United States Department of the Interior

U. S. GEOLOGICAL SURVEY
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IN REPLY REFER TO:

April 30, 2002

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington DC 20555

Gentlemen:

The U.S. Geological Survey is herein requesting that Facility License No. R-113 (Docket 50-274) be extended by 855 days to recover shutdown time during which the reactor was in construction (503 days) and in a major modification (352 days). The R-113 license is currently scheduled to expire on 10/10/2007. The requested extension would give a new expiration date of 2/11/2010.

This request has been reviewed and approved by the USGS Reactor Operations Committee. Correspondence concerning this request should be directed to Tim DeBey, Reactor Supervisor.

Sincerely,

Diane N. Wells

Diane Wells
Reactor Administrator

A020

Extension of Geological Survey TRIGA Reactor (GSTR) License (R-113)

1. Extension Request Description

A. Recapture of construction time. The R-113 license for the GSTR was issued on February 24, 1969, as a 40-year license with an expiration of October 10, 2007. The license expiration date was based retroactively from the date of construction permit (CPRR-102) issuance, not on the date of operating permit issuance. Following the issuance of the operating license, initial criticality was reached on February 26, 1969. A period of 503 days passed between the issuance of the construction period and the issuance of the operating license. The material condition of the reactor facility at this time was optimum since all components were new and being installed at that time.

B. Recapture of major modification time. Severe corrosion of the reactor tank was discovered over a period of time in 1987. This led to the eventual decision to cease all operations until the tank corrosion problem could be fully resolved. The NRC Region IV office approved the shutdown decision and instructed the GSTR staff not to restart operations without prior approval from the regional office. In a September 25, 1987 letter, the NRC was notified by the USGS Reactor Administrator that routine operations would cease on October 2, 1987. Operations beyond that date would be restricted to those low power operations that were required to meet Technical Specification surveillance requirements. An amendment request was submitted shortly thereafter to seek relief from those Technical Specification requirements that mandated reactor operations. On December 1, 1987, fuel was unloaded from the core to prevent any further operations until approved by the NRC. On January 4, 1988, Amendment No. 4 was issued to the R-113 license to allow relief from certain Technical Specification surveillance requirements while the reactor was defueled and while reactor tank water level was below the normal level. The tank corrosion problem was resolved by the installation of a new reactor tank. The new tank installation and reassembly of reactor structural components was completed in late 1988. A request for restart was sent to the Region IV Administrator on October 25, 1988. Following an inspection by the NRC on November 10, 1988, restart of the GSTR was approved on November 17, 1988. A period of 352 days passed between December 1, 1987 and November 17, 1988. The material condition of the reactor facility was significantly improved during this shutdown time.

2. Historical Background Information

The site on which the Denver Federal Center (DFC) now sits was originally a 1,500 acre cattle ranch called Downingdale under the ownership of Major Jacob Downing. In February 1913, the ranch was purchased by the Thomas S. Hayden Realty Company. That parcel of land was expanded until it encompassed 6,300 acres in size. Known as Hayden Ranch, this cattle ranch reached from Garrison Street west to Rooney Road and from West 6th Avenue to Alameda Avenue. In January 1941, a portion of the Hayden Ranch was approved as the site for the Denver Ordinance Plant to be

operated by the Remington Arms Company for the purpose of manufacturing munitions for the war effort. At its peak, the plant incorporated 230 buildings, employed 20,000 workers and manufactured 6.2 million rounds of ammunition a day. Immediately following Japan's surrender in 1945, the Denver Ordinance Plant was closed and declared surplus property. In 1946, the facility re-opened as the DFC with the Veterans Administration and the Bureau of Reclamation as the first federal tenants. In 1949, the U.S. General Services Administration was created to manage the Federal Government's real estate and office needs. Since that time, GSA has owned and operated the campus. Today, federal employees occupy all five of the manufacturing buildings, the administration building and the ballistics building. From its humble beginning as a cattle ranch, the DFC now enjoys its present day status as the largest compound of federal agencies outside Washington D.C.

The GSTR is located in Building 15 on the DFC. This building is not one of the original Remington Arms facilities, but was constructed for the USGS in the mid 1960's. The building design called for the inclusion of a particle accelerator; however, during the late stages of construction it was realized that the accelerator would not provide sufficient radiation intensities to perform the research that was desired. At that point the GSTR was added to the building construction plans. GSTR construction was started in 1967 and completed in 1969.

3. Chronology of Major Events at the GSTR

Date	Event
10/10/67	Construction Permit CPRR-102 issued
2/24/69	Operating License R-113 issued (1000 kW)
2/26/69	Initial Criticality
3/11/69	Initial Operation at 1000 kW
3/27/70	Replaced motor on continuous air monitor
5/5/70	Tech Specs Amended (no number) to require specific maintenance and surveillance on transient rod
5/28/70	License Change No. 1 issued to amend Ar-41 release limits
6/23/71	License Change No. 2 issued to add restrictions on use of explosives at the facility
3/8/73	Replaced motor for cooling tower fans
1/14/74	License Change No. 3 issued to change the function of the reactor area radiation alarm
3/21/75	Replaced motor on continuous air monitor
6/13/75	Replaced air compressor for transient rod air supply
11/12/75	License Amendment No. 1 issued to require periodic fuel measurements
6/24/76	Installed new motor for reactor room main exhaust fan
7/20/76	Installed new motor for demineralizer pump
11/1/76	Installed new seals on primary water pump
11/9/77	Installed new motor for reactor room main exhaust fan
8/14/78	License Amendment No. 2 issued to require surveillance pulsing operations

7/10/79	License Amendment No. 3 issued to increase fuel possession limit
6/23/80	Replaced bearings on reactor room main exhaust fan
7/27/83	Replaced motor and pump seals on demineralizer pump
6/13/84	Replaced motor and pump seals on demineralizer pump
7/3/84	Replaced ion chamber for nuclear instrumentation
3/11/85	Replaced another ion chamber for nuclear instrumentation
3/25/85	Replaced motor and blower on continuous air monitor
11/13/85	Replaced lazy susan irradiation facility in graphite reflector
12/18/85	Installed new motor for reactor room main exhaust fan
7/14/86	Replaced ion chamber for nuclear instrumentation
10/2/87	Reactor operations ceased except those low power operations mandated by Technical Specifications
12/1/87	Reactor fuel unloaded; all operations ceased
1/4/88	License Amendment No. 4 issued to allow postponement of certain surveillance requirements while the reactor was defueled and while the reactor tank water level was lowered
1/28/88	Replaced diffuser and impeller on demineralizer pump
10/6/88	Installed new primary (reactor) tank
11/17/88	Reactor restart authorized
12/22/88	License Amendment No. 5 issued to increase fuel possession limit
3/29/91	License Amendment No. 6 issued to allow installation and use of microprocessor-based instrumentation and control system
4/10/91	Installed microprocessor-based instrumentation and control system
1/30/92	License Amendment No. 7 issued to require certain audits
2/24/92	Replaced demineralizer pump and motor
11/93	Replaced stationary Radiation Area Monitors (RAMs) throughout facility
3/27/95	Replaced primary cooling pump
4/3/95	Cleaned and repaired secondary cooling tank; installed thermoplastic liner inside secondary tank
3/16/98	License Amendment No. 8 issued to allow use of 12 wt% fuel
4/15/98	License Amendment No. 9 issued to delete references to NRC Regional office and require reporting to NRC Headquarters
10/15/99	Replaced the secondary cooling pump and motor
5/11/99	Replaced electronics in the Continuous Air Monitor (CAM)
5/18/00	Replaced the two computers in the control system (CSC and DAC) with faster, more reliable computers and upgraded the software.
12/18/01	Replaced the mechanical chart recorder on the console with a solid state, paperless recorder.

4. Maintenance and Repair of GSTR Equipment

Reactor equipment and major components have been maintained during the life of the facility as required by the Technical Specifications, facility procedures, and equipment manuals. Much of the maintenance is performed as part of the routine checks and inspections performed at daily, weekly, monthly, quarterly, semiannual, biennial, and 60-

month intervals. Minor equipment repair such as lubrication of rotating equipment, the replacement of belts, bearings, switches, etc. occurs as a routine part of the facility operation.

The existing GSTR reactor tank is of considerably more rugged construction than the original tank. The original GSTR reactor tank was made of 0.25" thick aluminum. The new reactor tank is made of aluminum that is 1.00" thick on the bottom with the thickness reduced in steps until the top 10' is again 0.25" thick. The new tank sits inside of the old tank and it is dry on the outside; that is, the outside of the new tank is surrounded by an air void that is nominally 2" thick. This eliminates the potential corrosion caused by the tank coming in contact with moisture that may be present in the supporting concrete monolith. Aluminum is not subject to ductile-brittle transition. Reactor water is maintained by continuous filtering and deionizing of the water to maintain the conductivity less than 5 μmhos. At the end of the requested license extension term, the new reactor tank will have seen less than 22 years of service.

The existing control and instrumentation system was installed in 1991 and recently upgraded (in 2000) to provide a high level of functioning and reliability. At the end of the requested 40-year license term, the reactor control and instrumentation system will have seen less than 20 years of service since its initial installation and approximately 10 years of service since the last major upgrade.

Stationary radiation monitoring equipment (RAMs and CAM) have been replaced or provided major upgrades within 20 years of the end of the requested 40-year license term. The facility security alarm system has been continually maintained and upgraded as needed to maintain its reliable operation.

Major reactor cooling system components (primary pump, primary tank, secondary pump and secondary water tank have been replaced or upgraded since 1995. Both original pumps operated satisfactorily for over 25 years and the replacement pumps are equivalent or better such that an equivalent or longer operating life is expected.

5. Safety Evaluation

The basis for this request of recovery of facility shutdown time is that the USGS will not have received the full benefit of its 40-year license if it is allowed to expire on October 10, 2007. The failure to achieve the full benefit is not and was not within the control of the USGS. The issuance of a reactor operating license constitutes a significant investment on the part of the licensee and the regulatory agency. It is especially important to the USGS that the full benefit of that investment is realized.

Routine compliance inspections, facility oversight and audits have ensured that the facility has been operated in a safe manner. Facility changes that might affect safety-related equipment were evaluated and reviewed, either through the process specified in 10 CFR 50.59 or through a formal amendment request that was submitted to the regulatory

agency. The Reactor Operations Committee also meets at least twice a year to provide safety oversight of the facility and its operations. During more than 33 years of reactor operation, the types of experiments and operations performed at the facility have remained substantially the same.

The Emergency Plan and Procedures, Security Plan, Facility Procedures and Facility Operations Manual have been maintained up-to-date throughout the life of the facility.

The reactor building has received routine maintenance and repairs such as painting, re-roofing, and maintenance of lighting, heating and cooling systems. The building is fully occupied by federal workers involved in basic earth science research. The General Services Administration (GSA) is responsible for the ongoing maintenance and repair of the building.

The GSTR is located within the confines of the DFC, a controlled-access, 609-acre facility that houses numerous federal agencies. Although safety analyses of the GSTR show that the radiological affect of the maximum credible accident at the GSTR would have minimal consequences outside of the DFC boundary, routine environmental surveillance has been performed both inside and up to 4 miles outside of the DFC boundary. Environmental samples were collected prior to the commencement of operations in 1969 and further sampling has been performed on a biennial basis.

Contamination control is maintained through good personnel training, good housekeeping practices within the facility, and monthly wipe tests and surveys. Contamination within the facility has always been minor and has always been cleaned up as soon as it was discovered. The primary gaseous effluent is argon-41, a normal activation product that primarily occurs from activation of dissolved air in the cooling water. The primary solid effluent has been ion exchange resin that was radioactive from impurities in the cooling water. There were only three years of liquid discharges, 1988-1990, when slightly contaminated water was discharged to the sanitary sewer as allowed in 10 CFR 20. Since 1990, the small quantities of contaminated water that may be generated have been evaporated or solidified for disposal. Three incidents involving minor fission product leakage from fuel clad failures occurred, in 1969, 1992, and 1994.

Periodic control rod and fuel element inspections have been performed as required over the life of the facility. Three fuel clad failures have occurred to date at the facility. The first failure was in a fueled-follower control rod during the early operations of the GSTR. This was due to a manufacturing defect. The remaining two fuel clad failures occurred as pinhole leaks in two instrumented elements that were manufactured at the same time. Fuel clad failures have been accompanied with the identification of Kr-88, Rb-88, and Cs-138 fission products in the reactor water and air above the reactor tank. All three clad failures were quickly detected and annunciated by the facility's continuous air monitor (CAM). No fuel elements have failed the inspections that check for element bowing, elongation, and visual defects. Although the GSTR is a pulsing reactor, the GSTR is rarely pulsed. Within the first 10 years of operation, 145 pulses were performed. Over

the next 23 years of operation, only 41 additional pulses were performed. This low pulse frequency is expected to continue.

6. Conclusion

The USGS believes that the design, operation, testing, and monitoring of the GSTR mechanical and electrical equipment, structures, and reactor tank justify the requested 855 day extension of the GSTR operating license.