Dow North America
The Dow Chemical Company
Midland, Michigan 48667

February 7, 1994

Director, Office of Nuclear Reactor Regulation
Document Control Desk
US Nuclear Regulatory Commission
Washington DC 20555

DOW TRIGA RESEARCH REACTOR - DOCKET 50-264

Enclosed is the Annual Report for the Dow TRIGA facility for the year 1993.

Very truly yours,

C W Kocher

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Enclosure

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DOW TRIGA* RESEARCH REACTOR

ANNUAL REPORT - 1993

There were no major changes, maintenance problems, or down time involving the reactor during 1993. Operation of the reactor continues to be plagued with an unacceptably large number of unintentional shutdowns (SCRAMs), most of which seem to be caused by the control system itself, although there seems to be a year-to-year decrease of these.

There were no US NRC inspections in 1993. The required annual audit was conducted by an outside consultant; recommendations were made and the Reactor Operations Committee has responded to these recommendations. The normal in-house audits of the radiation protection program, safety and housekeeping, and records were also performed and the recommendations acted upon. An audit by the carrier of the nuclear liability insurance was performed; there were no suggestions, open questions, or recommendations.

A. Staff, Licenses, and Training

The staff consists of five Senior Reactor Operators, no changes having taken place during 1993:

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

Licenses are current. Rigot and Quinn renewed licenses in 1993, Kocher's license will be up for renewal in 1995, while the Buchmann and Romick licenses will be up for renewal in 1997. All operators took medical examinations during 1993.

The current two-year requalification program started in the second quarter of 1992 and seven sessions have been held. The SROs are current with operating experience and participation in hypothetical emergency drills, Reactor Operation Committee meetings, an annual operating examination, and the annual fuel inventory. Written examinations following each of the seven quarterly training sessions were passed by all operators, with no indication of any deficiencies.

Operation of the reactor is an important part of the training program, since this reactor is operated on an as-needed basis, which results in numerous operations each involving reactivity manipulations, use of the control console, placement and retrieval of samples and handling of radioactive materials. The minimum experience of an operator during 1993 was 29.4 hours of actual operating time, involving 180 reactivity manipulations, and the maximum experience was 117.1 hours of actual operating time, involving 611 reactivity manipulations. Furthermore, each licensed person performed about 1/5 of the daily checkout procedures and at least two monthly checkout procedures; one of the monthly checkouts (an extensive combination of tasks involving the physical plant, the control system, and operating characteristics) was performed under the direction of another SRO as part of the annual operating examination.

* TRIGA is a registered trademark of General Atomics

R. A. Wolcott has replaced J. J. Havel as chairman of the Reactor Operations Committee:

R. A. Wolcott	Facility Director; Chairman
C. W. Kocher	Reactor Supervisor
E. M. Crim	Radiation Safety Officer
W. L. Rigot	Assistant Reactor Supervisor
T. D. Lickly	

Wolcott is the Research Manager in charge of the Dow Michigan Division Inorganic Materials Science and Environmental Analysis group of the Analytical Sciences Laboratory; Kocher and Rigot report administratively to Wolcott; Crim is the Dow Midland location Radiation Safety Officer as well as the TRIGA Radiation Safety Officer and reports, as does Lickly, to the Dow North America Health and Environmental Services department.

B. Reactor Operating Experience

The reactor was operated for 1.21 Megawatt-days during 1993 for a total of 287 hours (an average of 14.2% of the available normal working hours) and 1,602 reactivity manipulations, including checkouts and testing as well as the irradiation of samples.

C. Major Changes

During 1993 there were no major changes in the facility and there were no authorizations of new tests or experiments significantly different than those performed previously.

D. Unscheduled Shutdowns

There were 47 unscheduled shutdowns (SCRAMs) during 1993, down from 59 during 1992 and 72 during 1991. During the almost ten years following 1-1-81 the yearly average was 6 SCRAMs, with a high of 9 (1983) and a low of 3 (1989), using the control instrumentation installed in 1971 and 1973. After installation of the new console there were 4 SCRAMs during installation and startup in the last two weeks of December, 1990, 72 during 1991, 59 during 1992, and 47 during 1993. Some of these were related to hardware problems which have since been fixed, but a large majority seem to be due to two aspects of the control system: computer crashes and noise in the digital smoothing process which produces the period signal.

About 77% of the SCRAMs were associated with the operation of the console: the digital smoothing process (about 34%), computer crashes (about 26%), period SCRAMs at the count-rate/Campbell crossover (about 13%), and others (about 4%).

About 15% of the SCRAMs were caused by a malfunctioning board in the control panel; this board was replaced in October 1993 and no further such SCRAMs have occurred.

The difference in the total number of SCRAMs between 1992 and 1993 was caused entirely by the difference in the number of events caused by the digital smoothing process: 29 in 1992 and 16 in 1993. The 1992 experience paralleled the 1991 experience in both number (31 in 1991) and in the rate of events. 1993 was different but there is no known cause that

can be correlated with the SCRAM experience; there were no significant changes made in the software, the hardware, or the operating procedures.

E. Major Preventive and Corrective Maintenance of Safety Significance

There have been no maintenance items of safety significance.

F. Radioactive Effluents

The only radioactive material normally released to the environment from the facility is argon-41, which is produced from activation of the natural argon dissolved in the pool water and 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.

During 1993 the reactor room air particulate monitor sporadically indicated very slight increases of air-borne radioactivity over the natural background levels. These increases were of the order of the background level and the sum of background plus the anomalous radioactivity was never more than about one-fourth the level required to trip the alarm on the air particulate monitor. At times during the year, especially during the late summer or early autumn or during conditions of thermal inversion, the normal background radioactivity level, due to radon daughters, often exceeds the maximum (background plus anomalous radioactivity) observed during the 1993 episodes. Although this effect was closely correlated with operation of the reactor at power levels above 100 kilowatts there were many more operations at those power levels throughout that time which did not lead to the anomalous radioactivity. Months passed between some episodes. It was observed that the anomalous radioactivity seemed to have a half-life of about 15 minutes; given this, the known flow of air through the particulate monitor, the air flow from the reactor room, and an approximate efficiency of the G-M detector in the air particulate monitor it was possible to estimate the maximum concentration of radioactive materials in the air and the total radioactive material released during these episodes. There was not enough material deposited on the filters or in the reactor pool water to allow an identification by gamma-ray spectroscopy. If, however, a tentative identification of the radionuclide is made based on the half-life and on the assumption that the nuclide is a uranium-235 fission fragment then the releases can be compared with values for maximum concentrations listed in 10CFR20.

Overall the average release after dilution or diffusion is estimated to be less than 25% of the allowed or recommended maximum 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 10CFR20.

C. W. Kocher
Reactor Supervisor

CW Kocher 2-7-94