access Records - Entries (Exhibit 14A).

268. [HH], pp. 200-01.

269. Ibid., p. 201.

270. Access Chart (Exhibit 14C).

271. [HH], pp. 176-79.

272 Section VI(D).

273. Volume II (individual section pertaining to [HH]).

274. See Sections VI(B) and (D).

275. [ZZ], 10/7/87, pp. 141-42.

276. [A], pp. 125-26; 133.

277. Ibid., p. 145.

278. [ZZ], 12/3/87, p. 8; see [ZZ], 10/7/87, p. 132.

279. [A], p. 131.

280. [HH], pp. 214-16;
[A], pp. 145-46;
[II], 10/8/87, pp. 107-09;
[ZZ], 10/7/87, pp. 142-43.

281. [HH] pp. 250-51;
[A], p. 132.

282. [R], pp. 73-80;
[HH], pp. 163-64.

The testimony of [R] and [HH] was corroborated by [A] and [ZZ], who confirmed [HH]'s admission.

283. [R], p. 90.

284. Ibid.

285. [HH], pp. 193-95.

286. [A], p. 128-30,

287. [R], p. 90.

288. [N], p. 64.

289. Ibid., p. 69.

290. Ibid., pp. 64-65.

291. [R], p. 95.

292. Ibid., pp. 87-89.

293. This estimate is based upon the time of [HH]'s notification to the NRC, which he recorded as 4:05 a.m. (Exhibit 8), in conjunction with the testimony discussed in the text that [HH] was in the process of making this notification when [R] called, causing [HH] to hand the phone to [A].

294. [R], pp. 89-90.

295. Ibid., p. 90.

296. Ibid.

297. Ibid., p. 92.

298. Ibid.

299. Ibid., p. 94.

300. Ibid., p. 93.

301. [HH], p. 250;

[A], p. 132.

At approximately 4:30 a.m., [A] had a conversation with EOs [WW] and [AAA] in the lunch room, during which he mentioned that SAR tape was "missing," not that it had run out of tape. See:

[A], pp. 136-38;

[WW], pp. 44-48;

[AAA], 32-34;

Access Chart (Exhibit 14C).

302. [HH], p. 193.

303. Ibid., pp. 194-96.

304. [A], p. 128.

305. Ibid., p. 129.

306. Ibid.

307. Ibid.. p. 132.

308. Ibid., p. 131.

309. Ibid.

310. [R], p. 94.

311. [MM], p. 61.

312. Ibid., p. 63.

313. [R], p. 58.

314. [NN], pp. 32-34.

315. [O], pp. 26-28.

316. See [ZZ], 10/7/87, p. 153.

317. [N], pp. 64-68.

318. Ibid., p. 67.

319. [SS], pp. 22-23.

320. Ibid., pp. 36-37.

321. Ibid.

322. Ibid., pp. 40-41.

323. [N], pp. 67-68; 76-77;
[R], pp. 93-95.

324. E.g., [N], pp. 69-74;
[R], pp. 101-02;
[SS], pp. 22-25.

325. Access Records - "Entries" (Exhibit 14A).

326. Ibid.

327. [R], p. 101.

328. [R], pp. 101-02, 115;
[SS], p. 29.

329. [MM], p. 84;

Access Records - "Entries" (Exhibit 14A).

330. [MM], p. 84.

331. Ibid., pp. 84-87.

332. Ibid., pp. 86-88.

333. Ibid., pp. 90-91;

Access Records - "Exits" (Exhibit 14B).

334. [MM], pp. 125-27;

Access Records - "Entries" (Exhibit 14A).

335. [MM], pp. 127-28;

Notes - [MM] (Exhibit 12A).

336. [MM], p. 131.

337. Ibid., p. 133;

Access Records - "Exits" (Exhibit 14B).

338. [N], pp. 74-75;

[R], pp. 102-05.

339. [N], p. 74.

340. E.g., [R], pp. 100-01, 105.

341. [MM], pp. 147-48;

Access Records - "Entries" (Exhibit 14A).

342. [R], p. 106;

[O], pp. 31-32;

[MM], p. 148.

343. [MM], pp. 151-57, 175-76.

344. [N], pp. 85-86;

[SS]. pp. 41-42;

[HH], p. 227.

345. [R], p. 116;

Access Records - "Entries" (Exhibit 14A).

346. [R], p. 116.

347. Ibid., p. 117.

348. Ibid.

349. [SS], p. 39.

350. [R], p. 120.

351. [R], p. 119.

352. Sworn Statement of [LL] (Oct. 15, 1987), pp. 5-7 [hereinafter cited as "[LL]"];

Sworn Statement of [U] (Oct. 1, 1987), pp. 7-11 [hereinafter cited as "[U]"];

Sworn Statement of [Q] (Oct. 13, 1987), pp. 8-11 [hereinafter cited as "[Q]"];

353. [U], p. 11.

354. [U], pp. 11-20;

Control Room Access Records ("Entries and "Exits") (Exhibits 14A, 14B).

355. Sworn Statement of [UU] (Oct. 15, 1987), pp. 11-16;

Sworn Statement of [CC] (Oct. 15, 1987), pp. 6-10;

SAR Tape Fragment (Exhibit 13A).

356. [Q], pp. 15-18.

357. Ibid., pp. 22-28.

358. [SS], p. 45.

359. [R], p. 123.

360. [SS], pp. 45.46.

F. Reporting of Missing SAR Tape to NRC

361. Section VI(E).

362. 10 C.F.R. § 50.72(c) (regarding immediate followup to telephone notifications, § 50.73 (requiring detailed written reports of event within 30 days) (Exhibit 28);

see also, 10 C.F.R. Sections 50.36(c)(1)(i)(A); 50.72(b)(2) (Exhibit 28);

Station Procedure 126 (Exhibit 25).

363. For example, data from the recovered tape fragments were used in later GPUN and NRC reports concerning the event. See, e.g., NRC Augmented Inspection Team Report, No. 50-219/87-29 (Sept. 25, 1987), Table 1 (Exhibit 27).

364. Examples of such informal exchanges on September 11 were joint GPUN-NRC examination of technical data, coordinating news releases, and discussing the wording of a followup notification. See [O], pp. 33, 50; Sworn Statement of [S] (Oct. 1, 1987), pp. 25-30 [hereinafter cited as "[S]"].

365. See Sections V(B) and (E).

366. Station Procedure 126, Enclosure 5, pp. E6-1, 2 (Exhibit 25).

367. [R], p. 125;

NRC Notification Form, 16:00 (Exhibit 30).

368. [O], p. 51;

NRC Notification Form, 16:00 (Exhibit 30).

369. [R], pp. 125-26.

370. Ibid., p. 126;

[O], p. 49;

[NN], p. 40.

371. [O], p. 49.

372. [N], p. 89.

373. [O], pp. 49-50.

374. NRC Notification Form, 16:00 (Exhibit 30).

375. Notes - [R] (Exhibit 12C).

376. NRC Notification Form, 16:00 (Exhibit 30).

377. As discussed in Section VI(C), the 1:20 p.m.

notification contained a statement about the nature of the safety limit violation itself -- i.e., that two recirculation discharge valves had been closed -- that our analysis of the technical data showed to have been inaccurate. This statement, however, clearly reflected the honest opinion of both GPUN and NRC investigators based upon their analyses of the data available at the time.

378. [R], pp. 124-26;

[N], p. 89;

[NN], pp. 40-42;

[O], pp. 32-35.

379. In an interim report to the company, we estimated that the discovery of the tape fragments -- and therefore the report to the NRC -- occurred between 10 and 10:30 a.m. Letter from Edwin H. Stier to Philip R. Clark (Sept. 21, 1987), p. 4 (Exhibit 35). Later testimony and analysis of computerized control room entry and exit data established that the recovery of the tape fragments occurred approximately an hour later than we had estimated. This does not in any way change any conclusion we have reached concerning the actions of GPUN management personnel.

380. Transcript of 6 a.m. meeting (Exhibit 21).

Table 1

List of Exhibits

(1) Diagram of Control Room

- (a) Diagram drawn by [II]
- (b) Diagram drawn by [VV]
- (c) Diagram drawn by [MM]
- (d) Diagram drawn by [I]
- (e) Diagram drawn by [ZZ]
- (f) Diagram drawn by [PP]
- (g) Diagram drawn by [HH]

(2)
- (a) Diagram of Dry Well Cooling System
- (b) Diagram of Typical Recirc Alarm Loop

(3) Oyster Creek Nuclear Generating Station Procedure 2000-RAP-3024.01, "NSS Annunciator Response Procedures," Rev. 22, effective date 7/12/87, pp. 11.0-13.0, E-4-b.

(4) Recirculation System Controls Diagram

(5)
- (a) Photograph of Recirc Pump C Controls
- (b) Photograph of Section F of Control Panel
- (c) Photograph of Control Panel showing recirc pumps A-D controls
- (d) Photograph of Sequence Alarm Recorder (SAR)
- (e) Photograph of Sequence Alarm Recorder (SAR)

(6) GPU Nuclear Oyster Creek Station, Control Room Log -- September 11, 1987, 12-8 shift.

(7) Group Shift Supervisor (GSS) Log -- 12-8 shift - 9/11/87

(8) Event Notification Form (1 page only) [from Station Procedure 126]
NRC notification time 4:05

(9)
- (a) Appendix A to Provisional Operating License DPR-16, October 1, 1986, Technical Specifications and Bases for Oyster Creek Nuclear Power Plant, Unit No. 1, Ocean County, New Jersey, Section 2.1, "Safety Limit - Fuel Cladding Integrity," p. 2.1-1.
- (b) Report on Safety Limit Violation to Public Affairs/Information Office [Oyster Creek Duty Notifications Form, Public Information Dept.]
- (c) Appendix A to Provisional Operating License DPR-16, October 1, 1986, Technical Specifications and Bases for Oyster Creek Nuclear Power Plant, Unit No. 1, Ocean County, New Jersey, Section 6.7, "Safety Limit

Violation," p. 6-14.

(10) Chronology prepared by "B" shift GOS, [A], September 11, 1987.

(11) Notes of 9/11/87 Critique of Safety Limit Violation

(12) (a) Notes - [MM] (concerning 9/11/87)
(b) Notes - [X] (concerning 9/11/87)
(c) Notes - [R] (concerning 9/11/87)

(13) Fragments of SAR tape found 9/11/87
(a) 3 pieces
(b) 76" piece
(c) 43" piece

(14) Control Room Access Records -- 10:00 p.m., 9/10/87 -- 11:30 a.m., 9/11/87

(a) "Entries"
(b) "Exits"
(c) Chart showing "B" shift operating crew control room entries and exits - 9/11/87

(15) Appendix A to Provisional Operating License DPR-16, October 1, 1986; Technical Specifications and Bases for Oyster Creek Nuclear Power Plant, Unit No. 1, Ocean County, New Jersey, Section 6.1, "Responsibility," p. 6-1 and Section 6.2, "Organization," pp. 6-1 thru 6-5.

(16) Oyster Creek Generating Station Procedure 106, "Conduct of Operations," Rev. 45, Effective date 8/13/87.

(17) Oyster Creek Generating Station Procedure 301, "Nuclear Steam Supply System," Rev. 39, Effective date 3/29/87.

(18) Diagram of Reactor Building, drawn by Omark, referenced in deposition at pp. 21-21.

(19) (a) Diagram of lunch room -- drawn [AAA]
(b) Diagram of lunch room -- drawn [WW]
(c) Diagram of lunch room -- drawn [J]

(20) Oyster Creek Nuclear Generating Station Procedure No. 620.4.004, "Surveillance Review Form," date effective 9/11/87, pp. 1-7 and E1-1 -- E1-4 (from [VV] deposition, p. 165).

(21) Transcript of 6:00 a.m. meeting.

(22) 11-U-6 Forced Outage Inventory, Rev. 1, September 10, 1987.

(23) RCA Computer Printout showing control room entry (referenced in [H] deposition, p. 15)

(24) Diagram of Radcon Area (discussed in [H] deposition, p. 23).

(25) Oyster Creek Nuclear Generating Station Procedure 126, "Procedure for Notification of Station Events," Rev. 7, Effective date 3/28/87.

(26) Oyster Creek Nuclear Generating Station Procedure 2000-ABN-3200.19, "RBCCW Failure Response," Rev. 3, effective date 8/31/86.

(27) NRC Augmented Inspection Team Report, No. 50-219/87-29, 9/28/87.

(28) 10 C.F.R. -- Sections 50.72, 50.73

(29) NRC Notification Form (10:20)

(30) NRC Notification Form (16:00)

(31) Letter, I. R. Finfrock to NRC, May 12, 1979, with attachment (JCP&L Report on the May 2, 1979 Transient at the Oyster Creek Nuclear Generating Station).

(32) Oyster Creek Nuclear Generating Station Procedure #2000-ABN-3200.02, "Recirculation Pump Trip," Rev. 3, effective date 9/1/86.

(33) JCP&L Modification Proposal 224-7-3, "Oyster Creek Control Room Alarms," Rev. 6 (July 10, 1984), Section 1, p. 1.

(34) GPUN Records Retention Policy #1000-POL-1210.02, eff. date August 29, 1984.

(35) Letter from Edwin H. Stier to Philip R. Clark, President, GPUN, 9/21/87.

(36) Letter from D. L. Ziemann (NRC) to I. R. Finfrock, Jr. (JCP&L) dated May 30, 1979, enclosing Amendment 36 to Operating License DPR-16.

(37) Letter from R. F. Wilson (GPUN) to J. A. Zwolinski (NRC) dated September 19, 1985.

(38) GPUN Division I System Design Description for Oyster Creek Nuclear Generating Station Recirculation Valve Interlock Modification, Rev. 0, 8/30/85.

(39) Letter from R. F. Wilson (GPUN) to J. A. Zwolinski (NRC) dated January 30, 1986.

(40) Letter from J. A. Zwolinski (NRC) to P. B. Fiedler (GPUN) dated April 16, 1986.

(41) Letter from J. N. Donohew, Jr. (NRC) to P. B. Fiedler (GPUN) dated July 15, 1986, with attached Safety Evaluation.

(42) GPUN Request for Project Approval for "Recir. Valve Interlock Modification," Rev. 4, 2/14/86, B/A No. 402207.

(43) GPUN Turnover Notification for the Recirculation Valve Interlock Modification dated 7/17/86.

(44) GPUN Division II System Design Description for the Oyster Creek Nuclear Generating Station Recirculation Valve Interlock Modification, Rev. 2, 1/29/86.

(45) Dranetz Technologies Inc., System 22 Sequence of Events Recorder, TM-103700, Operation Manual, 3/1/84.

(46) NUREG-0737, "Clarification of TMI Action Plan Requirements," November 1980, pp. iii-viii, 1-1, 1-10 (Item II.K.3.19)

(47) Letter from P. R. Clark (GPUN) to Dr. T. E. Murley (NRC) dated 9/20/87, with Attachments I, II, III.

(48) Oyster Creek Nuclear Generating Station Procedure 101, "Organization and Responsibility," Rev. 16, effective date 2/21/87.

(49) Jersey Central Power & Light Co./IBEW Agreement and Supplements, November 1, 1985-October 31, 1987, pp. 1, 51-52.

(50) Statement -- [HH], written September 17, 1987 (discussed in [HH] deposition, pp. 297-298)

(51) Memo from GGGGGG to ZZZZZZ, dated March 21, 1985.

(52) Memo from EEEEEEEE to Distribution, dated July 23, 1985.

(53) Memo from mm to GGGGGG, dated July 25, 1985.

(54) Memo from GGGGGG to mm dated August 1, 1985.

(55) Preliminary Engineering Design Review (PEDR) Conference Notes, August 8, 1985.

(56) Report of Ruben J. Echemendia, Ph.D., Licensed Clinical Psychologist (February 13, 1988).

(57) Memo from GGGGGG to ZZZZZZ dated January 28, 1986.

(58) GPUN Corporate Policy 1000-POL-2002.00, "Standards of Conduct," (eff. 5/15/86), pp. 1.0-2.0

(59) GPUN Corporate Policy 1000-ADM-2130.01, "Disciplinary Guidelines," (eff. 5/2/85), pp. 1.0-6.0

Table 2

List of Witnesses

Witness	Date of Deposition
[HH]	October 22, 1987
[SS]	October 29, 1987
[II]	October 8, 1987 December 3, 1987
[R]	November 4, 1987
[TT]	October 2, 1987
CANDELETTI, Glenn R. (Dr.)	November 30, 1987
[E]	October 13, 1987
[G]	October 2, 1987
[VV]	October 23, 1987
[LL]	October 15, 1987
[A]	October 27, 1987
[Y]	October 2, 1987
[X]	October 6, 1987
[NN]	October 16, 1987
[P]	October 7, 1987
[AAA]	October 13, 1987
[OO]	October 2, 1987
[RR].	October 1, 1987
[MM]	October 14, 1987
[WW]	October 5, 1987
[S]	October 1, 1987
[U]	October 1, 1987
[T]	October 13, 1987

Witness	Date of Deposition
[I]	October 8, 1987 December 4, 1987
[ZZ]	October 7, 1987 December 3, 1987
[O]	October 15, 1987
[J]	October 14, 1987
[UU]	October 15, 1987
[XX]	October 1, 1987
[QQ]	October 16, 1987
[PP]	October 5, 1987
[N]	November 4, 1987
[D]	October 2, 1987
[CC]	October 15, 1987
[H]	October 1, 1987
[Q]	October 13, 1987