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October 3, 2002
NG-02-0909

Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station 0-P1-17
Washington, D.C. 20555-0001

Subject: Duane Arnold Energy Center
Docket No: 50-331
Op. License No: DPR-49
Licensee Event Report #2002-002-00
File: A-120

Dear Sirs:

Please find attached the subject Licensee Event Report (LER) submitted in accordance with 10CFR50.73. There are no new commitments contained within this report. Should you have any questions regarding this report, please contact this office.

Sincerely,

10/3/02

John Bjorseth,
Plant Manager – Nuclear

cc: Mr. James Dyer
Regional Administrator, Region III
U.S. Nuclear Regulatory Commission
801 Warrenville Road
Lisle, IL 60532

NRC Resident Inspector – DAEC
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NRC FORM 366 (1-2001) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

Estimated burden per response to comply with this mandatory information collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U S Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
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TITLE (4)
Technical Specification Required Shutdown Due to Residual Heat Removal Service Water (RHRSW) Strainer Plugging Caused by Algae Intrusion from the Cedar River

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MO	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO	MO	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
08	05	2002	2002	– 002 –	00	10	03	2002	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	1
POWER LEVEL (10)	094

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply) (11)

	20 2201(b)		20.2203(a)(3)(ii)		50 73(a)(2)(ii)(B)		50 73(a)(2)(ix)(A)
	20 2201(d)		20.2203(a)(4)		50.73(a)(2)(iii)		50 73(a)(2)(x)
	20 2203(a)(1)		50.36(c)(1)(i)(A)		50.73(a)(2)(iv)(A)		73 71(a)(4)
	20 2203(a)(2)(i)		50 36(c)(1)(ii)(A)		50.73(a)(2)(v)(A)		73 71(a)(5)
	20 2203(a)(2)(ii)		50 36(c)(2)	X	50.73(a)(2)(v)(B)		OTHER Specify in Abstract below or in NRC Form 366A
	20 2203(a)(2)(iii)		50 46(a)(3)(ii)		50.73(a)(2)(v)(C)		
	20 2203(a)(2)(iv)	X	50 73(a)(2)(i)(A)		50.73(a)(2)(v)(D)		
	20 2203(a)(2)(v)		50 73(a)(2)(i)(B)		50 73(a)(2)(vii)		
	20 2203(a)(2)(vi)		50 73(a)(2)(i)(C)		50 73(a)(2)(viii)(A)		
	20 2203(a)(3)(i)		50 73(a)(2)(ii)(A)		50 73(a)(2)(viii)(B)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Ron Minear, General Maintenance Supervisor	319-851-7539

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i e , approximately 15 single-spaced typewritten lines) (16)

On August 5, 2002, with one loop of Residual Heat Removal Service Water (RHRSW) already inoperable, the other (redundant) loop was declared inoperable for the same reason. As a result, a plant shutdown was initiated and completed in accordance with the plant's Technical Specifications (TS). The cause of the event was the introduction of large amounts of algae into the RHRSW system strainers. Strainers in the pump discharge paths became clogged with the algae during routine testing, resulting in high differential pressures across the strainers. Per plant procedures, operators considered the strainers inoperable, which led to both RHRSW loops being declared inoperable, even though TS required cooling water flow rates could still be achieved. Corrective actions included cleaning the strainers, chemical treatment of the incoming river water that supplies the RHRSW system, and inspections and cleaning of service water pits where algae is likely to grow or settle. There were no actual safety consequences associated with this event. Potential consequences were minimal due to the ability to achieve TS required flow rates and procedural steps in place to bypass the strainers had the need arisen. The plant commenced startup on August 11, 2002.

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TEXT *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

I. Description of Event:

On Sunday, August 4, 2002, at 1056 hours while operating at 94% licensed thermal power, operators commenced "B" RHRSW loop operation in preparation for planned maintenance on the "A" loop of RHRSW (refer to Attachments 1 and 2 for one-line diagrams). There were other systems inoperable at the time, none of which impacted this event. During the test, a strainer high differential pressure alarm was received on the "B" RHRSW loop. Investigation indicated that the differential pressure instrument was pegged upscale high (greater than 15 psid). The procedural limit was 12 psid (Operating Instruction 416, Revision 25). As a result, at 1105 hours, "B" RHRSW subsystem was declared inoperable and Technical Specification (TS) Limiting Condition for Operation (LCO) 3.7.1 Condition C, one RHRSW subsystem inoperable for reasons other than an inoperable pump, was entered. The applicable TS Required Action for Condition C is to restore the RHRSW subsystem to an operable status within 7 days.

Throughout the remainder of the day and into the following day (August 5), plant personnel and divers were called in, planning meetings held, troubleshooting efforts attempted and maintenance to clean and inspect the strainer and service water pit were performed. During this time, the "B" Emergency Service Water (ESW) pump, which draws water from the same pit as "B" loop RHRSW pumps, had been running and did not show signs of algae plugging or high strainer differential pressures. Based on that observation and a similar algae problem from a September 4, 2001 event, during which only the "B" RHRSW loop was impacted, efforts were initially focused on the "B" RHRSW loop.

Later the same day (August 5), after completing initial actions on the "B" RHRSW loop, the "A" loop of RHRSW was tested to check for similar problems. During the test of the "A" loop, the "B" loop was still considered inoperable, but was considered available based on being able to pass required cooling water flow rates. After startup of the "A" pump (in the "A" loop), at 2252 the "C" RHRSW pump was started. Strainer differential pressure trended up and exceeded 12 psid. At 2333 hours, the "A" RHRSW loop was declared inoperable and TS LCO 3.7.1, Condition D, both RHRSW subsystems inoperable, was entered. The applicable required action for Condition D is to restore one RHRSW subsystem to an operable status within 8 hours. Recovery efforts were unable to restore one of the subsystems within this 8 hours. At 0733 on August 6, 2002, TS LCO 3.7.1, Condition E, was entered. Condition E requires the plant to be in Mode 3 (hot shutdown) within 12 hours and be in Mode 4 (cold shutdown) within 36 hours. Mode 3 was reached at 1710 on August 6, 2002 and mode 4 at 1915 hours on August 7, 2002.

The plant commenced startup on August 11, 2002.

II. Cause of Event:

The introduction and accumulation of large amounts of algae from the Cedar River is the cause of the RHRSW strainer high differential pressures that resulted in the plant shutdown. Underlying causes include less than adequate river monitoring and management, changes in the Cedar River conditions, and a failure of corrective actions from a previous similar event.

II. Cause of Event (continued):

River Monitoring and Management:

Internal and external operating experience reviews indicate previous site difficulties and less than adequate river maintenance and monitoring to prevent formation of conditions that promote algae growth. Development of high levels of silt build-up (discovered in July, 2002) in the river upstream and directly in front of the intake structure allowed higher than normal silt build-up internal to the intake pits and stilling basin. Evaluations of the silt by external consultants show significant levels of nutrients, which can support algae growth.

Changes in the Cedar River Conditions:

Evaluations of the Cedar River during the summer of 2002 show higher than normal levels of turbidity and extremely high chlorophyll levels (>500 ppm) in the river. Twenty different strains of algae were found in the post event sample from an RHRSW strainer. Included in the sample was a significant amount of filamentous algae, which serves as a trap for other types of suspended solids that may be found in the water. Reports from other facilities (e.g. Prairie Creek Generating Station) that use water from the Cedar River for cooling, indicate that similarly large amounts of algae were found in their systems during the same timeframe.

Previous Similar Event:

On September 4, 2001 while performing routine testing of RHRSW, a "B" RHRSW strainer high differential pressure alarm was received. The "B" loop of RHRSW was declared inoperable, however, the "A" loop of RHRSW was not impacted. Inspections revealed algae present in the strainer. A root cause analysis was performed, which concluded that the algae growth was due to inadequate cleaning frequency of the intake structure pits and stilling basin. Other causes included the lack of chemical addition in or upstream of the stilling basin to treat the river water before it enters the RHRSW pit.

Corrective Actions from this root cause were in place and an effectiveness review had been completed prior to this (August 2002) event. The effectiveness review (completed in May, 2002) concluded that actions were implemented and effective. An ongoing program of enhanced weekly pit chlorination, more frequent pit inspections, and cleaning during the warmer months was considered to be an effective control strategy. River water conditions and the silt build-up in front of the intake structure were different initial conditions between the September 2001 and the August 2002 events. In view of this (August 2002) event, the timing of the effectiveness review (closed before summer months when algae is more likely to grow) and the frequency and effectiveness of the corrective measures were inadequate to prevent this event. Previous actions also failed to include analysis and contingency plans to maintain RHRSW subsystem operability by using the strainer bypass valve.

III. Assessment of Safety Consequences:

The RHRSW system is designed to provide cooling water for the Residual Heat Removal (RHR) system heat exchangers, required for a safe reactor shutdown following a Design Basis Accident (DBA) or transient. The RHRSW system is operated whenever the RHR heat exchangers are required to operate in the shutdown cooling mode or in the suppression pool cooling mode of the RHR system and is a manually initiated system. Except for short durations associated with cleaning strainers, both subsystems of RHRSW remained available throughout the event. The pumps in each loop remained capable of passing TS required flow. The TS requirement for an operable RHRSW subsystem is: (1) two operable pumps and (2) an operable flow path capable of taking suction from the pump house and transferring the water to the RHR heat exchangers at the assumed flow rate. Annunciator Response Procedure (ARP) 1C03B, D-5, Revision 5, "RHRSW/ESW STRAINER HI DP," in place at the time of the event, included steps for operators to open the strainer bypass valve if there had been an actual low flow condition. An evaluation performed prior to plant re-start also concluded that the use of the strainer bypass is acceptable to meet the TS definition of an operable subsystem as described above. During the event, concerns for plugging or fouling the RHRSW side of the RHR heat exchangers outweighed the potential use of the strainer bypass valve(s) to maintain operability.

At the time of the event, the plant was in LCOs day 4 of 7 per TS 3.8.6 Action A.2, and day 4 of 31 per TS 3.8.6 Action A.3, both for station battery 1D1. These pre-existing LCOs did not impact this event, nor would they have complicated the algae-related problems had an accident occurred. The ESW system, which pumps cooling water from the same service water pits as RHRSW, was not impacted by the algae and remained operable throughout the event. It is believed that lower design flow velocities through the ESW strainers account for this difference. Variations in plant operating modes would have had minimal impact on the significance of this event. The RHRSW strainer bypass valve was opened during the plant cool-down associated with this event. The use of the bypass valve was to help minimize strainer differential pressure during shutdown cooling. The bypass was not required for cooling water flow requirements to achieve cold shutdown.

There were no actual safety consequences associated with this event. Potential safety consequences were minimal. There was no impact on public health and safety.

IV. Corrective Actions:

A. Completed:

1. Prior to plant startup, an evaluation was completed (10CFR50.59 evaluation 02-002) that concluded that RHRSW system operability can be maintained with the strainer bypassed. Associated with this evaluation, RHR heat exchanger monitoring instrumentation was installed (Temporary Modification 02-043) and will be made permanent (AR 32082).
2. The RHRSW strainers, RHRSW pits, stilling basin, and "A" and "B" river water supply pits were cleaned to remove any accumulated algae.

Corrective Actions-Completed (continued):

3. The inspection frequency for RHRSW/ESW pit and stilling basin inspections was increased to monthly during summer months and acceptance criteria for the inspections were revised to a lower tolerance for the presence of silt and algae (AR 32127).
4. Chemical addition to the stilling basin with an algaecide was increased to twice a week (AR 32123).
5. Preventive work orders for RHRSW/ESW pit and stilling basin cleaning have been revised to include chemical treatment with algaecide whenever cleaning is required (AR 32124).
6. Environmental and chemical company consultants and the University of Iowa have been contacted for external expertise and recommendations for controlling the algae and overall river condition monitoring improvements (AR 32130 and AR 32025).

B. Follow-up and On-going Actions:

1. A river management project team and team leader have been assigned to coordinate and monitor river conditions, cleaning, de-silting, chemical treatment effectiveness, and future modifications to the river and plant equipment for controlling algae growth (AR 32129).
2. A separate, but related root cause analysis will be completed associated with silt levels in the Cedar River (AR 31776).
3. In response to the effectiveness review and corrective actions from the September 2001 similar event, guidance on how and when to perform an effectiveness review will be added to the root cause process procedure (AR 32785).

V. Additional Information:

Previous Similar Occurrences:

There was one previous similar event that is discussed within the Cause Section of this report.

EIIS System and Component Codes:

Residual Heat Removal (RHR): BO
RHR Service Water (RHRSW): BI
Emergency Service Water (ESW): BI

The RHRSW strainers are Zurn (Z010) model 593-16 self-cleaning type.

This event is being submitted pursuant to 10CFR50.73(a)(2)(i)(A) and 10CFR50.73(a)(2)(v)(B). Event notifications (ENs) 39111 and 39112.

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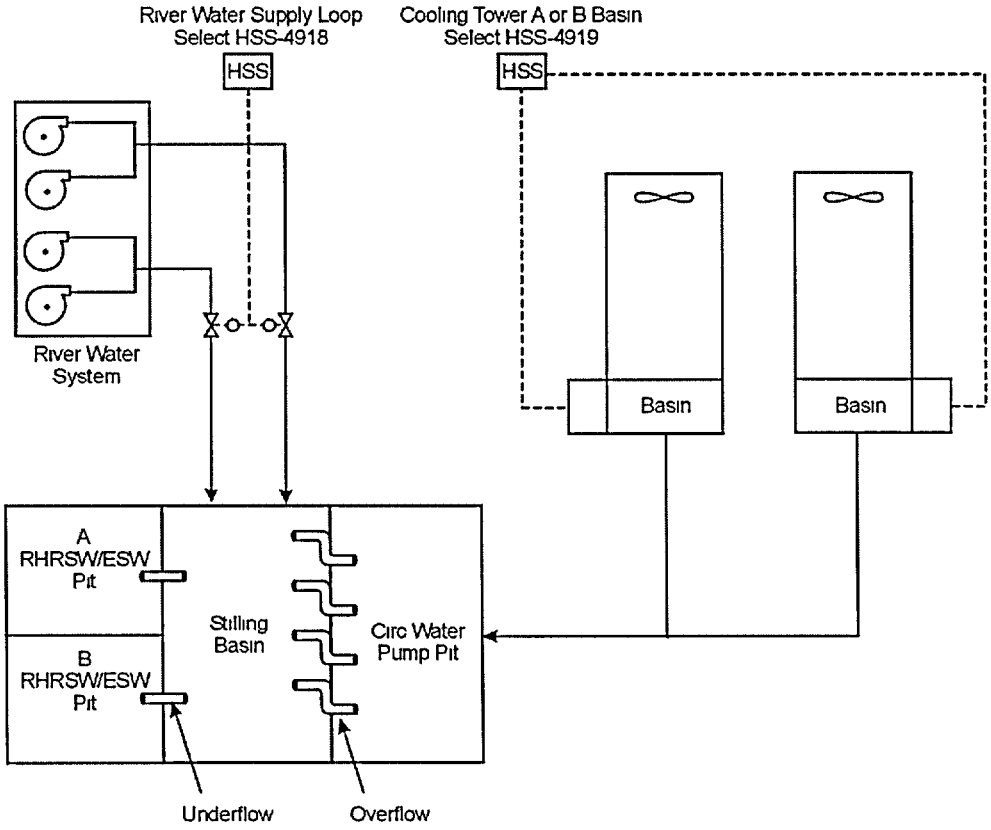
TEXT *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

Attachment 1, River Water Flow to RHRSW Pits



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Attachment 2, RHRSW Diagram