

## Nuclear power operations, Deep Freeze 73

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During calendar 1972, the PM-3A nuclear power plant at McMurdo Station provided electrical power for 4,706:25 hours, an annual availability rate of 54 percent. This lowest availability since the first year of Navy operation of the plant was caused by (1) deterioration and subsequent repair of control rod drive cables and connections and (2) discovery of a shield water leak at the connection between the reactor tank and the steam generator tank. The cable deterioration, a continuing problem because of high radiation and high humidity in the reactor tank, was corrected during the first quarter of 1972 and prolonged the annual maintenance shutdown.

The interconnect leak was discovered during a scheduled maintenance shutdown in September after a 2,900-hour power run. The plant was shut down for an extensive study to determine the cause and effects of the leak. In October, a nuclear consulting firm was contracted by the Naval Nuclear Power Unit, Fort Belvoir, Virginia, to determine possible consequences of the leak. By this time the operating crew had discovered the path of the leak to be into the insulation canning around the reactor and its associated piping, and thence through the interconnect into the steam generator tank.

Although the chloride content of the shield water is kept extremely low, less than 0.2 parts per million, it was theorized that chloride stress corrosion cracking was possible at points of high inherent stress on the reactor and its piping, particularly at the junction of the piping and the reactor vessel.

The naval unit at Fort Belvoir, in conjunction with the Contractor, decided that the probability of chloride stress corrosion cracking was high enough to warrant an inspection by specialists to determine the extent of the cracking and the probability of repair. The inspection team, consisting of a chemist, a mechanical engineer specializing in the design and operation of cutting tools, a metals testing expert, and a leader-coordinator, was at the PM-3A in January and February 1973.

At the time the team left, the future of the PM-3A was undecided, but it was known that the plant would not operate during the 1973 austral winter. Accordingly, it was decided that a reduced crew, 12 men, would remain on-site to monitor and maintain the

nuclear plant and to operate the water distillation plant.

Before the inspection team arrived, the operating crew fabricated and installed a temporary lead shield to reduce radiation levels near the reactor and then cut the insulation canning on the pipe in two places. Water was discovered inside the pipe canning, and the pressure vessel insulation canning was found to be flooded. On-site chemical analysis of water from inside the insulation canning revealed the presence of chlorides in sufficient quantity to initiate chloride stress corrosion cracking. Samples were sent to chemical firms in the United States for independent laboratory analysis. On completion of this initial inspection, the openings in the canning were repaired and the temporary shield removed.

During 1972, the water distillation plant consisted of two copper-nickel units and one badly corroded carbon steel unit. A third copper-nickel unit was purchased and shipped to the site for installation during the 1973 winter. These units adequately provided the station with water; at no time was usage curtailed. The insides of the two 55,000-gallon fresh water storage tanks were painted to reduce corrosion. The exterior of one was painted, and the other is scheduled for painting this winter. A hypochlorinator was added to the fresh-water system, and a testing program to maintain chlorine residual was begun. All steam and condensate lines were lagged to increase efficiency of operation and to allow continuous operation of all three distillation units. Procedures have been written and materials ordered for the addition of soda ash in the water to prevent leaching of lead from soldered pipe joints.

**Table 1. PM-3A electrical energy production, 1962-1972.**

Calendar year	Hours at power	Availability (percent)	Megawatt-hours delivered	Diesel-fuel equivalent <sup>1</sup> of net production (thousand gallons)
<sup>2</sup> 1962	—	—	<sup>3</sup> 1,803	134
<sup>2</sup> 1963	—	—	3,268	242
<sup>4</sup> 1964	3,146	64	2,410	179
1965	5,333	61	5,240	389
1966	6,782	77	6,780	503
1967	7,555	87	7,400	549
1968	7,471	85	7,680	570
1969	6,911	79	7,620	565
1970	5,986	68	6,736	499
1971	6,244	72	6,864	509
1972	4,706	54	4,938	366
1962-1972	54,134	72	60,739	4,505

<sup>1</sup> The conversion figure of 13.48 kwh per gallon of diesel fuel is derived from actual McMurdo diesel plant operations in 1967.

<sup>2</sup> Contractor's tests, January 1, 1962, to June 9, 1964.

<sup>3</sup> Estimated.

<sup>4</sup> June 10 to December 31 only. See note 2.

cwo Du Bay, CEC, U.S. Navy, was plant superintendent for PM-3A during 1972-1973.

Extensive corrosion to the salt water intake line required its replacement during the summer season by the public works department. Fiberglass pipe with integrated insulation and heat tapes replaced the copper line. An unexpected benefit from the new installation was the ability to deliver more water, thus ending the

need to use both salt water pumps unless all three distillation units are operating.

Nearly 6 million gallons of water were produced in 1972, but because the nuclear power plant was inoperative all fresh water produced since October has been by diesel-fueled boiler. In addition to providing water to McMurdo Station, the plant supplied the Coast Guard icebreaker *Northwind* and the supply ship USNS *Pvt. John R. Towle*. The Dry Valley Drilling Project was provided over 2,000 gallons per week for its operation. In January 1973, 705,000 gallons was produced, setting an all time monthly record.

The replacement crew arrived in October 1972 and took over operation of the plant on November 6, 1972, when Lcdr. Thomas C. Crane, CEC, USN, relieved Lcdr. Lee R. Bohning, CEC, USN, as officer in charge. Lcdr. Crane's second in command is CWO3 Du Bay.

As the plant was to be inoperative during 1973, it was decided that neither the officer in charge nor the plant superintendent would winter over. In February 1973, senior chief construction electrician Jerry L. Schloredt relieved Lcdr. Crane and became acting officer in charge.

**Table 2. PM-3A water distillation, 1967-1972.**

Calendar year	Water distilled by nuclear energy (thousand gallons)	Diesel fuel equivalent of net production (thousand gallons) <sup>1</sup>
1967	1,943	57
1968	2,168	63
1969	2,647	77
1970	1,924	56
1971	2,838	83
1972	1,857	54

<sup>1</sup> The conversion figure of 34.28 gallons of water per gallon of diesel fuel is derived by using the auxiliary boiler usage of 17.5 gallons of diesel fuel per hour and the distillation unit's normal output of 600 gallons of water per hour.

## Deep Freeze personnel, winter 1972

At the conclusion of the 1972-1973 summer season, *Deep Freeze* support personnel remained to winter over at three U.S. Antarctic stations. Listed below are the names of these military support personnel, who are assigned to the Naval Support Force, Antarctica (NSFA), the Naval Nuclear Power Unit (NNPU), or Antarctic Development Squadron Six (VXE-6).

### Amundsen-Scott South Pole Station

Butler, Charles H., CS2, NSFA  
 Davis, Gerald W., CM2, NSFA  
 Dickenson, Roy T., EO1, NSFA  
 Gugert, George L., SK2, NSFA  
 Harris, Perry E., BUC, NSFA  
 Hopkins, Charles E., CE1, NSFA  
 Huffman, Hugh K., RM1, NSFA  
 Kline, Roy W., HM1, NSFA  
 Ramella, Stephen D., ETN2, NSFA  
 Saxman, Kenneth E., UT1, NSFA  
 Swarsen, Ronald J., LT (MC), NSFA  
 Tripp, Daniel F., CE2, NSFA  
 Walcott, Fred P., LT (CEC), NSFA  
*officer in charge*

### Palmer Station

Ames, Jack C., UT2, NSFA  
 Cadle, Gary L., CE2, NSFA  
 Evans, Jimmie L., CM1, NSFA  
 Houston, Robert B., RM1, NSFA  
 Jukkola, Lloyd A., LT (CEC), NSFA  
*officer in charge*  
 Morgan, Paul W., SK2, NSFA  
 Sandau, Charles L., CS1, NSFA  
 Spencer, Donald A., LT (MC), NSFA  
 Thornhill, Charles H., HM1, NSFA  
 Williamson, Melvin W., BU1, NSFA

### McMurdo Station

Abel, Roger C., ETN2, NSFA

Acs, Frank J., BU1, NSFA  
 Affeldt, James A., SW1, NSFA  
 Anderson, Edwin D., SK2, NSFA  
 Anglin, John M., HT2, NSFA  
 Aten, Gerald E., PC3, NSFA  
 Aust, Roger C., ETN3, NSFA  
 Baker, Barney G., CE2, NNPU  
 Baker, James A., CM1, NSFA  
 Bates, Michael W., RM3, NSFA  
 Benoit, Albert A., CSC, NSFA  
 Blessing, George R., CDR, NSFA,  
*officer in charge and  
 commander, NSFA Detachment Alfa*  
 Blewett, Thomas R., RM3, NSFA  
 Brian, Carl E., BU3, NSFA  
 Brillante, Murray O., SK3, NSFA  
 Bryan, Thomas M., ETC, NSFA  
 Bryant, Michael F., SH2, NSFA  
 Burlingame, James J., SN, NSFA  
 Bushall, William Jr., CE2, NNPU  
 Cantu, John J., UT1, NSFA  
 Cavanaugh, Ronald F., CM1, NNPU  
 Chavez, Pedro C., HTFA, NSFA  
 Chopping, Edward L., EA1, NSFA  
 Cleek, Gary M., AG2, NSFA  
 Coffell, Richard D., BUCN, NSFA  
 Coffman, Allen R., CE1, NSFA  
 Combs, Peter T., HTFN, NSFA  
 Connelly, Charles D., YN2, NSFA  
 Conroy, Charles A., SH3, NSFA

Connor, Robert J., DK1, NSFA  
 Costaldi, Mario E., LT (MC), NSFA  
 Coughenour, Newton J., CE2, NSFA  
 Craddock, Kenneth M., HM1, NSFA  
 Craig, Robert C., PN1, NSFA  
 Crawford, John A., ET1, NSFA  
 Cullins, Michael, CMCN, NSFA  
 Curtis, David M., HT3, NSFA  
 DeLong, David L., EOC, NNPU  
 Delves, Michael L., CE3, NSFA  
 Donohoe, John M., SK2, NSFA  
 Dubois, David A., SK1, NSFA  
 East, Leroy G., SW1, NNPU  
 Edson, Carl M., RM1, NSFA  
 Epley, Melvin R., HMC, NSFA  
 Feldsine, Donald G., CE3, NSFA  
 Fisher, Earl F., LCDR (DC), NSFA  
 Flood, Donald A., SK2, NSFA  
 Ford, Curtis B., AG2, NSFA  
 Forrest, Gregory, CE2, NSFA  
 Foster, Christopher, HTFN, NSFA  
 Giannini, Theodore R., EO2, NSFA  
 Gillespie, Erskine T., RM1, NSFA  
 Gunn, James T., ET1, NSFA  
 Hand, Thomas D., DT1, NSFA  
 Harper, Cecil D., Jr., LCDR, (CH),  
 NSFA  
 Henline, Rickey L., CMCN, NSFA  
 Hudlemeyer, Donald J., EO2, NSFA  
 Hudson, Ronald R., LT, NSFA