November 17, 2008

Dow Chemical Company
FAC: Research Reactor
ATTN: Melinda Krahenbuhl
1602 Bldg
Midland, MI 48667

SUBJECT: INITIAL EXAMINATION REPORT NO. 50-264/OL-09-01, DOW CHEMICAL COMPANY TRIGA REACTOR

Dear Dr. Krahenbuhl:

During the week of October 20, 2008, the NRC administered an operator licensing examination at your Dow Chemical TRIGA Reactor. The examination was conducted according to NUREG-1478, "Operator Licensing Examiner Standards for Research and Test Reactors," Revision 2. Examination questions and preliminary findings were discussed with those members of your staff identified in the enclosed report at the conclusion of the examination.

In accordance with Title 10 of the Code of Federal Regulations Section 2.390, a copy of this letter and the enclosures will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html. The NRC is forwarding the individual grades to you in a separate letter which will not be released publicly. Should you have any questions concerning this examination, please contact Mr. Paul V. Doyle, Jr. at (301) 415-1058 or via internet e-mail pvd@nrc.gov.

Sincerely,

/RA/

Johnny H. Eads, Jr., Chief
Research and Test Reactors Branch B
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-264

Enclosures: 1. Initial Examination Report No. 50-264/OL-09-01
2. Written examination with facility comments incorporated

cc without enclosures: See next page

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DISTRIBUTION w/ encls.:

PUBLIC	PRTB r/f	RidsNRRDPRPRTA
RidsNRRDPRPRTB	Facility File (CRevelle) O-13 D-07	

ADAMS ACCESSION #: ML **TEMPLATE #:NRR-074**

OFFICE	PRTB:CE		IOLB:LA	E	PRTB:SC	
NAME	PDoyle		CRevelle		JEads	
DATE	11/ 02/2008		11/12/2008		11/17/2008	

OFFICIAL RECORD COPY

Dow Chemical Company Docket No. 50-264

cc:

Office of the Mayor
333 West Ellsworth
Midland, MI 48640

Office of the Governor
Room 1 - Capitol Building
Lansing, MI 48913

Alex Pollock
Chair, Radiation Safety Committee
2030/410 Dow Center
Midland, MI 48674

Dr. Kevin Hool, Level 1 Manager,
The Dow Chemical Company
1897 Building
Midland, MI 48667

Test, Research, and Training
Reactor Newsletter
University of Florida
202 Nuclear Sciences Center
Gainesville, FL 32611

U. S. NUCLEAR REGULATORY COMMISSION
OPERATOR LICENSING INITIAL EXAMINATION REPORT

REPORT NO.: 50-264/OL-09-01

FACILITY DOCKET NO.: 50-264

FACILITY LICENSE NO.: R-108

FACILITY: Dow Chemical Company TRIGA Reactor

EXAMINATION DATES: October 21, 2008

SUBMITTED BY: _____ _____
Paul V. Doyle Jr., Chief Examiner Date

SUMMARY:

On October 21, 2008, the NRC administered an operator licensing examination to one Senior Reactor Operator candidate. The candidate passed all portions of the administered examination.

REPORT DETAILS

1. Examiners: Paul V. Doyle Jr., Chief Examiner, NRC

2. Results:

	RO PASS/FAIL	SRO PASS/FAIL	TOTAL PASS/FAIL
Written	0/0	1/0	1/0
Operating Tests	0/0	1/0	1/0
Overall	0/0	1/0	1/0

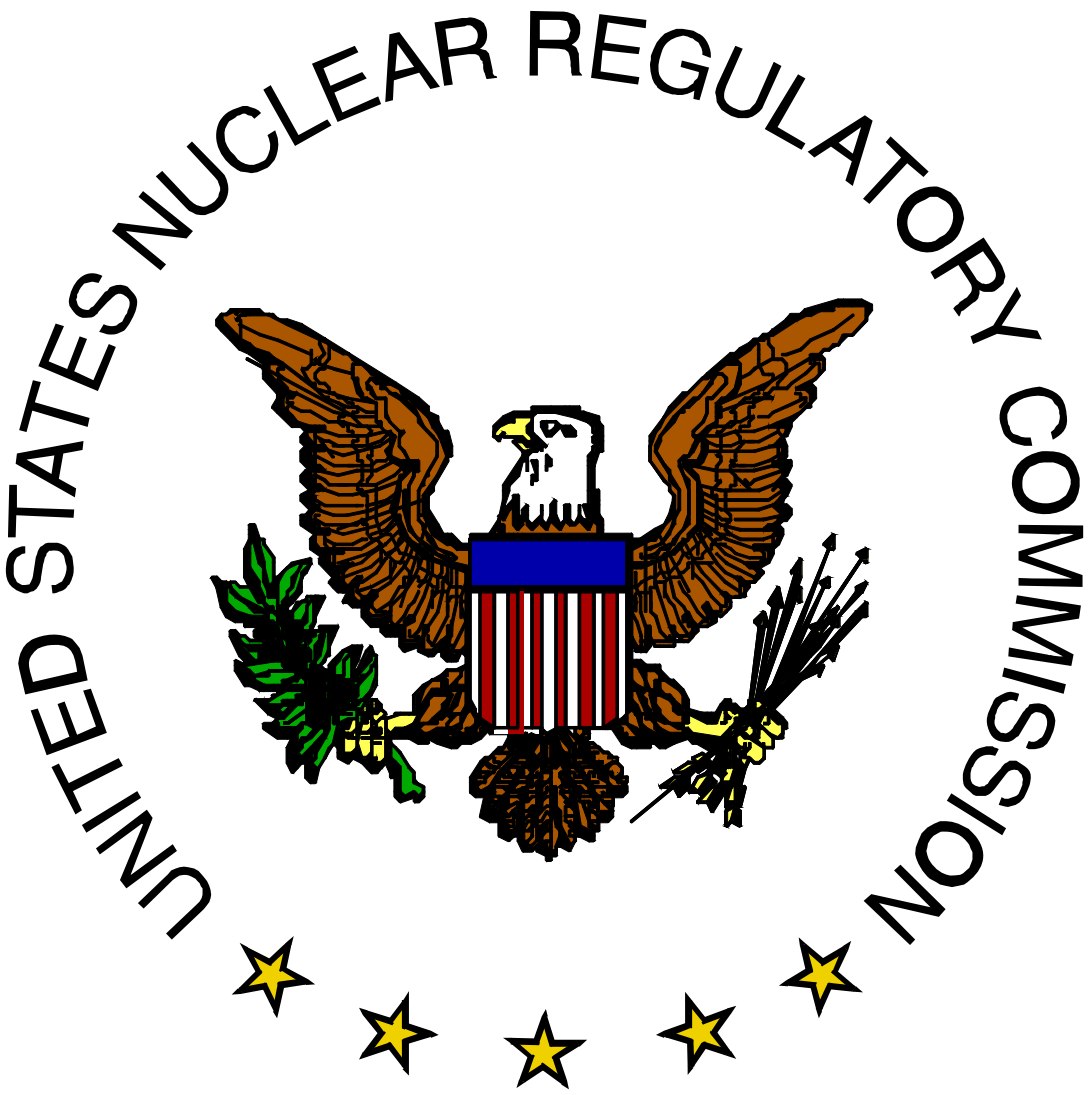
3. Exit Meeting:
Paul V. Doyle Jr., NRC, Examiner
Melinda Krahenbuhl, Reactor Director, Dow Chemical
Siaka Yussuf, Reactor Supervisor, Dow Chemical

During the exit meeting, the facility had the following comments with regard to the written examination. Question B.05; The requirement for a Senior Reactor Operator per Administrative procedure 3.4 was changed to match the technical specifications in July, 2008. Question B.13; The requirement for a seven second scram was removed from the technical specifications as part of amendment #7. Question C.09; The requirement to add sodium hexa-meta phosphate has been deleted from facility procedures. All three comments have been accepted and these questions have been deleted from the examination.

ENCLOSURE 1

OPERATOR LICENSING EXAMINATION

With Answer Key



DOW CHEMICAL TRIGA REACTOR

OCTOBER 21, 2008

QUESTION B.01 [1.0 point]

The Total Effective Dose Equivalent (TEDE) is defined as the sum of the deep-dose equivalent and the committed effective dose equivalent. The deep-dose equivalent is related to:

a. the dose to organs or tissues.

b. the external exposure to the skin or an extremity.

c. the external exposure to the lens of the eye.

d. the external whole-body exposure.

QUESTION B.02 [1.0 point]

Which ONE of the following describes the half-life for radioactive material that is disposed of in the Neutron Activation Analysis Group classified as Temporarily Radioactive Material?

a. 15 days

b. 30 days

c. 90 days

d. 150 days

QUESTION B.03 [1.0 point]

The General Description of the Dow TRIGA Research Reactor and Facilities § 1.6.2 Water Purification System, has a note stating “Some highly corrosive materials such as _____ and copper are not removed by the water treatment system. Special care should be exercised when using these materials to prevent adding them to the reactor pool. Which **ONE** of the following materials belongs in the blank?

a. Sodium chloride

b. Boron-carbide

c. Cadmium

d. Mercury

QUESTION B.04 [1.0 point]

An accident results in a person being incapacitated in a radiation area with a general reading of 500 R/hr. Which one of the following is the maximum permissible exposure time per person to attempt to save the incapacitated persons life?

a. 10 minutes

b. 20 minutes

c. 30 minutes

d. 40 minutes

~~QUESTION B.05 [1.0 point]~~ QUESTION DELETED: PROCEDURE CHANGED JULY, 2008

~~Which ONE of the following scenarios is allowed by technical specifications, but is NOT allowed by DOW TRIGA administrative procedure 3.4 *Procedural and Administrative Limitations*? During weekend operations …~~

~~a. a single operator in the control room, the rest of building 1602 empty.~~

~~b. a single senior operator in the control room the rest of building 1602 empty.~~

~~c. a single operator in the control room, a non-licensed '2nd person' in building 1602, the shift senior operator at a meeting in another building 20 minutes away.~~

~~d. a single senior operator in the control room and a non-licensed '2nd person' in building 1602.~~

QUESTION B.06 [1.0 point]

Which ONE of the following is the correct posting required if the radiation level in the area is 75 mr/hr?

a. CAUTION RADIATION AREA

b. CAUTION HIGH RADIATION AREA

c. CAUTION AIRBORNE RADIOACTIVITY AREA

d. CAUTION RADIOACTIVE MATERIAL(S)

QUESTION B.07 [1.0 point]
Which ONE of the following reactor operations does NOT require the presence of the Reactor Supervisor or a designated alternate?

a. Manipulation of fuel in the core

b. Maintenance performed on the core

c. Recovery from an unexplained scram

d. Movement of an in-core experiment worth $0.50

QUESTION B.08 [1.0 point]
A survey instrument with a window probe is used to measure the beta-gamma dose rate from an irradiated experiment. The dose rate is 100 mrem/hour with the window open and 60 mrem/hour with the window closed. The gamma dose rate is:

a. 100 mrem/hour.

b. 60 mrem/hour.

c. 40 mrem/hour.

d. 160 mrem/hour.

QUESTION B.09 [1.0 point]
In the event of a reportable occurrence, the reactor shall be shutdown and not restarted until authorized by the:

a. Facility Director

b. Radiation Safeguards Committee

c. Reactor Operations Committee

d. U.S. NRC

QUESTION B.10 [1.0 point]
Which ONE of the following indicates that a Limiting Safety System Setting (LSSS) is being exceeded?

a. Reactor operation at 750 Kw

b. Reactor operation at 300 Kw

c. Reactor operation at 150 Kw

d. Reactor operation at 75 Kw

QUESTION B.11 [2.0 points, ½ each]

Identify whether the following conditions require the entry to be entered into the reactor operations logbook in normal ink (N), in red ink (R), or underlined in red ink (U).

a. Change of operators.

b. Replacing an old fuel element with a new fuel element.

c. Scram due to exceeding LSSS.

d. Moving the neutron source.

QUESTION B.12 [1.0 point]

All of the below listed surveillances are required to be performed annually per the technical specifications. Which ONE is **NOT** tested semi-annually per DOW TRIGA procedure 4.1.4.

a. Area Radiation Monitor calibration.

b. Control rod drop time measurement.

c. A power thermal calibration of the NM1000 channel.

d. Control rod reactivity worth measurement

~~QUESTION B.13 [1.0 point]~~ QUESTION DELETED: TECHNICAL SPECIFICATIONS CHANGE #7 DELETED 7 SECOND PERIOD REQUIREMENT

~~Which ONE of the following is the minimum Reactor Period allowed by the DOW Technical Specifications during reactor operation?~~

~~a. 10 seconds~~

~~b. 8 seconds~~

~~c. 7 seconds~~

~~d. 5 seconds~~

QUESTION B.14 [1.0 point]

A "high radiation area" is an area:

a. where airborne radioactive materials, composed wholly or partly of licensed material, exist in concentrations are In excess of the derived air concentrations (DACs) specified in appendix B, or an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6 percent of the annual limit on intake (ALI) or 12 DAC-hours.

b. accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem (0.05 mSv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

c. accessible to individuals, in which radiation levels from radiation sources external to the body could result in an individual receiving a dose equivalent in excess of 0.1 rem (1 mSv) in 1 hour at 30 centimeters from the radiation source or 30 centimeters from any surface that the radiation penetrates.

d. access to which is limited by the licensee for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials

QUESTION C.01 [2.0 points, 1/5 each]

Using the picture of the Core map provided, identify each of the lettered positions with its correct component listed in column B. (Note: Only one answer for each, all choices must be used.)

Column A	Column B
a. Position A	1. Audible Experiment Fission Chamber
b. Position B	2. Lazy Susan Tube
c. Position C	3. Neutron Source
d. Position D	4. NM1000 Uncompensated Ionization Chamber
e. Position E	5. NP1000 Fission Chamber
f. Position F	6. Percent Power Ionization Chamber
g. Position G	7. Pneumatic Tube
h. Position H	8. Regulating Rod
i. Position I	9. Shim Rod #1
j. Position J	10. Shim Rod #2

QUESTION C.02 [1.0 point]

What is the design steady-state capacity of the combined pool cooling systems?

a. 100 kilowatts

b. 300 kilowatts

c. 1000 kilowatts

d. 1100 kilowatts

QUESTION C.03 [1.0 point]

WHICH **ONE** of the following detectors is used primarily to measure N^{16} release to the environment?

a. NONE, N^{16} has too short a half-life to require environmental monitoring.

b. Continuous Air Monitor

c. Area Radiation Monitor

d. Water Radiation Monitor

QUESTION C.04 [1.0 point]
The “PULL ROD” is associated with the …

a. Rod UP limit switch.

b. Rod DOWN limit switch.

c. Motor UP limit switch.

d. Motor DOWN limit switch

QUESTION C.05 [1.0 point]
Which **ONE** of the following is the material samples are inserted into the lazy susan which are expected to get warm?

a. polyethylene

b. aluminum

c. cadmium

d. gadolinium.

QUESTION C.06 [1.0 point]
Using the drawing of a pneumatic tube system provided, identify the valve lineup which will result in sending a "rabbit" INTO the core.

	OPEN	**SHUT**
a.	1 & 2	3 & 4
b.	3 & 4	1 & 2
c.	1 & 3	2 & 4
d.	2 & 4	1 & 3

QUESTION C.07 [1.0 point]
Which ONE of the following is the actual method used to generate the rod position indication, for the standard control rods on the control panel?

a. Voltage changes generated by the movement of a lead screw between two coils of a transformer.

b. A ten-turn potentiometer linked to the rod drive motor

c. A series of several reed switches which as the rod moves up close to generate a current proportional to rod position.

d. A servo motor connected to the UP and DN buttons which when either button is depressed generates a signal proportional to rod speed.

QUESTION C.08 [1.0 point]

Which ONE of the following is the neutron source utilized in the reactor?

a. ^{241}Am — ^{9}Be

b. ^{239}Pu — ^{9}Be

c. ^{210}Po — ^{9}Be

d. ^{124}Sb — ^{9}Be

QUESTION C.09 [1.0 point] QUESTION DELETED: FACILITY NO LONGER ADDS COMPOUND

~~Which ONE of the following compounds is added to ensure proper operation of the secondary system?~~

~~a. ethylene glycol~~

~~b. sodium hexa-meta phosphate~~

~~c. sodium tetraborate decahydrate (borax)~~

~~d. chlorine bleach~~

QUESTION C.10 [2.0 points, ⅓ each]

Identify whether each of the following is associated with the **OLD** cooling system, the **NEW** cooling system or **BOTH.**

a. open loop

b. closed loop

c. chill water system

d. sewer system

e. pump

f. air separator tank

QUESTION C.11 [1.0 point]

The 'cambelling circuit' in the output of the fission chamber, allows the channel to detect over 10 decades of reactor power by

a. the setting of a 'discriminator' voltage which removes the smaller pulses due to gamma and alphas in the detector from the signal.

b. the use of two chambers in the detector, one lined giving a signal due to both alphas, gammas and neutrons; the other not lined, giving a signal due to alphas and gammas only. The cambelling circuit adds the signal output of the two chambers algebraically to give a signal due to neutrons only.

c. the combination of the output of the single detector as both a proportional counter and as an ionization chamber.

d. there is no campbelling circuit associated with the fission chamber, it is associated with the uncompensated ionization chamber.

QUESTION C.12 [1.0 point]

During a survey of the demineralizer ½ hour after shutdown, you note that the dose rate has increased by a factor of 10 over the previous day's reading. Is this normal or abnormal, and why?

a. Normal, due to N^{16} in the coolant.

b. Abnormal, due to the concentration of H^3 in the demineralizer.

c. Abnormal, due to fission products in the demineralizer.

d. Normal, due to Ar^{41} entrained in the coolant system.

QUESTION C.13 [1.0 point]

The purpose of the graphite slugs located at the top and bottom of each fuel rod is to …

a. absorb neutrons, thereby reducing neutron embrittlement of the upper and lower guide plates.

b. absorb neutrons, thereby reducing neutron leakage from the core.

c. reflect neutrons, thereby reducing neutron leakage from the core.

d. couple neutrons from the core to the nuclear instrumentation, decreasing shadowing effects.

B.01 d
REF: Training Manual, Part B1, Definitions.

B.02 a
REF: Dow Chemical, Chapter 4, § 4.7.2, p. 4-42. Also NRC examination administered March, 1991.

B.03 d
REF: General Description of the Dow TRIGA Research Reactor and Facilities § 1.6.2

B.04 b (200 R)/(500 R/hr) = 0.4 hr = 24 minutes.
REF: Dow Chemical Radiation Safety, § 5.1.5, Figure 5-3. (Rewrite of question from March, 1991 examination.)

~~B.05 d~~ **QUESTION DELETED: PROCEDURE CHANGED JULY 2008**
~~REF: DOW TRIGA administrative procedure 3.4.~~

B.06 a
REF: 10CFR20.202.B(2), pp. 303-304. Also NRC examination administered March, 1991.

B.07 d
REF: Technical Specifications § 6.1.3, p. 35. Also NRC examination administered March, 1991.

B.08 b
REF: Standard NRC Radiation Health Physics Question

B.09 a
REF: Technical Specification 6.5.2

B.10 a
REF: Technical Specifications § 2.2, p. 7

B.11 a, N; b, R; c, N; d, U
REF: Dow Chemical Administrative Procedure Section 3.5.6. Rewrite of NRC question administered December, 1987.

B.12 c
REF: Rewrite of NRC question administered December, 1987.

~~B.13 c~~ **QUESTION DELETED: TECHNICAL SPECIFICATIONS CHANGE #7 DELETED 7 SECOND PERIOD REQUIREMENT**
~~REF: Technical Specifications, § 3.3.a, p. 13. Also NRC examination administered March, 1991.~~

B.14 c
REF: Facility supplied question

C.01 a, 5; b, 6; c, 9; d, 2; e, 7; f, 4; g, 10; h, 3; i, 1; j, 8
Ref: General Description of Dow TRIGA Research Reactor and Facilities, drawing of Core Map

C.02 d
REF: Facility Modification of cooling system, 50.59 review.

C.03 a
REF: Standard NRC question

C.04 b
REF: General Description of Dow TRIGA Research Reactor and Facilities § 1.5.3

C.05 b
REF: General Description of Dow TRIGA Research Reactor and Facilities § 1.11.1

C.06 c
REF: General Description of Dow TRIGA Research Reactor and Facilities drawing of Pneumatic Tube system.

C.07 b
REF: General Description of Dow TRIGA Research Reactor and Facilities § 1.5.3.

C.08 a
REF:

~~C.09 b~~ **QUESTION DELETED: FACILITY NO LONGER ADDS COMPOUND**
~~REF: General Description of DOW TRIGA research reactor and facilities § 1.11.2~~

C.10 a, OLD; b, NEW; c, NEW; d, OLD; e, BOTH; f, NEW
REF: Facility Modification of cooling system, 50.59 review.

C.11 c
REF: General Description of DOW TRIGA research reactor and facilities § 2.2.2

C.12 c
REF: The demineralizer removes ionic impurities. N^{16}, has much too short a half-life, H^{3} emits much too weak a beta to be detected, and Ar^{41} is a noble gas, it will NOT concentrate in the demineralizer.

C.13 c
REF: SAR § 4.2.1 , *Reactor Fuel*, Figure 4.3.