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US Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Dear Sirs:

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

The purpose of this letter is to present the results of the GPU Nuclear evaluations concerning the off-gas releases generated during plasma arc cutting of Reactor Vessel components. As stated in GPU Nuclear letter 4410-87-L-0067 dated May 7, 1987, it is currently planned to use nitrogen, N_2, as the primary and secondary torch gases. GPU Nuclear has evaluated the off-gas releases as a result of using nitrogen and has determined that there are no safety concerns associated with its use.

During underwater plasma arc cutting operations with nitrogen, the relatively abundant elements of nitrogen and oxygen can combine to form oxides of different molecular composition. The principal oxides of concern are nitric oxide, NO, and nitrogen dioxide, NO_2. During cutting operations, nitric oxide will initially be formed as its formation is favored at the high temperatures produced by the plasma arc torch. NO is subsequently oxidized in the atmosphere to the more toxic and irritating compound nitrogen dioxide.

Nitric oxide gas is colorless, odorless, and only slightly soluble (approximately 60 ppm by weight at 25°C in water). The threshold limit value (TLV) for NO as listed by the American Conference of Governmental Industrial Hygienists (AIGIH) is 30 mg NO/m^3 or 25 ppm NO by volume. Nitrogen dioxide gas is a light yellowish-orange color at low concentrations and a reddish brown color at high concentrations. NO_2 has a very pungent odor, a high

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oxidation rate, and is very corrosive. The TLV for NO_2 as listed by the AIGIH is 6 mg/m^3 or 3 ppm NO_2 by volume. The oxides NO and NO_2 are commonly designated by the composite formula NO_x.

GPU Nuclear has experimentally established the fractional conversion of nitrogen to NO_x from off-gas sampling measurements made during the course of testing the TMI-2 plasma arc torch. These sampling measurements were made during torch cutting operations in a small test tank (approximately 2200 gallons). The gas sampling results indicated one peak measurement of 7200 ppm; however, a simple arithmetic average of all peak measurements was less than 3000 ppm. Consequently, while there existed variation in the NO_x measurements, all gas sampling data indicates that less than one (1) volume percent of the total nitrogen torch gas volume (4 cfm primary and 7 cfm secondary) is converted to NO_x during torch operation, and the majority of the data supports less than 0.3 volume % (i.e., 0.003 ft^3 NO_x/ft^3 N_2).

During in-vessel cutting, the off-gas will be collected above the RV and transferred to the "B" D-ring in the vicinity of the plant purge system exhaust suction point. The purge is routed to the station vent, where it is again diluted by the Auxiliary Building and Fuel Handling Building ventilation system exhausts. Thus, the off-gas from the plasma arc cutting is diluted with large air volumes of the Reactor Building or large air flows existing in plant ventilation systems prior to any exposure to personnel or the environment.

The maximum nitrogen oxide production rate during cutting is about 0.033 ft^3/min (0.003 ft^3 NO_x/ft^3 N_2 x 11 ft^3 N_2/min). Using this production rate the maximum concentration for any dilution flow rate can be estimated. For example, at the release point from the Defueling Work Platform off-gas system, which has flow rate of approximately 4000 cfm, the concentration would be approximately 8 ppm of NO_x by volume (0.033 ft^3 NO_x/min)/(4000 ft^3 air/min). The maximum concentration in the purge system, assuming direct intake from the off-gas system, and assuming a purge flow rate of 25,000 cfm, would be approximately 1 ppm. For a station vent flow rate of 100,000 cfm the release point concentration would be 0.33 ppm by volume.

The average concentration in the Reactor Building may also be calculated for different time intervals. Assuming no purge operation, a containment air volume 2 x 10^6 ft^3, and two (2) minutes of cutting per hour, the average concentration at the end of a 24-hour period would be less than 1 ppm (0.033 ft^3/min x 2 min/hr x 24 hour)/(2E6 ft^3). Note that this assumes uniform mixing in the containment air volume. It also assumes an optimistic cutting rate and an average production rate of 3000 ppm measured during test cutting.

Thus, the concentrations of by-product gas in the Reactor Building are expected to remain acceptably low, even during periods of no purge operation. Administrative controls will be required to ensure that personnel access to the "B" D-ring is prohibited during plasma arc cutting. Work area monitoring for by-product gas will be performed by the Safety and Health Department to ensure occupational exposure limits are not exceeded.

In addition, since NO_2 is listed under the National Emission Standards for Hazardous Air Pollutants as promulgated by the United States Environmental Protection Agency under the Federal Clean Air Act, GPU Nuclear submitted an application requesting state (PA) exemption from plan approval and permitting requirements with respect to potential NO_2 emissions. The state (PA) granted GPU Nuclear this exemption.

Sincerely,

F. R. Standerfer
Director, TMI-2

FRS/CJD/eml

cc: Regional Administrator, Region 1 - W. T. Russell
Director, TMI-2 Cleanup Project Directorate - Dr. W. D. Travers