



Dow U.S.A.

The Dow Chemical Company
Midland, Michigan 48677

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Director, Office of Nuclear Reactor Regulation
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DOW TRIGA RESEARCH REACTOR - DOCKET NO. 50-264

The 1991 annual report for the Dow TRIGA Research Reactor Facility is attached.

Yours,

C.W. Kocher

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DOW TRIGA RESEARCH REACTOR

ANNUAL REPORT - 1991

The reactor has seen more use this year than in the past, partly due to increased sample load and partly due to increased analytical sensitivity resulting from the increased power level. Problems with the new console, installed in late December 1990, prevented operation during the first week of January and for a time in October, but some hardware changes have led to smoother operations. A major problem seems to be related to the operation of the NM-1000 digital channel which provides information about, among other things, the reactor period; at low power levels, from source level to about 150 milliwatts, the noise in the period channel has caused an inordinate number of unintentional shutdowns. Some of this is related to the digital smoothing algorithm.

New fuel elements have replaced two dummy elements; the 300 kw power level has been activated; and two persons have been newly licensed as Senior Reactor Operators.

A. Staff, Licenses, and Training

The staff consists of five persons:

C. W. Kocher	Senior Reactor Operator	Reactor Supervisor
W. L. Rigot	Senior Reactor Operator	Assistant Reactor Supervisor
T. J. Quinn	Senior Reactor Operator	Assistant Reactor Supervisor
M. E. Buchmann	Senior Reactor Operator	
J. D. Romick	Senior Reactor Operator	

Licenses of the SROs are current, with renewals expected in 1993 (Rigot and Quinn), 1995 (Kocher), and 1997 (Buchmann and Romick). Medical examinations are current.

The current two-year requalification program was started in the second quarter of 1990 and seven sessions have been held. The SROs are current with operating experience and participation in hypothetical emergency drills, Reactor Operations Committee meetings, and the annual fuel inventory.

The Reactor Operations Committee continues with five members:

J. J. Havel	Facility Director
C. W. Kocher	Reactor Supervisor and Senior Reactor Operator
S. W. Maxey	Radiation Safety Officer
W. L. Rigot	Senior Reactor Operator
T. D. Lickly	

B. Reactor Operating Experience

The reactor was operated for about 0.88 megawatt-days during the year, and from 2-8-91 through 12-31-91 (the time during which the new console was used to accumulate operating hours) the reactor was operated for a total time of about 251 hours. The operators performed over 1800 reactivity manipulations, including the daily, monthly and annual checkouts, the training and operating examinations for two SROs, and the irradiation of samples.

DOW TRIGA RESEARCH REACTOR

C. Major Changes

Two new fuel elements were added to the core in January 1991, replacing two graphite-loaded dummy elements in the F-ring. This brought the core excess to about \$2.30 (0.0161 \$\text{kg}/\text{k})�.

The reactor was operated at power levels above 100 kilowatts for the first time on 30 January 1991, utilizing the higher power levels allowed by the license of May 1989.

The reactor was operated at 250 kilowatts for the first time to irradiate samples for neutron activation analysis on 5 February 1991.

D. Unscheduled Shutdowns

During the period 1 January 1991 and 31 December 1991 there were seventy-two unintentional shutdowns. Many of these were the result of the installation and training process but a number were related to problems with the new console. Some of these problems have been solved but one at least still remains to be solved.

1. Forty-three unintentional shutdowns occurred because the period setpoint (8 seconds) was reached.

Of these, 5 occurred during testing of the automatic mode of operation; modification of the setpoints of the automatic mode eliminated this problem in April 1991 and it has not recurred.

Four more occurred during the crossover between the count-rate mode and the P:MS mode of the wide-range log channel which supplies the period signal. The setpoints for this channel were improved to provide a smoother crossover and this has not recurred since June.

One occurred at a power level of 1 kilowatt in January and can be attributed to the operator's attempt to evaluate the noise in the period circuit at this level.

Thirty-two other unintentional shutdowns due to the period setpoint occurred at power levels less than one watt, during startup of the reactor from the normal source level of about 1 milliwatt. Of these, eleven occurred at a level which is recognized by the manufacturer as a switching-point of the digital smoothing algorithm. The manufacturer has so far been unable to modify the algorithm to eliminate this problem.

All of these low-level period shutdowns seem to occur because of the noisiness of the period signal from the digital smoothing algorithm. This console is the first to be operated at a TRIGA reactor which has such a high minimum period requirement - seven seconds. Other TRIGA reactors, licensed to be pulsed, do not have period scrams; a control rod rundown system suffices.

BOW TRIGA RESEARCH REACTOR

The manufacturer is suggesting that we ask for a lower period requirement, of the order of one to three seconds. We would thus be able to operate at a nominal period of 10 to 13 seconds and the noise of the period circuit would not activate the period shutdown circuit. Unless the digital algorithm is modified or the period setpoint is changed we expect to continue to observe these unintentional shutdowns.

2. Eleven unintentional shutdowns occurred while the reactor was at power. Five of these occurred during the first month of operation, including three immediately following the implementation of the 300 kw operation, and these are attributed to learning experiences. Two others occurred while the reactor was in the automatic mode; modifications of this mode have been made and this is not expected to recur. One other occurred on a day when the reactor had three period scrams and one computer crash, and is attributed to noise in the computer system.

Three unintentional shutdowns are attributed to operator error - lack of attention to the power level while watching other parts of the system, including making entries in the logbook.

3. Two unintentional shutdowns were caused by a faulty connection in the console keyswitch; the connection was repaired and no further problems are expected.
4. Seven unintentional shutdowns occurred because the computer stopped operating or because the computer booted. The power supply of one of the computers was replaced in September and the problem has not recurred.
5. Nine unintentional shutdowns occurred when the watchdog circuits timed out, indicating that the network was not functioning. Six of these occurred within four days late in October; the network cable was replaced and the problem has not recurred.

Of the twenty-nine unintentional shutdowns which did not involve the period circuit eighteen resulted in hardware changes that appear to have eliminated these events, two resulted in software changes, five were attributed to the start-up exercises, and one was probably due to a computer malfunction. The remaining three, due to operator error, have been addressed in the training program.

E. Major Preventive and Corrective Maintenance of Safety Significance

The Continuous Air Monitor (CAM) was replaced in December following a false HIGH RADIATION ALARM. The new CAM is an Eberline AMS-3A, a slight modification of the Eberline AMS-3 that has been used here since 1980. The AMS-3 was returned to the manufacturer to be rebuilt and calibrated; it will be used as a backup system.

The power supply of one of the two computers was replaced and the network cable connecting the computers was replaced to provide more reliable service.

DOW TRIGA RESEARCH REACTOR

The hard disc of one of the computers was replaced following a power failure.

The keyswitch was repaired to eliminate unintentional shutdowns.

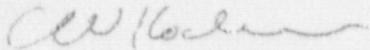
F. Radioactive Effluents

The only radioactive material released to the environment from this facility is argon-41, which is produced from activation of the natural argon dissolved in the pool water, and which subsequently escapes from the pool into the reactor room and from there to the outside of the building, and from the natural argon present in the air used to transport samples from a laboratory into a terminus in the core of the reactor.

The average release after dilution or diffusion is estimated to be less than 25% of the allowed or recommended concentration.

G. Radiation Exposures

Radiation exposures received by facility personnel and visitors are monitored using film badges and thermoluminescent detectors. No persons have received exposures approaching 25% of those allowed or recommended in 10 CFR 20.



C. W. Kocher
Facitor Supervisor
25 March 1992

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