Nuclear

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TMI-2 Cleanup Project Directorate
Attn: Dr. W. D. Travers
Director
US Nuclear Regulatory Commission
c/o Three Mile Island Nuclear Station
Middletown, PA 17057

Dear Dr. Travers:

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
Use of Plasma Arc Torch

GPU Nuclear letter 4410-86-L-0132 dated August 18, 1986, proposed to remove upper end fittings from the reactor vessel (RV) and store them in containers external to the RV. The purpose of this letter is to describe an alternative to the storage of end fittings which is currently under consideration. GPU Nuclear proposes to use a plasma arc torch to cut the upper end fittings inside the RV so that they may be placed directly in fuel canisters for transfer from the RV to the fuel canal. This proposal does not replace the storage option; it provides an alternative to be considered.

The equipment to be utilized for cutting the upper end fittings will consist of a frame, an end fitting clamping station and indexing device, an analog multi-axis cutting and tracking system and a plasma arc torch. The frame assembly will interface with the tool slot of the Defueling Platform. The plasma arc tracking device will provide guidance for the required cutting configurations needed to properly cut the end fitting. The plasma arc torch is mounted in the tracking unit. The plasma arc torch is a tungsten electrode, water-cooled metal cutting device that utilizes a direct-current, high frequency, stabilized arc between the tungsten electrode and work piece to perform the cutting. Off-site testing of plasma arc cutting devices has provided assurance that this is a viable method of sizing end fittings.



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Safety considerations relative to this proposal are:

1. Primary system integrity
2. Gas release
3. Radioactive releases
4. RCS water heat up
5. Pyrophoricity
6. Instrument interference

Each of these concerns has been considered in the following manner:

1. Primary System Integrity - Cutting of the end fittings with the plasma arc torch will be performed below the water level of the RV. In addition, the torch will not be operated near the Internal Indexing Fixture (IIF) cylinder or the Core Support Assembly (CSA) upper cylinder. The process of cutting with the remote - underwater plasma torch requires a specific and deliberate operator action. The operator controlled settings for location, thickness of metal, water depth, speed of cut and cut location preclude the torch from accidentally cutting material significantly different from that initially programmed. In addition, it is not possible to pass an arc current through more than 1/2 to 3/4 of an inch of water; therefore, damage to the reactor pressure vessel or the IIF is precluded.

2. Gas Release - The gases to be used with the plasma arc torch, either separately or in combination, are nitrogen, carbon dioxide, and argon. Each of these gases is non-flammable and non-toxic. Testing of the plasma arc torch has shown that off-gas rates of 5 to 7 SCFM are typical. An additional 1 to 2 SCFM may be added due to the cover gas. Therefore, maximum off-gas flow is estimated at less than 10 SCFM. This gas will readily mix with the ventilation flow of 4000 SCFM of the Defueling Platform Off-Gas System. Any steam that may be generated during operation will condense before breaking the water surface. The off-gas from the operation of the plasma arc will not represent a safety concern to the operators.

3. Radioactivity Releases - The central zone of the plasma arc torch reaches temperatures of 20,000 to 50,000°F and is completely ionized. The plasma arc torch heats and melts the metal by transfer of energy from the high-temperature, high energy arc between the electrode and work piece. It is expected that any fuel on these metal surfaces will be heated to the liquid or vapor state, immediately oxidize, transfer its heat to the surrounding water, resolidify and sink into the RV. Soluble isotopes trapped in the fuel matrix may become dissolved in the water. Any increase in the isotope concentration of the water is expected to be less than the increases noted during the core bore program.

4. RCS Water Heat Up - Calculations indicate that the energy input from the operation of the plasma arc will increase the RCS temperature no more than 0.25°F per hour.

5. Pyrophoricity - The Defueling Safety Evaluation Report (SER) addressed pyrophoricity concerns during defueling activities. This SER concludes that it would not be possible to sustain a pyrophoric reaction during planned defueling activities or postulated accidents. The use of the plasma arc torch does not affect the conclusions of the Defueling SER. In addition, off-site testing of the plasma arc torch with 7/16 inch diameter zircaloy tubes underwater indicated no pyrophoric tendency; in fact, the flame was self-extinguishing as the torch moved past the rods.

6. Instrument Interference - A high frequency generator is used to establish and stabilize the arc between the electrode and the work piece. The frequencies encountered have the capability to disrupt instruments inside the Reactor Building (RB), the most crucial being the criticality monitors. However, instrument interference is not expected to be a problem due to the shielding provided by the RV water. The high frequency generator is also shielded. In addition, the high frequency generator is used only for very short periods of time to establish and stabilize the arc. If interference with the criticality monitors occurs, administrative controls will be developed to prohibit any fuel movements in the RB during plasma arc torch operations. Any interference with other instruments will be handled in a similar manner.

Based on the above discussion, the proposed activity does not represent an unreviewed safety question since it does not increase the probability or consequences of a previously evaluated accident, create the possibility of an accident different than previously evaluated, or reduce the margin of safety as defined in the Technical Specifications. Therefore, the proposed activity can be performed without under risk to the health and safety of public.

Sincerely,

Thomas J. Dennett

F. R. Standerfer
Vice President/Director, TMI-2

FRS/CJD/eml