UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

December 4, 1990

Dr. Eugene DeLoatch
Black Engineer of the Year Selection Committee
729 E. Pratt Street
Suite 504
Baltimore, Maryland 21202

Dear Dr. DeLoatch:

It is my distinct pleasure to recommend Lawrence G. Bell for the 1991 Black Engineer of the Year Award. As I read the description of the type of person you are seeking to honor, "... role models, people who can excite both young people and professionals about science and engineering," it was clear to me that Mr. Bell was our outstanding candidate. During his tenure in my organization, the Office for Analysis and Evaluation of Operational Data, Mr. Bell has been best known for his benchmark review of "scram" experience at commercial light water nuclear power plants. His work has been a cornerstone in our efforts to understand this important area of nuclear reactor safety. Prior to this assignment, Mr. Bell also served with distinction in a safety oversight role at the Three Mile Island nuclear station, where he assisted in the engineering aspects of the cleanup efforts following the accident of 1979.

Mr. Bell came to our organization early in its history and was one of the original staff engineers charged with examining broad trends in safety related experience at U.S. commercial nuclear power plants. He developed the approach, methods, and tools for analyzing the causes of rapid, unplanned reactor plant shutdowns or "scrams." At that time this topic was gaining attention both in the U.S. and internationally as an area where improved performance was needed. This topic is particularly complex for the U.S. since we have a variety of reactor designs that use quite different plant protection systems and power production systems. Finding common themes in the causes c' .rams, and potential improvements, was a significant technical challenge which Mr. Bell met successfully. As a result of his technical eminence in the field of analyzing those operating events at nuclear power plants, Mr. Bell has also been active in contributing to other major NFC programs to improve the safety of nuclear power in our country.

Mr. Bell's resume lists numerous other technical contributions to the work of the U.S. Nuclear Regulatory Commission and the Atomic Energy Commission. He has compiled a record of achievement in the field of nuclear safety. From my personal experience, I know Mr. Bell to be a conscientious, dedicated professional and a person who can be counted on to work toward the goals set for the country. In summary, I feel Mr. Bell exemplifies the type of successful, self-made engineer whose career can inspire others to enter technical fields. Although my recommendation focuses primarily on his major technical achievements, he is an all-around outstanding individual and truly merits my highest recommendation for this award.

Sincerely,

Edward L. Jordan, Director
Office for Analysis and
Evaluation of Operational Data

RESUME

Lawrence G. Bell

Experience:

1984 - Present
U. S. Nuclear Regulatory Commission
Washington D.C.

Selected for Office for Analysis and Evaluation of Operational Data (AEOD), Division of Safety Programs, Trends and Patterns Branch. Lead engineer in the analysis of industry reactor scram experience. Perform as technical monitor for programs being conducted by AEOD under contract with the Idaho National Engineering Laboratory (INEL). Responsible for review and evaluation of nuclear power plant operating data, industry reports, specific utility reports, and event reports to identify safety issues. Conduct independent technical discussions with industry groups, other NRC offices, nuclear plant staff, and equipment vendors. Review foreign reactor experience in areas of expertise. Completed publication of "Operating Experience Feedback Report - Progress in Scram Reduction" and Addendum. Prepared and presented a paper at the American Nuclear Society (ANS) summer meeting in Atlanta Ga. in June 1989 on "Unplanned Reactor Scrams." Performed an analysis of nuclear power plant component failures in support of a Commission rulemaking on maintenance. Conducted investigations of component reliability and maintenance at plant sites.

1980 - 1984
U. S. Nuclear Regulatory Commission
Washington D.C.

Assigned to the Three Mile Island (TMI) Program Office in Washington. Responsible for technical monitoring and review of waste generation rates at the TMI site, decontamination methods, waste packaging, waste processing, and waste disposal methods. Prepared agency responses to questions relating to TMI accident from the U. S. Congress, States, and others. Interacted with representatives from government agencies and the nuclear industry in matters related to TMI activities. U.S. NRC representative in the plant's control room to monitor the release of radioactive noble gases from the reactor's containment building to assure that regulatory limits were not exceeded.

1979 - 1980
U. S. Nuclear Regulatory Commission
Washington D.C.

Assigned to the Three Mile Island (TMI) Technical Support Staff on the TMI site. Responsible for on-site technical evaluations of liquid, gaseous, and solid radioactive waste treatment systems. With utility staff developed design criteria for new radioactive waste treatment systems. Provided technical evaluations of the utility operating procedures for the systems installed. Participated in the reviews and evaluations of the design criteria used in the final design of the liquid radioactive waste treatment system known as EPICOR-II. This system was used to process radioactive water generated as a result of the March 28, 1979 accident at TMI. Reviewed the progress of all new

Experience (Continued):

radioactive waste treatment systems and on-site waste storage facilities from the design phase through construction and operation. Participated in the preparation of the Environmental Impact Statements written to address the impact of processing post accident radioactive water at TMI. Provided guidance on design criteria for a new nuclear sampling system installed to gather data for both liquid and gaseous radioactive levels in tanks and buildings at the plant. Participated in an ongoing program to identify radioactive gas leaks in various plant systems. Maintained up-to-date information on all waste management activities, i.e., waste inventories, waste water movements, and radioactive waste system status changes.

1975 - 1979
U. S. Nuclear Regulatory Commission
Washington D. C.

Performed technical review of commercial nuclear power reactor radioactive waste treatment systems. Prepared the radioactive waste treatment system section of Environmental Statements and Safety Evaluation Reports. Reviewed and evaluated licensing topical reports, prepared and provided technical inputs related to radioactive waste treatment system problems, and participated in the development of criteria governing radioactive waste treatment systems. Cognizant engineer for computer programs used to calculate radioactive release source terms (industry defines source term as expected amount of a radioactive isotope) for use in the licensing process. Participated in the development of parameters used to calculate radioactive release source terms for both Pressurized Water Reactors (PWR) and Boiling Water Reactors (BWR). Provided technical input for the In-Plant Measurement Program. This program was an NRC-sponsored effort to measure radioactive releases via liquid and gaseous release points from operating reactors. Revised and re-wrote the BWR Gaseous Code. This program was used in the licensing process to calculate predicted releases of radioactive materials to the environment via gaseous releases. Maintained up to-date information on all solidification methods and radioactive monitoring systems. Participated in preparation of Appendix I (NRC Regulations) radiological technical specifications.

1972 - 1975
U.S. Atomic Energy Commission
Washington D.C.

Responsible for tracking releases of radioactive materials to the environment via liquid, gaseous, and solid sources for all U.S. commercial nuclear power reactors. Maintained computer programs for processing radioactive effluent data from all commercial U.S. nuclear power plants. Reviewed AEC special monitoring programs, and evaluated the results of actual power plant radioactive releases. Participated in the development of an improvement program for handling radioactive effluent data, and a verification program used to calibrate actual release data. Supported the Office of Regulatory Operations efforts to evaluate radioactive waste treatment systems. Evaluated, processed and published operating data received from licensed nuclear power reactors. Prepared routine and special reports, and made recommendations related to data collection changes. Assisted in the development of computer programs to process and retrieve operating data.

Experience (Continued):

1971 - 1972
U.S. Atomic Energy Commission
Idaho Operations Office

Worked in support of maintenance and high level radioactive waste solidification processes at the Idaho Chemical Processing Plant. Reviewed and analyzed radioactive effluent releases from Chemical Processing Plant for compliance with operating control limits. Interfaced with operating personnel to evaluate causes of any abnormal releases of radioactive materials to the environment. Followed the progress of activities related to high level radioactive waste treatment programs. Provided assistance in determining where improvements in effluent controls were possible.

1970 - 1971
U.S. Atomic Energy Commission
Idaho Operations Office

Technical review of process control computer applications at the National Reactor Test Site (NRTS), Idaho Falls Idaho. Supported programs to assure that main-frame (IBM 360) computer services were maintained at a high level for all users on the Reactor Test Site. Followed programs and work at the Hot Cells facilities. Followed progress of work related to instrument development.

1962 - 1966

U. S. Navy

Initial duty aboard a destroyer. In 1963 selected for submarine school. Assigned to USS Stonewall Jackson. Responsible for supervising operation and maintenance of the Main Hydraulic System, Carbon Dioxide Scrubber System, High Pressure Air System, and Oxygen Generators.

Education:

Savannah State College
B.S. Electronic Technology, 1970

The Catholic University Of America
B.S. Engineering, 1978

Lawrence G. Bell

JOB DESCRIPTION

Mr. Bell assists in the development, coordination, and implementation of operational data program development activities, particularly with regard to the analysis and evaluation of trends and patterns in operational experience. This activity is part of an integrated national program for the systematic collection, analysis, and feedback of operating experience.

His duties include the following:

Analyses and evaluations of operational data and information particularly with regard to trends and patterns considerations.

Identification of the need for and assistance in the development of computer-based systems for the collection, handling, screening, analysis, evaluation, and dissemination of operational experience data.

Development or coordination of new data gathering methods or reporting requirements in order to perform required analyses and identification of actions to improve the present reporting, analysis, dissemination, and feedback of operating experience.

Identification of improvements based upon the results of evaluations, and planning methods for providing feedback to licensing office and dissemination to licensees, industry, and the public.

Preparation of reports dealing with complete evaluations and, based upon the information presented, development of conclusions and identification of needed action.

Monitoring and coordination of the activities of NRC offices including program support contracts and work orders, in order to promote efficiency, assure communication, and minimize unrecognized duplication.

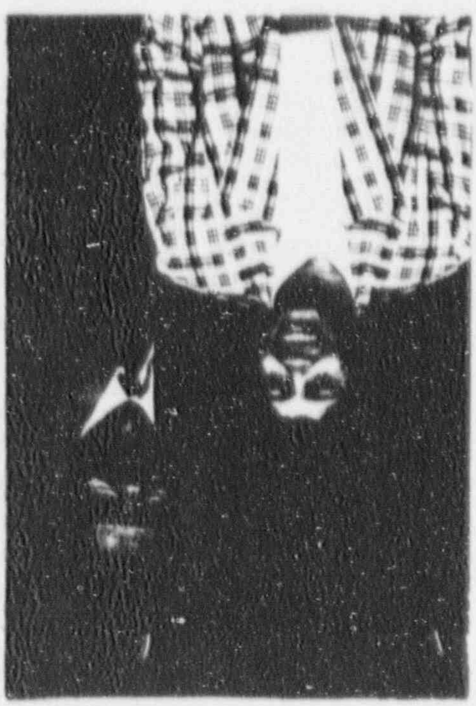
Reviewing the adequacy of program office and industry responses to operating experience and, based upon an assessment of the planned action and its state of implementation, developing an AEOD action plan.

Interfacing with other NRC groups involved with the collection, analysis, and dissemination of operating experience data and assuring the proper coordination and interfacing among NRC offices and between the NRC and outside organizations.

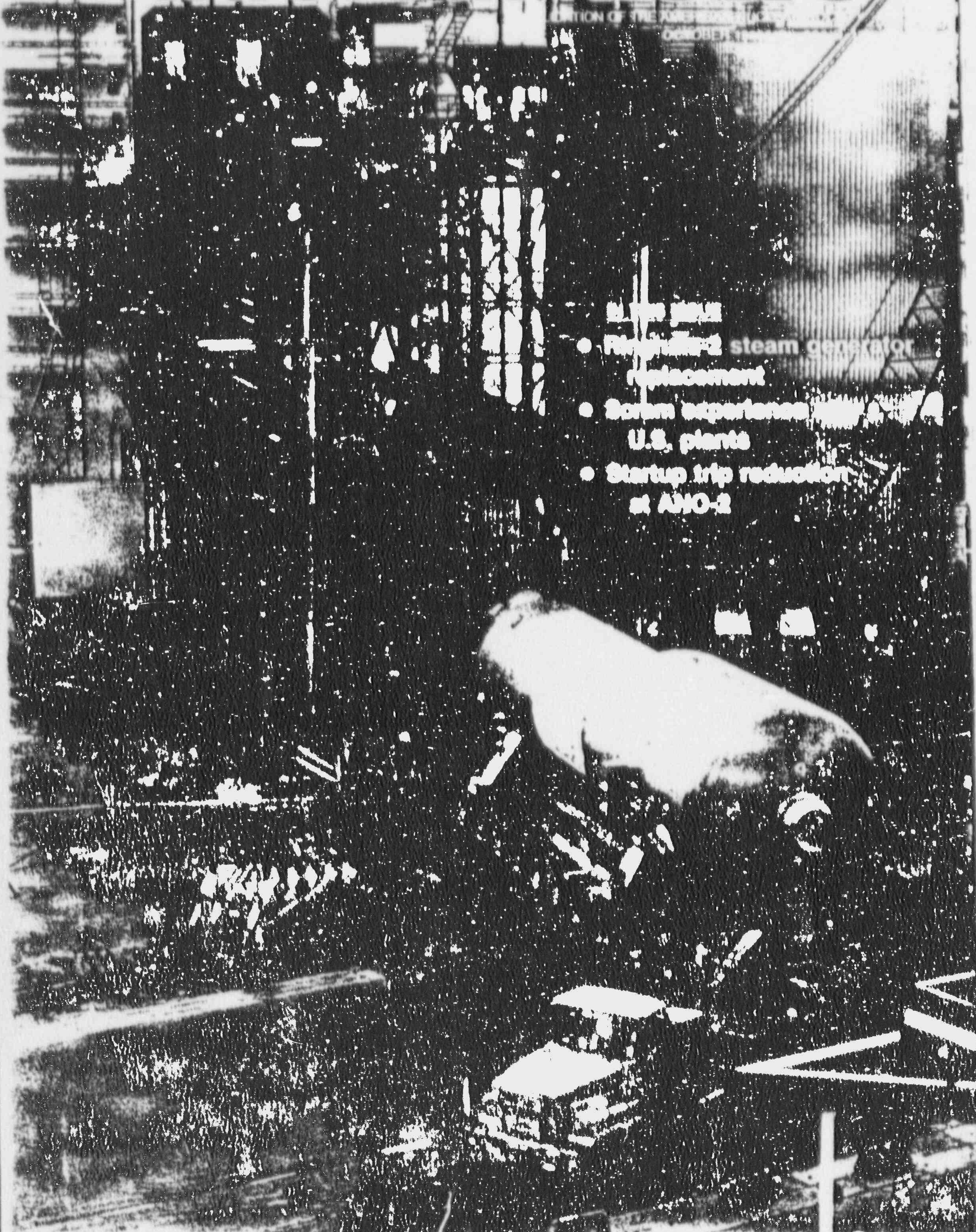
Assisting the office management in the preparation of presentations, special studies, reports and testimony as may be necessary.

Acting as office representative to, and at times leader, of working groups, to study office and agency problems related to operational data.

Developing work scope, milestones, reporting requirements for work to be performed by contractors.



nuclear news



Mature plants had significant scram reductions in 1988, according to the NRC's Office for Analysis and Evaluation of Operational Data (AEOD)

Scram experience at U.S. nuclear power plants

by Lawrence G. Bell

The U.S. nuclear power industry's unplanned scram rate has trended down in 1988 compared to 1987. In contrast with earlier years, most of this reduction was the result of improved performance at new plants (those with less than two years of licensed operation), with a number of these plants achieving a scram rate reduction from a relatively high value (e.g., greater than 3.0 scrams per 1000 critical hours).

A review of scram data for mature plants (those that have completed two years of licensed operation) revealed that these plants experienced significant scram reductions in 1988. Some of these plants operated during 1988 without any unplanned scrams. The results of a review of the most recent two quarters of available scram data (fourth quarter of 1988 and the first quarter of 1989) indicate that the industry scram rate may be leveling off. Scram reduction efforts by owners' groups and individual operating plants should be continued, with a goal of further improvements through generic activities.

The reduction in unplanned reactor scram rate from 1984 through 1988 represents a significant achievement by the U.S. nuclear industry. Plant-specific, owners' group, and industry-wide initiatives are to be commended.

Lawrence G. Bell is a nuclear engineer in the Trends and Patterns Section, Division of Safety Programs, Office for Analysis and Evaluation of Operational Data (AEOD), at the U.S. Nuclear Regulatory Commission. This article is adapted from a paper presented at the 1989 ANS Annual Meeting, held in Atlanta, Ga., in June.

NUREG-1275, Vol. 5, "Operating Experience Feedback Report—Progress in Scram Reduction," March 1989, provides an analysis of the causes and activities underlying these trends. It also discusses the individual nuclear steam supply system (NSSS) owners' group scram reduction programs.

The results

Our analysis, documented in NUREG-1275, Vol. 5, indicates that the overall industry improvement in unplanned scram experience from 1984 through 1987 was driven by the improved performance at mature plants. The 1988 analysis indicates that the learning curve of new plants (see NUREG-1275, Vol. 1) had a major effect on the continued lowering of the industry overall scram rate. We expect that future reduction will largely depend on further efforts at mature plants to implement scram reduction lessons.

The 1988 scram experience at mature

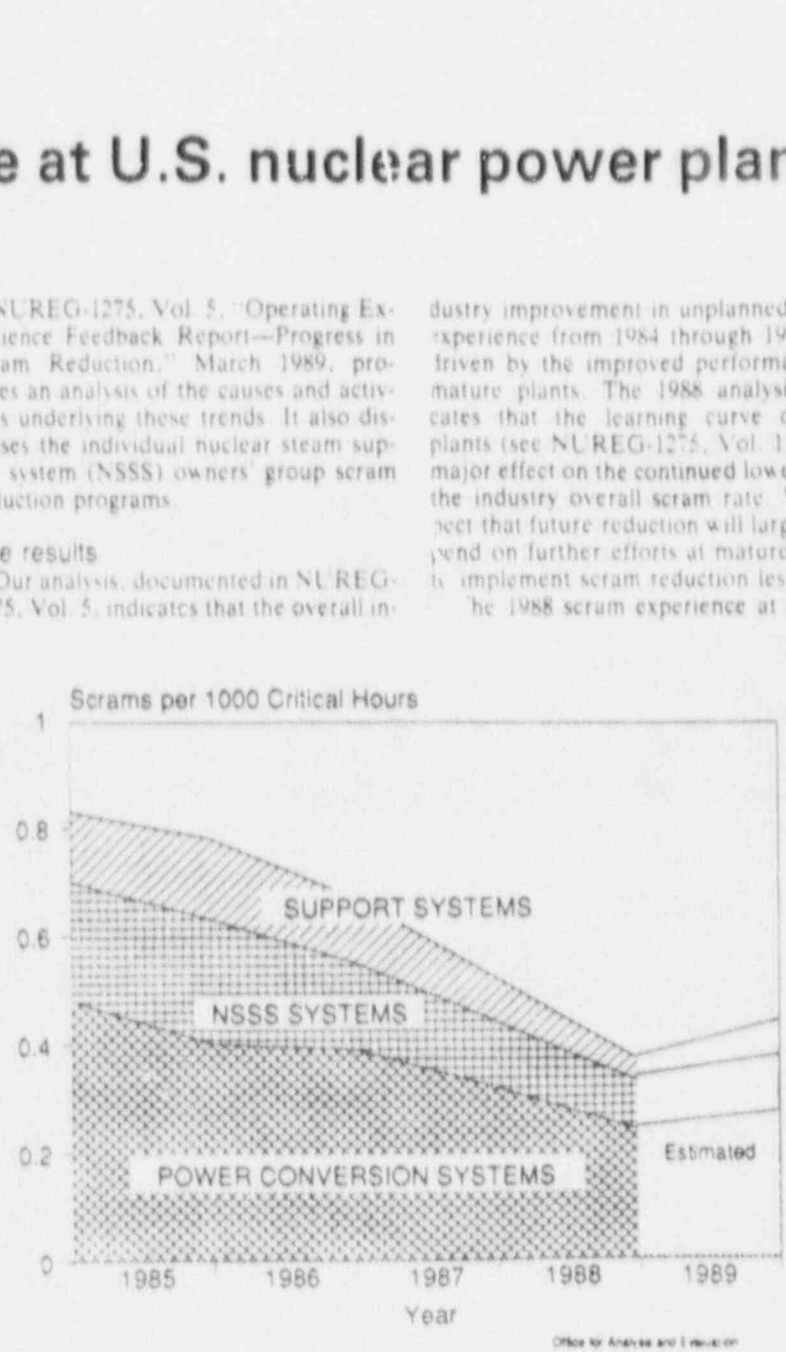


Fig. 1. U.S. industry scram improvement—mature plants (areas shown represent contribution by each system type).

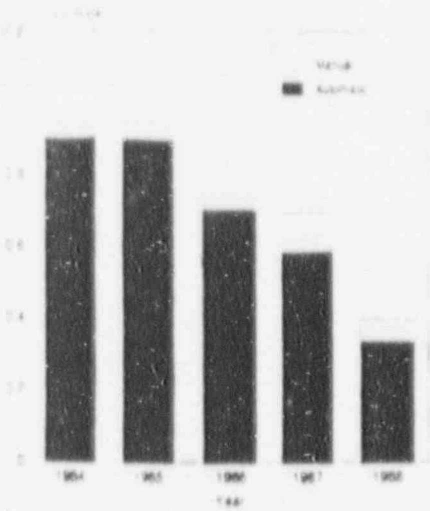


Fig. 2. U.S. LWR unplanned scram trend (scrams per 1000 critical hours)

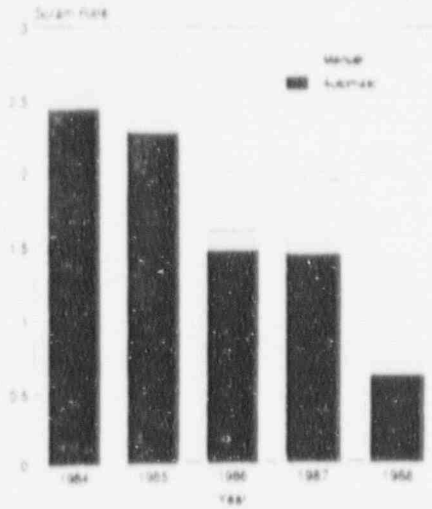


Fig. 3. New plant unplanned scram trend (scrams per 1000 critical hours)

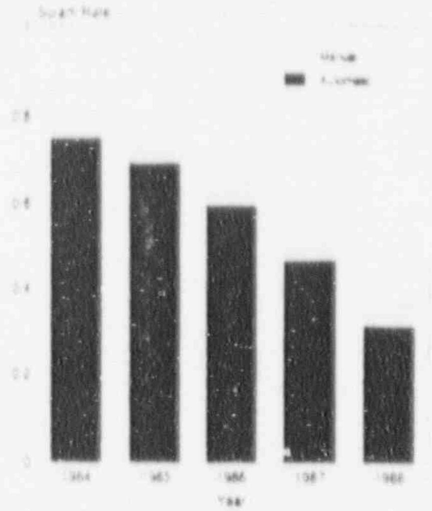


Fig. 4. Mature plant unplanned scram trend (scrams per 1000 critical hours)

plants revealed continued improvements in NSSS and balance-of-plant systems operation (see Fig. 1). Further improvement in this area presents a significant challenge to the industry. Initial 1989 estimates indicate a leveling in the mature plant scram rate at about 0.46 scrams per 1000 critical hours.

1989 estimates

A comparison of all quarterly scram rates for mature plants from 1984 to 1988 shows that in a given year, the first quarter rate tends to approximate the annual scram rate for that year. Table I presents the results of this comparison.

This correlation provides the capability to project that the rate for mature plants may level off or even increase slightly from 1988 to 1989. This is only a projection. Industry scram experience during the remainder of calendar 1989 could offset the rate observed during the first quarter, and yield an annual rate that is less than the 1988 rate. (Additional data recently received indicate that the scram rate for mature plants for the first half of 1989 is 0.45 per 1000 critical hours.)

1988 experience

The overall U.S. light-water reactor unplanned scram rate declined by 39 percent between 1987 and 1988 (from 0.71 to 0.43 scrams per 1000 critical hours). Figure 2 illustrates the trend at all U.S. LWRs for the five-year period starting with 1984, showing the contribution from both manual and automatic scrams.

In 1988, a total of 286 unplanned scrams occurred at U.S. LWRs, a net reduction of 144 scrams from the 430 in 1987. New plants experienced 99 fewer unplanned scrams than the comparably defined population in 1987. The reduction in this number at new plants can be attributed to the smaller number of plants that started up in 1988, and a large improvement at a number of plants that started up in 1987.

Several of these plants achieved a significant reduction in their scram rate from a relatively high value (e.g., greater than 3.0 scrams per 1000 critical hours). A large portion of the overall industry reduction in 1988 stemmed from this source. Figure 3 displays the scram rate trend for new plants over the last five years.

The number of unplanned scrams at mature plants in the population declined from 276 in 1987 to 231 in 1988—a net reduction of 45 scrams. Plants with NSSSs designed by Combustion Engineering, Inc. (C-E) and General Electric Company (GE) together accounted for most of the reduction from 1987 to 1988.

Figure 4 displays the general downward trend in the scram rate for mature plants. During 1988, the scram rate for all mature plants (plants that operated for all or part of 1988 as mature plants) was 0.39 scrams per 1000 critical hours.

The contribution from 10 plants that achieved maturity in 1988 kept the overall rate slightly elevated. During 1988, these plants had 31 scrams (14 percent of the total scram count for mature plants), with an average rate of 1.01 scrams per 1000 critical hours.

At various points in time, this declining rate can be traced to improvements in the performance of mature plants of a particular NSSS design. In 1985 and 1987, the improved performance of the main feedwater system at plants with Westinghouse-designed NSSSs drove the decline in the industry scram rate. In 1986, the reduction of reactor protection system (RPS)-initiated scrams at plants with GE-designed NSSSs was the most significant contributor to the decline. In 1988, the improved performance of the main feedwater and main turbine systems at plants with C-E-designed NSSSs combined with the overall improvement in performance of GE-designed NSSSs to yield a significant reduction in the unplanned scram rate.

TABLE I
COMPARISON OF FIRST QUARTER AND ANNUAL RATES FOR MATURE PLANTS (SCRAMS PER 1000 CRITICAL HOURS)

	1984	1985	1986	1987	1988	1989
First Quarter Rates	0.89	0.75	0.65	0.51	0.39	0.46
Annual Rates	0.83	0.79	0.68	0.52	0.39	0.46*

*Linear estimate

Westinghouse NSSS plants

In 1988, mature plants with Westinghouse Electric Corporation–designed NSSSs were responsible for 40 percent of all critical hours logged by the industry and 52 percent of all unplanned scrams. There was a small reduction in this group's rate (due primarily to an increase in the number of critical hours) from 1987 to 1988—from 0.49 to 0.45 scrams per 1000 critical hours.

In prior years, reductions in scrams initiated by the main feedwater system at these plants had been the leading source of scram reduction. In 1988, the main feedwater system contribution to the rate increased. The small decline in the overall 1988 rate for this group of mature plants can be attributed to a general reduction across all systems (with the notable exception of main feedwater) and an increase in the number of critical hours for these plants during that year. The rates for mature plants with Westinghouse-designed NSSSs as a function of initiating system are shown in Table II.

GE plants

Mature plants with GE-designed NSSSs experienced a significant reduction in unplanned scram rate from 1987 to 1988—down from 0.54 to 0.39 scrams per 1000 critical hours. This improvement in performance during 1988 largely can be attributed to five plants that oper-

TABLE II
INITIATING SYSTEMS AT MATURE PLANTS WITH WESTINGHOUSE NSSSs

	Scrams per 1 000 Critical Hours					
Systems	1984	1985	1986	1987	1988	1989*
Main Feedwater	0.34	0.18	0.21	0.10	0.14	0.19
Reactor Protection	0.16	0.14	0.13	0.09	0.10	0.04
Electrical Distribution	0.16	0.16	0.10	0.05	0.04	0.01
Main Turbine	0.11	0.05	0.12	0.10	0.06	0.09
Main Generator	0.08	0.05	0.02	0.04	0.02	0.03
Control Rod Drive	0.02	0.06	0.05	0.04	0.04	0.03
Other	0.02	0.04	0.05	<0.01	0.02	0.01
Reactor Coolant	0.06	0.03	<0.01	0.03	0.01	0.03
Main Steam	0.03	0.02	0.03	0.03	0.02	0.07
Condensate	0.04	0.04	0.02	0.01	0.01	0.03

*First quarter of 1989.

TABLE III
INITIATING SYSTEMS AT MATURE PLANTS WITH GE NSSSs

	Scrams per 1 000 Critical Hours					
Systems	1984	1985	1986	1987	1988	1989*
Main Feedwater	0.11	0.10	0.12	0.13	0.06	0.02
Main Turbine	0.13	0.13	0.09	0.08	0.08	0.09
RPS	0.12	0.17	0.07	0.07	0.06	0.07
Main Steam	0.13	0.07	0.06	0.05	0.02	0.09
Electric Distribution	0.05	0.10	0.07	0.05	0.02	0.09
Condensate	0.07	0.07	0.09	0.04	0.03	0.02
Other	0.05	0.03	0.05	0.03	0.02	0.02
Main Generator	<0.01	0.05	0.02	0.06	0.07	0.00
Reactor Recirculation	0.04	0.03	0.03	0.01	0.02	0.00
Control Rod Drive	0.02	0.04	0.03	0.01	0.01	0.02

*First quarter of 1989.

TABLE IV
INITIATING SYSTEMS AT MATURE PLANTS WITH C-E NSSSs

	Scrams per 1 000 Critical Hours					
Systems	1984	1985	1986	1987	1988	1989*
Main Feedwater	0.23	0.23	0.18	0.22	0.09	0.05
Main Turbine	0.07	0.09	0.08	0.11	0.00	0.05
Electrical Distribution	0.09	0.05	0.11	0.07	0.03	0.05
Control Rod Drive	0.13	0.15	0.03	0.02	0.00	0.00
Reactor Protection	0.13	0.05	0.08	0.05	0.03	0.14
Reactor Coolant	0.09	0.08	0.08	0.04	0.02	0.00
Main Generator	0.00	0.08	0.05	0.07	0.04	0.00
Main Steam	0.05	0.06	0.04	0.02	0.01	0.00
Condensate	0.00	0.02	0.07	0.04	0.02	0.00
Other	0.05	0.02	0.01	0.04	0.01	0.00

*First quarter of 1989.

TABLE V
INITIATING SYSTEMS AT MATURE PLANTS WITH B&W NSSSs

	Scrams per 1 000 Critical Hours					
Systems	1984	1985	1986	1987	1988	1989*
Main Feedwater	0.19	0.42	0.14	0.14	0.14	0.08
Main Turbine	0.04	0.17	0.08	0.02	0.04	0.17
Reactor Protection	0.08	0.07	0.05	0.04	0.00	0.08
Electrical Distribution	0.04	0.12	0.05	0.04	0.02	0.17
Condensate	0.02	0.00	0.08	0.02	0.02	0.00
Main Generator	0.02	0.02	0.02	0.02	0.00	0.08
Control Rod Drive	0.00	0.02	0.00	0.02	0.02	0.08
Main Steam	0.02	0.02	0.00	0.02	0.00	0.00
Other	0.00	0.00	0.00	0.02	0.00	0.08

*First quarter of 1989

ated in both 1987 and 1988 and experienced no scrams in 1988. This resulted in a net reduction of 20 scrams.

A total of 12 of the 25 plants in this group that operated in 1988 experienced a reduction in scram rate. During this year, the feedwater system contribution to the scram rate at plants with GE-designed NSSSs experienced the first significant reduction since 1984. The main turbine system and RPS contributions to the overall scram rate have remained essentially constant since 1986. The decrease in the overall scram rate in 1988 at this group of plants resulted from a large reduction in the number of scrams caused by equipment failures.

The scram rates for mature plants with GE-designed NSSSs as a function of initiating system are shown in Table III.

C-E plants

Mature plants with C-E-designed NSSSs achieved a 54 percent reduction (a reduction of 30 unplanned scrams) in the number of unplanned scrams from 1987 to 1988. This corresponds to a reduction in the rate from 0.67 to 0.28 scrams per 1000 critical hours. Most of this reduction can be attributed to decreases in scrams initiated by secondary side systems—primarily the main feedwater, main turbine, and main generator systems.

The main feedwater system's contribution to the overall scram rate for this group of plants declined by about 60 percent in 1988—from an essentially constant rate of 0.22 scrams per 1000 critical hours to 0.09 scrams per 1000 critical hours. The contribution from main turbine system-initiated scrams averaged 0.09 scrams per 1000 critical hours from 1985 through 1987, and then dropped to zero in 1988. The reductions in the scram rates for plants with C-E-designed NSSSs, especially those for 1988, can be attributed to a reduction in the number of scrams due to equipment failures.

The rates for mature plants with C-E-designed NSSSs as a function of initiating system are shown in Table IV.

B&W plants

In 1988, 14 unplanned scrams occurred at mature plants with Babcock & Wilcox Company-designed NSSSs. Nine of these were initiated by the main feedwater system. In 1988, the main feedwater system continued to be the most significant scram-initiating system at this group of plants. The main feedwater system's contribution to the rate has declined from a maximum of 0.42 scrams per 1000 critical hours in 1985 to an approximately constant rate of 0.14 scrams per 1000 critical hours since 1986. The overall rate for this group of plants declined from 0.33 to 0.27 scrams per 1000 critical hours from 1987 to 1988.

The rates for mature plants with B&W-designed NSSSs as a function of initiating system are shown in Table V.

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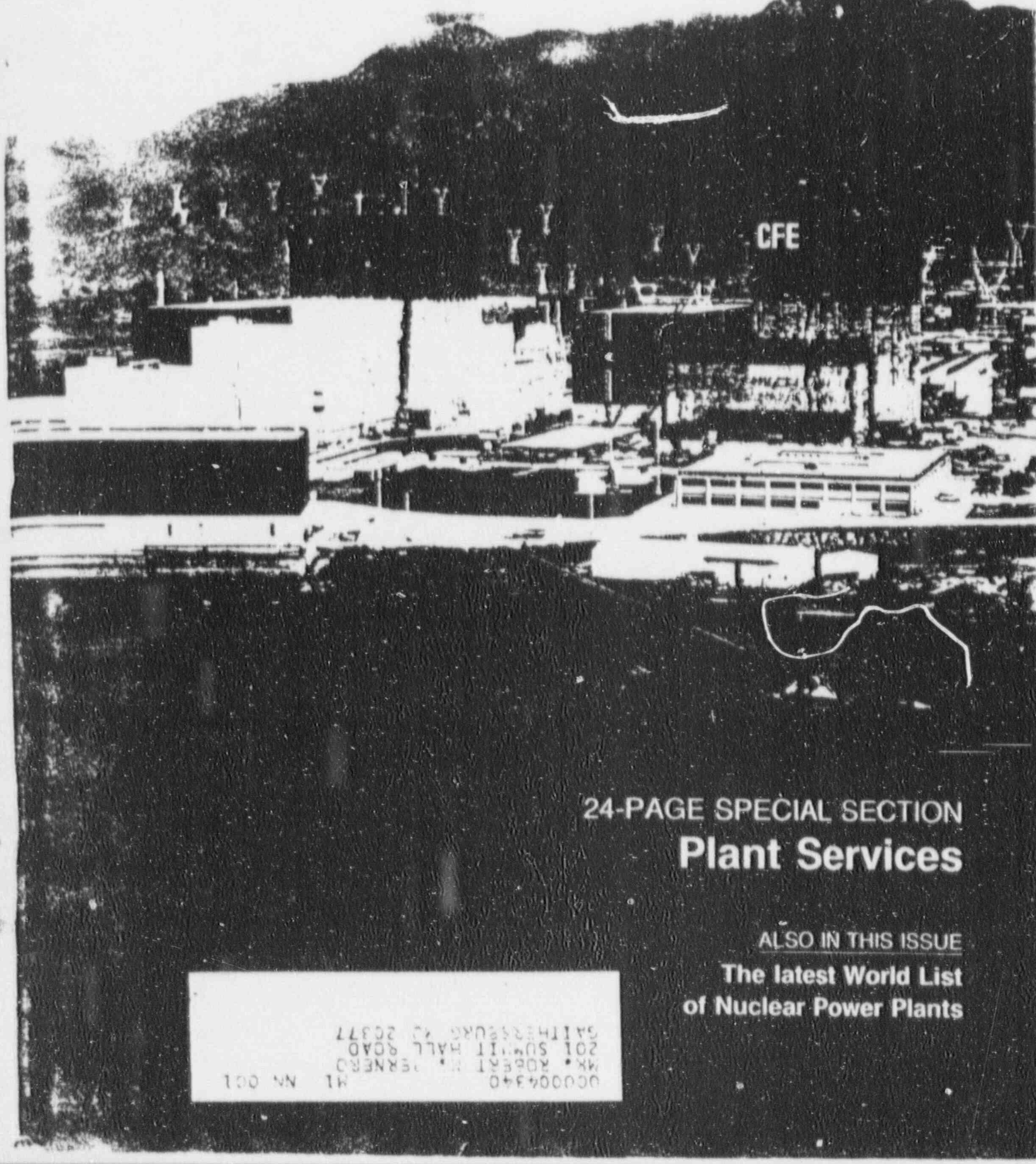
A PUBLICATION OF THE AMERICAN NUCLEAR SOCIETY

AUGUST 1989/VOL. 32/NO. 10



24-PAGE SPECIAL SECTION

Plant Services

ALSO IN THIS ISSUE

The latest World List of Nuclear Power Plants


O'Connor


Bell

months: the trip frequency has gone up a little bit," O'Connor said. "You're going to have peaks and valleys when you have only eight plants—any plant that trips more than once or twice really throws us out of whack. . . . But we still think that—overall—our program is on the right track, and we're [achieving] a lot of success."

Lawrence G. Bell, of the NRC's Office for Analysis and Evaluation of Operational Data (AEOD), said that "the industry should be commended on scram reductions achieved to date."

Experience has shown that the industry scram rate in the first quarter of a year tends to approximate the scram rate for an entire year, Bell noted. AEOD analysis of first quarter 1989 data indicates that "the industry's unplanned scram rate may be leveling off or possibly increasing, and that future reductions will be more difficult to achieve," he declared. "All the easy fixes have been taken care of."

The AEOD analyses of unplanned scram data have been published periodically in volumes of the NRC's NUREG-1275. AEOD defines the unplanned trips it gathers data on as "an actuation of the reactor protection system, whether au[illegible] rod motion." The conclusions that Bell discussed were based on data from January 1984 through March 31, 1989.

Scram reduction in 1984-87 was "primarily the result of specific improvements of systems at mature plants," Bell said. The AEOD defines "mature plants" as those that have completed two years of licensed operation; "new plants" have less than two years of operation. "In 1988, scram rates continued down, but the primary cause was plants that had started up in 1987"—new plants.

In 1988, there were 286 unplanned scrams at U.S. light-water reactors—144 fewer than in 1987. And the overall unplanned scram rate "declined by 39 percent between 198[illegible] and 1988," Bell said, from 0.71 to 0.43 scrams per 1000 critical hours.

In 1985 and 1986, improved performance of the main feedwater system at Westinghouse plants was the most significant cause of the decrease in the industry scram rate, Bell said. In 1986, the main reason for the reduction was fewer reactor protection system initiated scrams at GE units. "In 1988, the improved performance of the main feedwater and main turbine systems at [C-E plants], combined with the overall improvement in performance of GE [plants] to yield a significant reduction in the unplanned scram rate."—*Gregg M. Taylor*

NONDESTRUCTIVE TESTING

UT inspection of coolant pump welds at Tihange-1

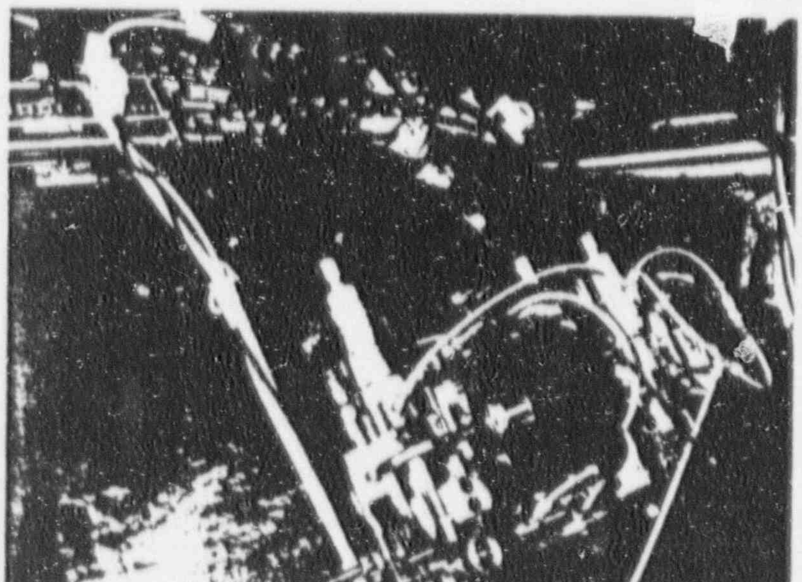
The first field application of a new ultrasonic technique for the volumetric examination of austenitic stainless steel main coolant pump bowl welds was achieved last February by Vinçotte, the nuclear inspection agency of Belgium, during a refueling outage at Tihange-1.

SEMO, the joint venture of Electricité de France and Belgian utilities that operates the unit, an 870-MWe pressurized water reactor, funded Vinçotte's development of the ultrasonic system.

Using the system, the total wall thickness of a main coolant pump was insonified, from the outer surface, under five orientations: one straight beam, and four angle beams (parallel and perpendicular to the weld axis, each in both directions). The metellurgical structure of the pump body, made from cast austenitic material, required the use of low-frequency compression wave ultrasonic transducers. Contact twin-crystal search units were used manually to inspect the outer third of the wall, while large-diameter focused beam probes were used with a mechanized scanner to examine down to a depth of 200 mm.

Because of the size of the probes, the scanning extent was limited by the pump bowl geometry. Typically, the outlet nozzle and the supporting feet prevent scanning about 30 percent of the full weldment volume.

Total inspection duration was two weeks, including testing equipment installation and removal. With this technique, no access to the inner surface of the coolant pump is required—it is not necessary to remove the rotor and the water guide. Also, the pump need not be drained. The only requisites are the dismantling of the heat insulation and a 150-mm clearance around the pump outer surface.



At Tihange-1 in Belgium last February, the Vinçotte agency performed the first use of an ultrasonic technique for weld inspection of an austenitic stainless steel main coolant pump. Photo at left shows the mechanized inspection of the pump bowl upper weld, using a focused beam ultrasonic transducer. Photo at right shows Vinçotte inspectors in the controlled area of Tihange-1, operating the equipment's data acquisition and processing system.

NUREG-1275
Vol. 5
Addendum

Operating Experience Feedback Report – Progress in Scram Reduction

Commercial Power Reactors

Manuscript Completed: May 1989
Date Published: August 1989

L. G. Bell

Office for Analysis and Evaluation of Operational Data
U.S. Nuclear Regulatory Commission
Washington, DC 20555

ABSTRACT

The U.S. Nuclear Regulatory Commission's (NRC) Office for Analysis and Evaluation of Operational Data (AEOD) evaluated U.S. Light Water Reactor (LWR) unplanned reactor scram experience in light of ongoing industry scram reduction programs in NUREG-1275, Vol. 5. The purpose of this work which covered the years 1984 through 1987 was to provide feedback to industry, the NRC staff, and the public regarding the trends in unplanned scrams at U.S. commercial power reactors. A primary objective of AEOD's analysis was to determine the major sources of unplanned scrams for the most recent data and to determine whether the scram reduction programs supported by various nuclear steam supply system (NSSS) owners groups were addressing the proper areas for future scram reduction. This addendum updates that work through March 1989.

Nuclear Plants Reduce Scram Rate, NRC Says

ATLANTA—The U.S. nuclear power industry is getting its operating act together by greatly reducing the number of unplanned scrams at its reactors, a Nuclear Regulatory Commission engineer said on Tuesday. Among reactor types, Combustion Engineering and General Electric stations have enjoyed the greatest success in reducing their frequency of scrams over the past year. Mature Westinghouse reactors accounted for the most scrams, the official said.

BY BILL RANKIN

Nuclear reactor scrams, or trips, have long been anathema to the utility industry. They put increased stress on plant equipment, challenge safety systems and reduce plant availability. But over the past few years, the nuclear industry "has made significant progress in scram reduction," Lawrence Bell, an NRC nuclear engineer, told the American Nuclear Society's annual meeting here. The overall scram rate for mature plants, he said, declined from 0.83 to 0.39 scrams per 1,000 critical hours from January 1984 to December of last year.

In the past year alone, the overall U.S. light water reactor unplanned scram rate has been cut by 39 percent, Bell said. Some plants, for example, operated during 1988 with no unplanned scrams. All told, last year there were 286 unplanned scrams at U.S. light water reactors. This represents a net industry reduction of 144 scrams from the 430 that occurred in 1987, he added.

Plants with nuclear steam supply systems designed by Combustion Engineering and General Electric accounted for most of the reduction in reactor trips from 1987 to 1988, Bell said.

Westinghouse-designed reactors accounted for the lion's share of last year's unplanned scrams. In 1988, Westinghouse reactors with two years of operating experience were responsible for 40 percent of all critical hours logged by the industry and 52 percent of all unplanned scrams, he said.

Turbine electrohydraulic control (EHC) subsystem problems continued to be the primary cause of industry scrams, Bell said: "Slightly more than half of all equipment failures for the main turbine that resulted in an unplanned scram came from within the EHC sub-system." In 1988, only one of the three nuclear reactor designs with main turbine system problems reduced its turbine-initiated scram rate to zero and first quarter 1989 data reveal a resumption of turbine-initiated scrams.

In previous years, reductions in scrams initiated by the main feedwater system at Westinghouse plants were the leading cause of improvement. But in 1988, the main feedwater system's contribution to the scram rate increased, Bell said. Nonetheless, Westinghouse's scram rate declined slightly last year from 0.49 trips per 1,000 critical hours in 1987 to 0.45 trips in 1988, he said.

The small decrease in the overall 1988 rate can be attributed "to a general reduction across all systems (with the notable exception of main feedwater) and an increase in the number of critical hours for these plans during that year," Bell said.

Mature General Electric nuclear plants enjoyed a significant reduction in unplanned scrams from 0.54 per 1,000 critical hours in 1987 to only 0.39 in 1988. The improvement in performance last year is largely attributable to five plants that collectively suffered 20 scrams in 1987 but none at all last year, the NRC official reported. The five plants were: Dresden 2, Fitzpatrick, LaSalle 1, Oyster Creek, Susquehanna 2.

"During this year, the feedwater system contribution to the scram rate at plants with GE-designed nuclear steam supply systems experienced the first significant reduction since 1984," Bell said. The main turbine and reactor protection system contributions to GE scram rates have remained relatively constant since 1986. What has been greatly reduced in the last year is the number of scrams caused by equipment failures, he noted.

Arkansas One and Zion Top The List Of The Reformed

ATLANTA—Of all the success stories regarding nuclear reactor scram reductions over the past few years, perhaps none is more favorable than that of the Arkansas Nuclear One plant and the Zion generating station in Illinois, plant managers told the American Nuclear Society's annual meeting here.

Unit 2 of the Arkansas Nuclear One plant is a 2,815-megawatt Combustion Engineering plant located on the Arkansas River in Russellville. Since the beginning of commercial operation in early 1980, Unit 2 has reduced its scrams from a high of 28 in 1981 to just two last year, said Curtis Taylor of Arkansas Power & Light Co.

This feat was accomplished by limiting the attrition of the plant's operating personnel (by raising pay), upgrading operating and maintenance procedures [illegible] at reduced human error, modifying the plant's low-power feedwater control system and control element assembly control system and greatly improving both operator and maintenance training, Taylor said.

The Zion plant, which consists of two Westinghouse four-loop pressurized water reactors, suffered 86 reactor trips from the time it entered commercial operation in mid-1973 until 1984, Commonwealth Edison Co. plant superintendent William Kurth told the meeting. But during 1987 there were no reactor trips at Zion. In all, Unit 1 went one year and nine months and Unit 2 more than two years without a reactor trip, he said.

Some of the major modifications which were made to Zion in the first five years of operation were the first of their kind and are now standard design, Kurth said. Perhaps most important was the main feedwater regulating [illegible] valves were added to [illegible] startup. "This changed [illegible] ups from something which was a hit and miss process to something that was achievable," he said. Also, "some maintenance is performed prior to every start-up even if the previous start-up was the day before."

—BILL RANKIN

NUREG-1275
Vol. 5

Operating Experience Feedback Report - Progress in Scram Reduction

Commercial Power Reactors

Manuscript Completed: June 1988
Date Published: March 1989

L.G. Bell, P.D. O'Reilly

Office for Analysis and Evaluation of Operational Data
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ABSTRACT

This report documents the results of a trends and patterns analysis of unplanned reactor scrams at commercial U.S. nuclear power reactors from January 1, 1984 to January 1, 1988. Major objectives of this report prepared by the Nuclear Regulatory Commission's (NRC's) Office for Analysis and Evaluation of Operational Data (AEOD) are to: (1) provide feedback of operational experience regarding reactor scram trends in support of the Commission's Strategic Goals, (2) examine the causes of unplanned scrams, and (3) examine the relationship between the causes of unplanned scrams and industry initiatives undertaken to reduce the frequency of unplanned scrams, especially with a view to the potential for future scram rate reduction.

Connection
Resource
BANK

August 25, 1989

Mr. Lawrence Bell
U.S. Nuclear Regulatory Commission
MNBB, Room 4215
Washington, D.C. 20555

Dear Mr. Bell,

As the summer slips by and we begin to focus on the new school year, I want to personally thank you for your contribution to the success of the Resource Bank. To date the Bank has served over 52,000 students in the Montgomery County school system. Each one of these students has had direct contact with a volunteer from the community.

I am proud to report the large-scale involvement by so many pupils. Yet what is most gratifying is the feedback I have received concerning the number of students whose lives you have touched, stimulating their imagination and inspiring them to explore new horizons.

By taking time from your busy schedule, you have shown our students that they are important and that you value them. You help them understand that work can be challenging, exciting, and also fun. Could we ask for more sincere and dedicated role models?

I salute you, the very best resource we have to enrich the educational environment for all children. It is with great pleasure and much appreciation that I thank you for the countless hours you have given students and teachers. I hope you have found your experience gratifying and that you will choose to continue in the future.

Enclosed you will find two new publications, one for teachers and one for speakers, that we will be circulating in the fall. We look forward to working with you again this school year.

Sincerely yours,

Judith Messitte

Judith Messitte
Coordinator
Connection Resource Bank

JM:nb

Enclosures

Montgomery County Public Schools
651 Great Falls Road, Room 11
Rockville, Maryland 20850
(301) 279-3929

Connection Resource BANK

Certificate of Appreciation

Awarded to

Lawrence Bell

for generous and significant contributions to the students and teachers of Montgomery County Public Schools

Montgomery County Public Schools

Superintendent of Schools

Coordinator, Connection Resource Bank

United States Nuclear Regulatory Commission

Certificate of Appreciation

awarded to

Lawrence G. Bell

In recognition of significant contributions to the Nuclear Regulatory Commission's schools volunteer assistance program.

October 2, 1990

Kenneth M. Carr
Chairman

United States Nuclear Regulatory Commission

Certificate of Appreciation

awarded to

Lawrence G. Bell

In recognition of significant contributions to the Nuclear Regulatory Commission's schools volunteer assistance program.

April 6, 1989
Date

Chairman

UNITED STATES NUCLEAR REGULATORY COMMISSION

United States Nuclear Regulatory Commission

Special Achievement Certificate

awarded to

Lawrence G. Bell

In recognition of special achievement which resulted in a significant contribution to the work of the Commission

Jan 7, 1987
Date

[signature]

U. S. NUCLEAR REGULATORY COMMISSION

CITATION

THIS AWARD IS PRESENTED TO LAWRENCE BELL IN RECOGNITION OF HIS VALUABLE CONTRIBUTION HE MADE TO THE TMI-2 CLEAN UP PROGRAM IN THE AREA OF WASTE MANAGEMENT AND PARTICULARLY WITH REGARD TO EFFLUENT FILTRATION AND EFFLUENT MONITORING SYSTEMS. HE WAS ONE OF THE PRINCIPAL AUTHORS OF NUREG'S-0591 AND 0662. HIS EFFORTS IN THE TMI-2 CLEAN UP PROGRAM REFLECT HIGHLY ON HIS HIS DEDICATION TO THE COMPLETION OF A DIFFICULT TASK AND ARE A CREDIT TO THE NRC.

United States Nuclear Regulatory Commission

Special Achievement Certificate

awarded to

Lawrence Bell

In recognition of special achievement which resulted in a significant contribution to the work of the Commission

11/14/80
Date

John T. Collins

Rcd by B Clanci on 11/13/

The Council of Engineering Deans of the Historically Black Colleges and Universities

November 1, 1990

Dear Friend:

Now is the absolute best time to nominate individuals for the Fifth Annual Black Engineer of the Year Awards Conference. This conference has built a strong national reputation as a quality program serving as encouragement to young people in their pursuit of technically-related professional careers.

We feel strongly that this year's program will have the greatest impact yet! WJZ-TV, part of the media giant Group W Broadcasting, will produce, televise, and syndicate the 1991 Black Engineer of the Year Awards program. At no other time in history has a major commercial television station stood so solidly behind this type of programming.

Since we are expecting record numbers of nominations, now is the time to select your candidates. The earlier we have your nominations, the more time we will have to review the package. You will also want to determine your participation level now. Preferred job fair locations will be at a premium. Banquet seating, too, is expected to go fast. You can lock in your preference by returning your sponsorship form today!

This is sure to be 1991's most important event for engineers. I urge you to participate and showcase the contributions of those outstanding Americans.

Sincerely,

Eugene M. DeLoatch

Dr. Eugene DeLoatch
Dean of Engineering, Morgan State University

729 E. Pratt Street • Suite 504 Baltimore, MD • 21202 (301) 244-7101

1991 Black Engineer of the Year Awards

Recognizing and Rewarding America's Successful Black Engineers, Scientists, and Technology Leaders.

BLACK ENGINEER OF THE YEAR AWARD CLASSIFICATIONS

Black Engineer of the Year Award: The Black Engineer of the Year is selected from the top nominations submitted in all the categories.

Outstanding Technical Contribution: A person with or without an engineering degree who has designed, developed, managed, or assisted in the development of a product service, system, or intellectual property that is a substantial achievement in his field.

Professional Achievement: A person with or without an engineering degree who has been a working professional for more than five years and has made significant achievements in his field.

Affirmative Action: A person who has successfully demonstrated that his or hers efforts to promote affirmative action has made a difference in his organization's approach to Black advancement in education, job promotion, business development, and community activities.

Education, College-level: A member of academia on the college level who has demonstrated a strong commitment to preserving superior engineering, scientific, and technical education programs.

Entrepreneur: A person who owns 50 percent or more of a thriving minority-owned engineering or technical company, with strong financial growth and more than ten employees.

Community Service: A person who has demonstrated leadership in the Black engineering community through volunteer work, contributions, and other activities that are not included in his or hers job.

Student Leadership: An undergraduate or graduate student who has demonstrated leadership in engineering through personal accomplishments and developments as well as promoted science, technology, and Black self-reliance.

Most Promising Engineer: This person must be an engineer with less than five years working experience who demonstrates tremendous potential for future engineering contributions.

PREPARING THE NOMINATION JACKET

All nominations are reviewed by a selection committee drawn from all parts of the minority engineering and science community nationwide. The selection committee is looking for role models, people who can excite both young people and professionals about science and engineering. To assure that your candidate's nomination is as competitive as possible, please submit the following information:

Nominee Profile

Please complete the attached Nomination Application.

Cover Letter

The cover letter should clearly state why your candidate merits recognition in the award classification specified. Include personal history information explaining the candidate's background, struggles, and achievements.

Job Description

Explain the candidate's work experience and why it is important. Include information that differentiates your candidate from the norm.

Curriculum Vitae and Resume

This is necessary because they show the selection committee your candidate's career path.

Letters of Recommendation

Please submit at least one recommendation from an individual familiar with your candidate. Recommendations from a high ranking official, a top-level manager or officer of a company, or a noted authority in the engineering community are suggested.

Papers and Articles

Submit any articles or papers that have been written by the nominee if his research supports his or hers candidacy. Enclose a brief summary highlighting the main points of each article submitted.

Publicity Clippings

Include any newspaper, magazine, or other clippings about your candidate.

All entries receive a certificate of recognition ready for framing.

Winners will be notified by mail upon the completion of judging. The winners will be honored at the Black Engineer of the Year Awards Banquet on Saturday, March 2, 1991 at the Baltimore Convention Center in Baltimore, Md.

Winners will be profiled in the special conference edition of US Black Engineer Magazine.

DEADLINE: Nominations must be postmarked by December 1, 1990.

Black Engineer of the Year
NOMINATION APPLICATION

Recognizing and rewarding America's successful Black engineers, scientists, and technology leaders.

BLACK ENGINEER OF THE YEAR AWARD CLASSIFICATIONS

Black Engineer of the Year * Outstanding Technical Contribution * Affirmative Action * Promotion of Higher Education * Entrepreneur * Community Service * Student Leadership * Most Promising Engineer (less than 5 years professional experience. * Professional Achievement (more than 5 years professional experience)

BLACK ENGINEER OF THE YEAR NOMINEE PROFILE

To The Selection Committee, I, ______________________

hereby nominate ______________________

for the award classification of ______________________

> I affirm that the statements in this nomination application are correct to the best of my knowledge and I understand that all decisions of the Selection Committee are final.

I am personally acquainted with the Nominee. I hereby endorse his/her nomination. Sponsor (signature & address):

____

____

____

Nominee's Name ______________________ Home Phone ( ) ______________________

Home Address ______________________

City, State, Zip ______________________

Birth Date __________ Marital Status __________ Spouse's Name ______________________

Last College Attended ______________________ Degree ______________________

Engineering Field ______________________ Registered P.E.? Yes ______ No ______

Company Name ______________________ Title ______________________

Business Address ______________________

City, State, Zip ______________________ Bus. Phone ( ) ______________________

Principal Job Function ______________________ Years of Professional Experience __________

Organizations to which Nominee belongs ______________________

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Why should Nominee be considered for this award? Please include a resume and curriculum vitae, organization personnel chart, papers and articles by and about the nominee, a full job description, letters of recommendation, a recent color photograph, and other supporting materials.

____

____

____

PLEASE FILL OUT THIS FORM AND RETURN BY DECEMBER 1 TO:
Black Engineer of the Year Selection Committee
729 East Pratt Street • Suite 504 • Baltimore, Maryland 21202