UNION CARBIDE

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April 10, 1979

Mr. Dominic DiIanni
Operating Reactors, Branch No. 4
Division of Reactor Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Reference: Docket 50 - 54

Dear Mr. DiIanni:

In accordance with our recent phone conversations, I have responses to the three items of our proposed Technical Specifications that we discussed, as follows:

(a) Specification 3.5.1 c(1): This refers to the potential reactivity of all experiments combined. Attached to this letter is our justification for retaining the present wording of our proposed specifications, including a copy of the related specifications from two other research reactors.

(b) Organization Chart: A revised chart is attached that designates the levels and describes the current organization structure.

(c) Specification 6.6.1: It was agreed that we would retain for two years those portions of pertinent recorder charts showing the course of unscheduled shutdowns. "Unplanned transients" have been included, at your request, by modifying the definition as follows:

> "1.8 Unscheduled Shutdowns - An unscheduled shutdown is any unplanned shutdown of the operating reactor, including unplanned shutdowns due to power, flow, or temperature transients".

I trust that the above will resolve these few remaining items. We are expecting you to send us a copy of the changes that we have discussed over the phone these past two weeks for our review before final acceptance.

Yours sincerely,

K. D. George

K. D. George
Senior Development Scientist

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enclosures

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C

UNION CARBIDE NUCLEAR REACTOR

Specification 3.5.1 c(1):

The definition of potential reactivity, as given in section 1.21, clearly shows that the concern is for the aggregate positive reactivity effect that could result from changes to experiments already installed in the reactor. This specification protects against any common mode or cause that could affect all such experiments simultaneously while they are resident in the reactor, and which could result in an increase in core reactivity. In contrast, changes to installed experiments that could give an aggregate negative reactivity are in the safe direction. The principle, that the positive (or potential) effect of in-reactor experiments is the significant quantity for which specifications are necessary, is well recognized at other research reactor facilities. Examples are the Bulk Shielding Reactor (BSR), a 2 - 5 MW reactor, and the Oak Ridge Research Reactor (ORR), a 30 MW reactor, copies of whose specifications are enclosed. It may be noted that if these specifications on combined reactivity were applied to the UCNR, our allowance for all experiments would be approximately 2.3% Δk (50% of control rod shutdown margin). In general, those experiments that will have a positive potential effect are those that reduce the reactivity while they are being loaded into the reactor. Specification c(1), as written, protects against hazards from such experiments.

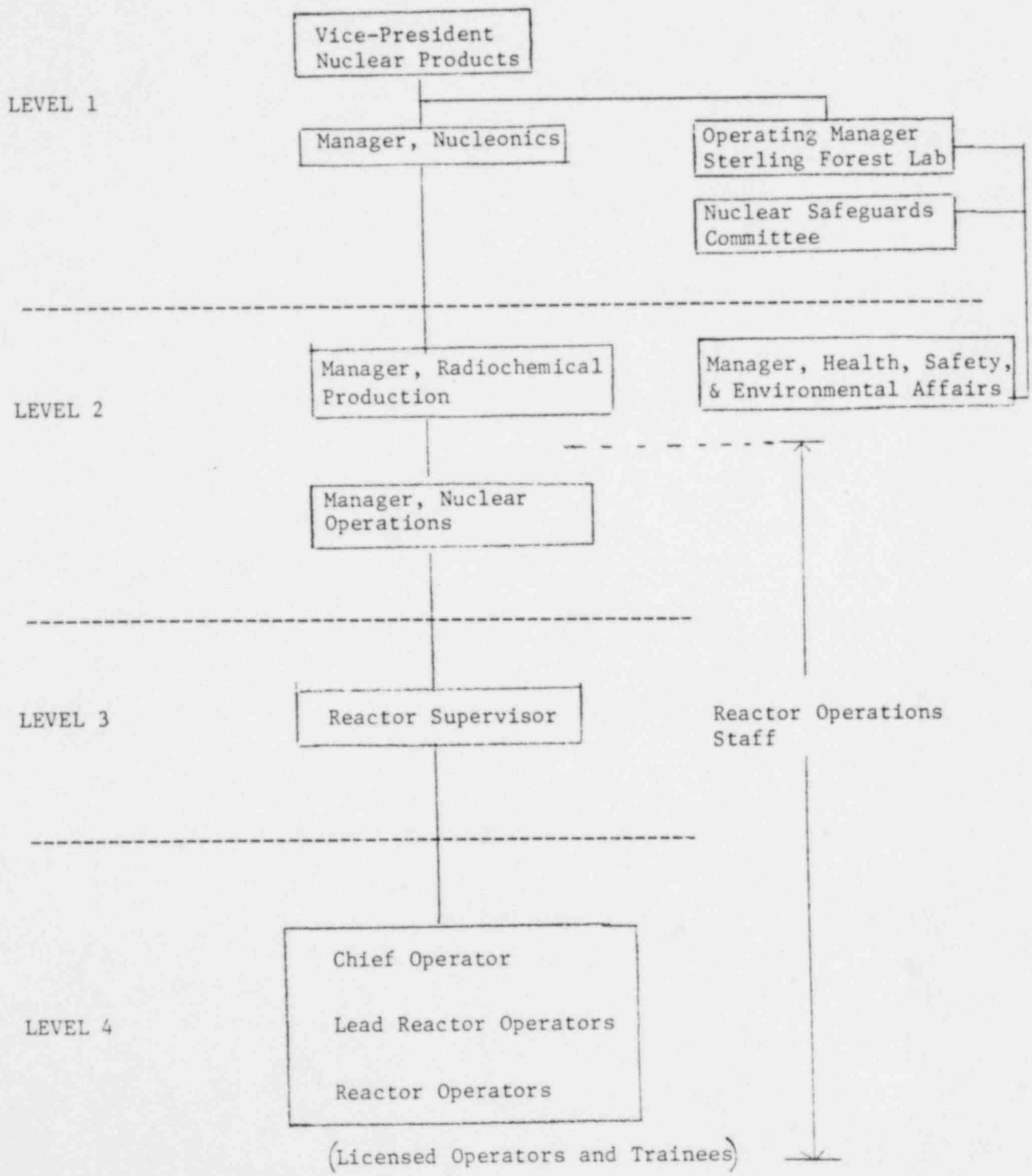
Hazards from experiments, that may have a positive effect (i.e. increase the core reactivity) while they are being loaded, are protected against through the limit on individual experiments in Specifications c(3) through c(5) and the fact that experiments are loaded one at a time. While these particular experiments have no combined potential reactivity, the number that could be loaded into the core would be limited by the need to satisfy specifications on minimum shutdown margin and core excess reactivity (sect. 3.1).

An example of an extreme case of experiments with no potential reactivity would be if all 750 g of SNM were to be loaded in individual experiments distributed throughout the reactor core. Each experiment position in the core would contain 62.5 grams (4 targets each with $\sim$ 15 g), and would have an average reactivity worth of $< 0.2\%$ Δk, for an in-core total (12 positions) of $< 2.4\%$. Removal of all these simultaneously through some hypothetical action would produce a negative reactivity step that would very effectively shut down the reactor.

Enclosures: ORR and BSR Tech. Spec., "Limitations on Experiments".

FIGURE 2

ORGANIZATIONAL STRUCTURE



BSR
(2-5 MW)

d. At least one β,γ stack monitor is operable.

Basis:

The minimum required number of radiation monitors in the building provides protection and warning of elevated levels of radiation so that there will be sufficient time to evacuate the building or portions of the building and to take necessary steps to prevent the spread of radioactivity to the surroundings.

Remote indication in the control room and at the remote control console provides continuously available information concerning the radioactivity levels within the building.

3.7 Limitations on Experiments

Applicability:

These specifications apply to all experiments installed in the BSR.

Objective:

The objective of these specifications is to establish general limits for BSR experiments that will protect the reactor from damage and shall limit radiation exposure to both on-site and off-site personnel to as low as practicable levels.

Specifications:

The following limitations apply to all in-reactor experiments:

a. Reactivity - The following limits apply to individual experiments:

(1) Experiments which can cause a positive reactivity change greater than 0.5% $\Delta k/k$ and which are movable experiments shall be equipped with a mechanical insertion-and-removal system having the same reliability as the reactor control-system drives. The reactivity insertion rate by these mechanisms shall not exceed 0.01% $\Delta k/k\ s^{-1}$.

(2) Experiments which can cause a positive reactivity change greater than 0.5% $\Delta k/k$ due to motion but which need not be moved while the reactor is critical shall be so firmly supported that no credible circumstance can cause them to be moved while the reactor is critical.

(3) Experiments which can cause a positive reactivity change greater than 0.5% $\Delta k/k$ due to being damaged by temperature

or pressure shall be instrumented to cause an appropriate reactor power or reactivity reduction if such temperature or pressure is approached. This is in addition to the safeguards built into the experiment to control the temperature and/or pressure.

(4) The combined reactivity worth of all experiments which can add positive reactivity to the core due to a common-mode failure shall be $\leq$50% of the shutdown margin of the shim-safety rod control system.

b. Hydraulic Stability - All in-core experiments shall be designed to withstand the hydraulic forces and each assembly shall be staked, welded, or adequately held to avoid loss into the reactor.

c. Temperature - Heat developed in any experiments by gamma absorption, fissions, electric heaters, etc., shall be dissipated by an adequate coolant flow. Under normal conditions, the temperature of the outer container shall not exceed the saturation temperature of the reactor coolant.

d. Explosives - No explosives or mixtures of material that under credible circumstances can detonate shall be irradiated in the reactor.

e. Pressure Containment - Where failure of pressure-containing walls of an experiment can cause a hazard to personnel or to the reactor, the container shall meet the intent of applicable pressure vessel codes. The design for each such container shall be reviewed by a competent engineer and written approval obtained from the Operations Division and the Reactor Experiment Review Committee (RERC).

Bases:

a. Reactivity

(1), (2), and (3) The upper limit of 0.5% $\Delta k/k$ for a reactivity change by an experiment ensures that such change will not result in prompt criticality. It also ensures that the servo system can immediately compensate for such change. The limit of 0.01% $\Delta k/k\ s^{-1}$ for an intentional, controlled reactivity insertion rate ensures adequate compensation by the servo system.

(4) The restriction on the combined reactivity worth of all experiments guarantees that the shutdown margin is always adequate to make the reactor subcritical.

b. Hydraulic Stability - The reactor components must be protected from damage that might result from the movement of an experiment in an uncontrolled manner due to hydraulic forces. The requirements of 3.7 (b) will ensure this.

c. Temperature - As with reactor components, the surfaces of experiment rigs are maintained below the saturation temperature of the reactor coolant to avoid steam blanketing and possible burnout.

d. Explosives - The irradiation of explosives is avoided to protect reactor components from possible damage.

e. Pressure Containment - Depending on location, failure of pressure-containing walls could affect reactivity or damage adjacent reactor components. Failure of pressure-containing walls external to the reactor may endanger personnel directly by impact injury or release of radioactive gases. The use of applicable pressure vessel codes insures that adequate safety margins are maintained.

ORR
(30 MW)

3.10 Limitations on Experiments

Applicability

These specifications apply to all experiments installed in the ORR.

Objective:

The objective of these specifications is to establish general limits for ORR experiments that will protect the reactor from damage and shall limit radiation exposure to both on-site and off-site personnel to as low as practicable levels.

Specifications:

The following limitations apply to all in-reactor experiments:

a. Reactivity - The following limits apply to individual experiments:

(1) Experiments which can cause a positive reactivity change greater than 0.5% $\Delta k/k$ and which are movable experiments shall be equipped with a mechanical insertion-and-removal system having the same reliability as the reactor control-system drives. The reactivity insertion rate by these mechanisms shall not exceed 0.025% $\Delta k/k\ s^{-1}$.

(2) Experiments which can cause a positive reactivity change greater than 0.5% $\Delta k/k$ due to motion but which need not be moved while the reactor is critical shall be so firmly supported that no credible circumstance can cause them to be moved while the reactor is critical.

(3) Experiments which can cause a positive reactivity change greater than 0.5% $\Delta k/k$ due to being damaged by temperature or pressure shall be instrumented to cause an appropriate reactor power or reactivity reduction if such temperature or pressure is approached. This is in addition to the safeguards built into the experiment to control the temperature and/or pressure.

(4) The combined reactivity worth of all experiments which can add positive reactivity to the core due to a common-mode failure shall be $\leq$50% of the shutdown margin of the shim-safety rod control system.

not specified 2% Δk

b. Hydraulic Stability - All in-tank experiments shall be designed to withstand the hydraulic forces and each assembly shall be staked, welded, or adequately held to avoid loss into the reactor.

c. Temperature - Heat developed in any experiments by gamma absorption, fissions, electric heaters, etc., shall be dissipated by an adequate coolant flow. Under normal conditions, the temperature of the outer container shall not exceed the saturation temperature of the reactor coolant.

d. Explosives - No explosives or mixtures of material that under credible circumstances can detonate shall be irradiated in the reactor.

e. Pressure Containment - Where failure of pressure-containing walls of an experiment can cause a hazard to personnel or to the reactor, the container shall meet the intent of applicable pressure vessel codes. The design for each such container shall be reviewed by a competent engineer and written approval obtained from the Operations Division and the Reactor Experiment Review Committee (RERC).

Bases:

a. Reactivity

(1), (2), and (3) The upper limit of 0.5% $\Delta k/k$ for a reactivity change by an experiment ensures that such change will not result in prompt criticality. It also ensures that the servo system can immediately compensate for such change. The limit of 0.025% $\Delta k/k\ s^{-1}$ for an intentional, controlled reactivity insertion rate ensures adequate compensation by the servo system.

(4) The restriction on the combined reactivity worth of all experiments guarantees that the shutdown margin is always adequate to make the reactor subcritical.

b. Hydraulic Stability - The reactor components shall be protected from damage that might result from the movement of an experiment in an uncontrolled manner due to hydraulic forces. Any bolts, nuts, or other items lost from an experiment could conceivably damage reactor components or block coolant flow paths.

c. Temperature - As with reactor components, the surfaces of experiment rigs are maintained below the saturation temperature of the reactor coolant to avoid steam blanketing and possible burnout.

d. Explosives - The irradiation of explosives is avoided to protect reactor components from possible damage.

e. Pressure Containment - Depending on location, failure of pressure-containing walls could affect reactivity or damage adjacent reactor components. Failure of pressure-containing walls external to the reactor may endanger personnel directly by impact injury or release of radioactive gases. The use of applicable pressure vessel codes insures that adequate safety margins are maintained.