



PERFORMANCE INDICATORS

Statistics show U.S. nuclear plants always improving

IN WHAT HAS become standard practice for the nuclear power industry in the United States, safety levels and electricity production continued to exceed industry goals for another year. According to plant performance statistics for year 2000 that were released in March by the Institute of Nuclear Power Operations (INPO), the nation's nuclear fleet continued to operate safely and reliably, while generating a record 755 billion kilowatt-hours of electricity.

A program of 12 performance indicators tracks different categories of plant performance. In 2000, indicators for the 10 categories that had established goals showed the

Safety levels and electricity production continued to exceed industry goals, according to INPO's year 2000 statistics.

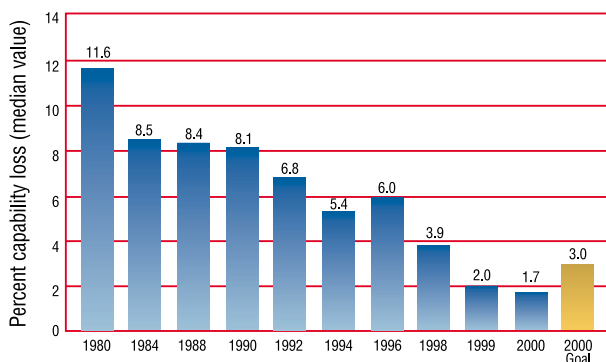
industry doing better than or equaling those goals, according to INPO.

Performance indicators were created by INPO (with input from the industry and others) in the early 1980s to provide an annual measure of nuclear plant achievements. In 1989, the World Association of Nuclear Operators (WANO) adopted the program for

measuring performance of plants around the world. Today, INPO collects U.S. industry data, which is then shared through the WANO with INPO members and participants worldwide.

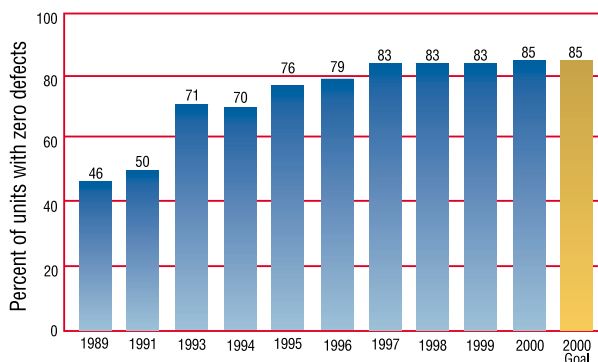
"The strong 2000 WANO performance indicator results for U.S. plants cap an outstanding decade of performance for the in-

UNPLANNED CAPABILITY LOSS FACTOR



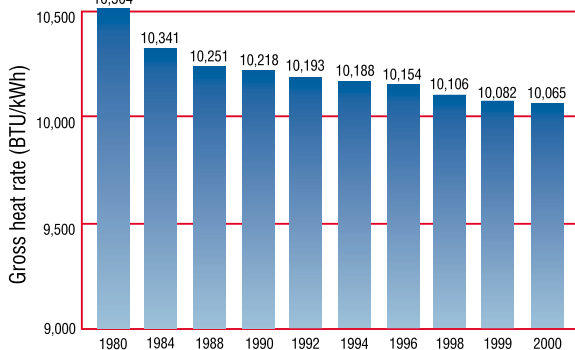
Unplanned capability loss factor is the percentage of maximum energy generation that a plant is not capable of supplying to the electrical grid because of unplanned energy losses, such as unplanned shutdowns or outage extensions. A low value indicates important plant equipment is well maintained and reliably operated and there are few outage extensions. Since 1980, the industry has made steady progress in controlling unplanned shutdowns and outage length. The 2000 value indicates continued improvement.

FUEL RELIABILITY



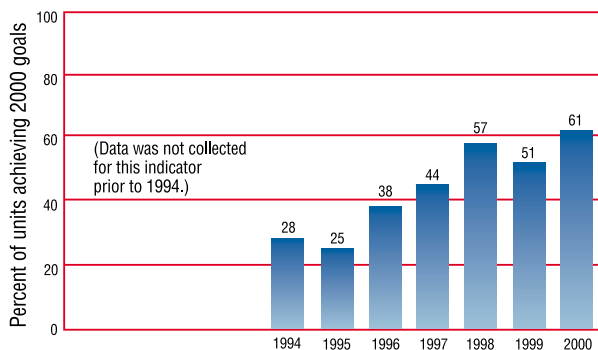
The industry uses sophisticated monitoring techniques to detect the smallest defects in the metal cladding that surrounds fuel. The fuel reliability indicator monitors progress in preventing these defects. Although minor defects pose no significant safety concern and are difficult to eliminate entirely, the long-term industry goal is that units should strive to operate with zero fuel cladding defects. The graph shows the percentage of units with no cladding defects apparent during steady-state operation. The percentage has improved significantly since 1989 and meets the 2000 goal for the first time.

THERMAL PERFORMANCE



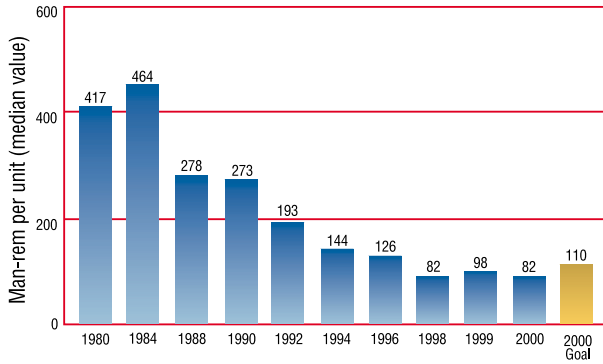
Thermal performance monitors how efficiently a plant converts thermal energy into electrical output. A low gross heat rate indicates high efficiency. The graph shows an improving trend in industry gross heat rate. Plants also measure thermal performance by comparing the best achievable heat rate to the heat rate actually attained. By this measure, the actual 2000 industry median value of 99.8 percent continues to achieve the industry goal.

CHEMISTRY PERFORMANCE

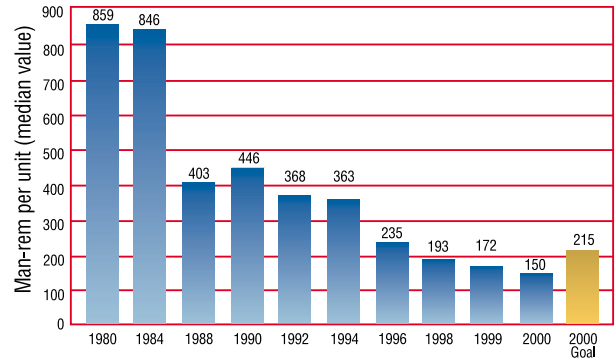


The chemistry performance indicator monitors operational chemistry control effectiveness as measured by the concentration of important impurities and corrosion products. In boiling water reactors, the indicator focus is on reactor coolant chemistry control. In pressurized water reactors, the focus is on secondary system chemistry. This graph shows the percentage of units achieving specific 2000 goals that vary according to plant design.

COLLECTIVE RADIATION EXPOSURE – PWR

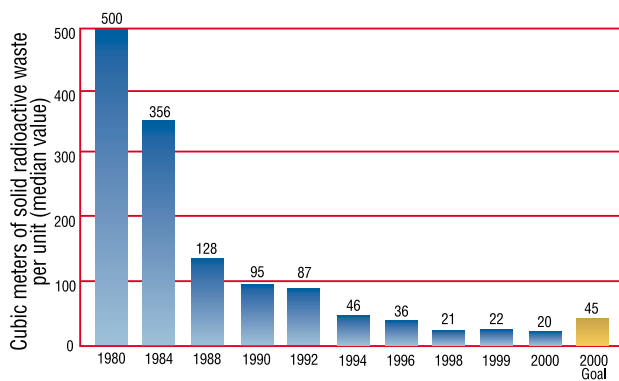


COLLECTIVE RADIATION EXPOSURE – BWR

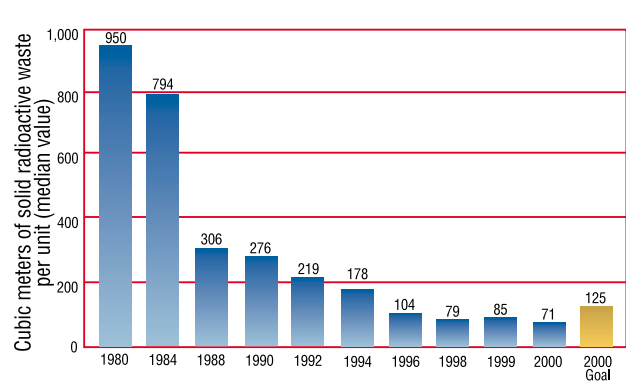


The collective radiation exposure indicator monitors the effectiveness of personnel radiation exposure controls for pressurized water reactors and boiling water reactors. Low exposure indicates strong management attention to radiological protection. Worker exposure has been reduced significantly over the past decade. The 2000 values continue to be better than the 2000 goals.

VOLUME OF SOLID RADIOACTIVE WASTE – PWR

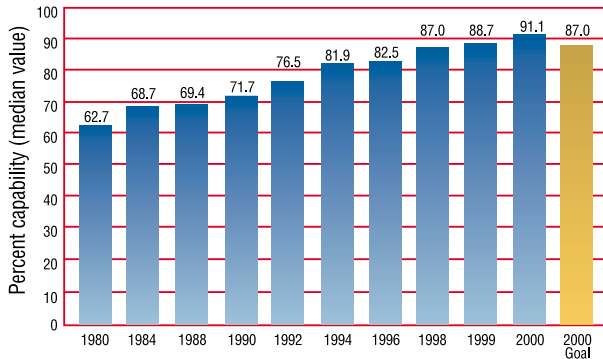


VOLUME OF SOLID RADIOACTIVE WASTE – BWR

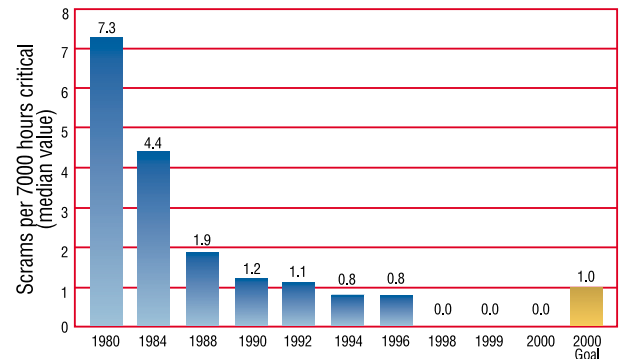


This indicator monitors the volume of solid radioactive waste processed per unit for pressurized water reactors and boiling water reactors. Minimizing radioactive waste reduces storage, transportation and disposal needs, lessening the environmental impact of nuclear power. The 2000 values continue to be better than the 2000 goals.

UNIT CAPABILITY FACTOR



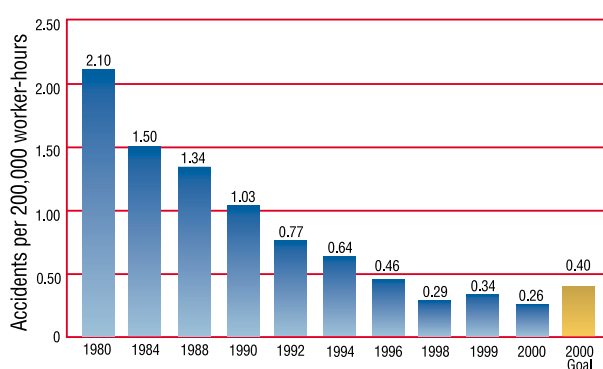
UNPLANNED AUTOMATIC SCRAMS



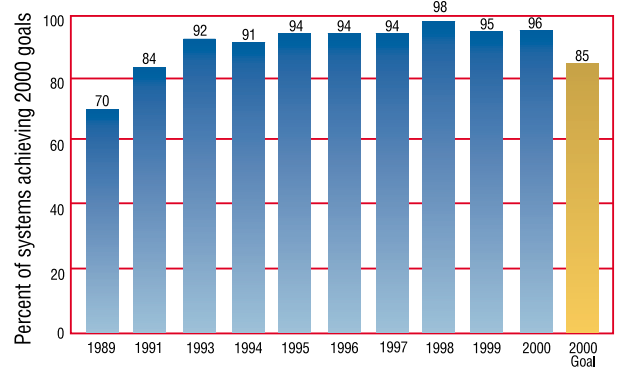
Unit capability factor is the percentage of maximum energy generation that a plant is capable of supplying to the electrical grid, limited only by factors within the control of plant management. A high unit capability factor indicates effective plant programs and practices to minimize unplanned energy losses and to optimize planned outages.

The unplanned automatic scrams per 7000 hours critical indicator tracks the median scram (automatic shutdown) rate for approximately one year (7000 hours) of operation. Unplanned automatic scrams result in thermal and hydraulic transients that affect plant systems. The scram rate has been significantly reduced since 1980. In 2000, 59 percent of operating units had zero automatic scrams.

INDUSTRIAL SAFETY ACCIDENT RATE



SAFETY SYSTEM PERFORMANCE



The industrial safety accident rate tracks the number of accidents that result in lost work time, restricted work or fatalities per 200,000 worker-hours. The nuclear industry continues to provide one of the safer industrial work environments. The 2000 value continues to achieve the 2000 goal.

The safety system performance indicator monitors the availability of three important standby safety systems to mitigate off-normal events. The industry's goal is to encourage a high state of readiness, with at least 85 percent of these systems meeting specific 2000 goals for availability in excess of 97 percent. The 85 percent target allows for normal year-to-year variations in individual system performance.

dustry,” said Alfred Tollison, INPO executive vice president. “The results show that the industry continues to place a priority on the programs and highly qualified people that make safe, reliable operations a reality.”

The 10 categories where results exceeded or met industry goals are:

■ **Unit capability factor:** The industry’s 2000 median capability factor of 91.1 percent was the highest since INPO began collecting data and exceeded WANO’s year 2000 goal for the second consecutive year. Unit capability factor is the percentage of maximum energy generation that a plant is capable of supplying to the electrical grid, limited only by factors within the control of plant management. According to INPO, a high unit capability factor indicates effective plant programs and practices to minimize unplanned energy losses and to optimize planned outages.

■ **Unplanned capability loss factor:** The 1.7 percent median loss factor was better than the year 2000 goal for the second consecutive year. Unplanned capability loss factor is the percentage of maximum energy generation that a plant is not capable of supplying to the electrical grid because of unplanned energy losses, such as unplanned shutdowns or outage extensions. A low value indicates that important plant equipment is well maintained and reliably operated and that there are few outage extensions, INPO said.

■ **Unplanned automatic scrams:** For the third straight year, unplanned automatic plant shutdowns stood at the median value of zero per plant, as measured by unplanned automatic scrams per 7000 hours critical for approximately one year (7000 hours) of operation. In 2000, 59 percent of operating units had zero automatic scrams.

■ **Safety system performance:** The industry recorded a median safety system performance of 96 percent. The safety system performance indicator monitors the availability of three important standby safety systems to mitigate off-normal events. The year 2000 goal of 85 percent, which has been exceeded each year since 1992, allows for normal year-to-year variations in individual system performance, according to INPO.

■ **Fuel reliability:** The median rate of 85 percent units with zero fuel clad defects equaled the year 2000 goal, the first time the goal had been reached. The fuel reliability indicator monitors progress in preventing defects in the metal cladding that surrounds fuel. Although minor defects pose no significant safety concern and are difficult to eliminate entirely, INPO said, the long-term industry goal is that units should strive to operate with zero fuel cladding defects.

■ **Industrial safety accident rate:** For the third consecutive year, U.S. nuclear plants exceeded the year 2000 goal of 0.40 accidents per

200 000 worker-hours. The rate in 2000 was 0.26 accidents. The industrial safety accident rate tracks the number of accidents that result in lost work time, restricted work, or fatalities per 200 000 worker-hours.

■ **Collective radiation exposure—pressurized water reactors:** At 82 man-rem per PWR unit in 2000, radiological protection practices kept collective exposure to workers below the year 2000 goal for the third straight year. This performance indicator monitors the effectiveness

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of personnel radiation exposure controls. Low exposure indicates strong management attention to radiological protection, according to INPO.

■ **Collective radiation exposure—boiling water reactors:** At 150 man-rem per BWR unit in 2000, exposure was below the year 2000 goal for the third straight year.

■ **Volume of solid radioactive waste—PWRs:** In 2000, the volume of solid radioactive waste per PWR was 20 m³, the fourth year in a row that it was below the year 2000 goal. Minimizing radioactive waste reduces storage, transportation, and disposal needs, which lessens the environmental impact of nuclear power, INPO said.

■ **Volume of solid radioactive waste—BWRs:** In 2000, 71 m³ per unit was generated. This was the fourth year in a row that it was less than the goal of 125 m³ per unit.

Year 2000 goals were not established for two PI categories—*chemistry performance* and *thermal performance*. For chemistry performance, 61 percent of nuclear units achieved their goals (which vary according to plant design). The chemistry performance indicator monitors operational chemistry control effectiveness as measured by the concentration of important impurities and corrosion products. In BWRs, the indicator focus is on reactor coolant chemistry control. In PWRs, the focus is on secondary system chemistry.

For thermal performance, the industry achieved a median value gross heat rate of 10 065 Btu/kWh in 2000, the best ever since statistics have been collected for the PI program. Thermal performance monitors how efficiently a plant converts thermal energy into electrical output. A low gross heat rate indicates high efficiency. Plants also measure thermal performance by comparing the best achievable heat rate to the heat rate actually attained. By this measure, according to INPO, the actual year 2000 industry median value of 99.8 percent continued to achieve the industry goal. **IN**