JUN 28 1988

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MEMORANDUM FOR: Ronald L. Ballard, Chief
Technical Review Branch, HLWM

FROM: Richard A. Weller, Section Leader
Materials Engineering Section
Technical Review Branch, HLWM

SUBJECT: MINUTES OF JUNE 9, 1988 MEETING WITH ARGONNE NATIONAL LABORATORY (ANL) STAFF ON THE DOE INTEGRAL FAST REACTOR

On June 9, 1988, NRC staff representatives from the Office of Nuclear Material Safety and Safeguards (Division of High-Level Waste Management; Division of Low-Level Waste Management and Decommissioning; Division of Fuel Cycle, Medical, Academic and Commercial Use Safety; and Planning Management, Policy Development and Analysis Staff) and Office of Nuclear Regulatory Research (Division of Engineering) met with representatives from the Argonne National Laboratory (Chemical Technology Division) to discuss the planned Department of Energy Integral Fast Reactor (IFR) and its closely coupled fuel cycle. A list of attendees and the meeting agenda are enclosed (Enclosure 1).

As stated in the May 2, 1988 letter (Enclosure 2) from T. Johnson, ANL, to R. Browning, NRC, the primary purpose of the meeting was to familiarize NRC staff with the IFR and its fuel cycle, establish informal contacts with agency staff, and obtain guidance from NRC staff on the detailed aspects of the treatment and disposal of both high-level and low-level wastes resulting from the reprocessing of IFR spent fuel. By letter (Enclosure 3) dated May 27, 1988, from R. Browning, NRC, to T. Johnson, ANL, informal contacts were established for the Division of High-Level Waste Management (R. Weller) and the Division of Low-Level Waste Management and Decommissioning (M. Tokar).

Les Burris (ANL) opened the meeting with an overview of the IFR and its coupled fuel cycle (see handouts, enclosures 4 and 5). The IFR is being developed by the DOE as an advanced reactor concept with planned commercialization. The IFR is a pool type, sodium cooled, fast breeder reactor with metal alloy (U, Pu and Zr) fuel with stainless steel cladding. The reactor concept is based on the assumption that discharged fuels from both the core and blanket will be reprocessed such that recovered U and Pu can be returned to the reactor as refabricated metal alloy fuel. The conceptual design provides for spent fuel reprocessing and fuel fabrication in facilities adjoining the reactor. Fuel reprocessing would employ a pyrochemical electrorefining process to separate and recover the actinides from the fission products. Planning assumptions related to the disposition of the various waste streams resulting from fuel reprocessing include the following. Transuranic (TRU) and high-level wastes would be disposed of in a geologic repository (e.g., Yucca Mountain) and low-level wastes would be disposed of in an on-site (i.e., reactor site) engineered

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near surface repository. With regard to the ANL planning assumption of on-site disposal of low-level waste, M. Tokar advised that present policy gives the states the responsibility for low-level waste disposal and that ANL planning assumptions should be consistent with that policy and the current efforts to establish state compacts and low-level waste disposal sites.

Following the general overview of the IFR and the coupled fuel cycle, T. Johnson described the principal waste streams that would be generated by reprocessing activities and discussed the proposed means for waste treatment, handling and disposal (see handout, enclosure 6). The proposed reprocessing of the IFR discharged fuels by a pyrochemical electrorefining process is substantially different from the more familiar PUREX process and yields waste streams with similarly different characteristics and properties. The first step in the reprocessing cycle involves the mechanical separation of core and blanket fuel from the cladding material and the chopping of the fuel pins and cladding into segments. The chopped fuel and cladding are then placed in a basket in the electrorefiner which consists of a liquid metal anode (cadmium at 500°C), a molten salt electrolyte, and a cathode (either a solid steel rod or liquid cadmium). The fuel segments first dissolve into the liquid metal anode (i.e., cadmium) and Pu and U are electrolytically transported from the liquid metal anode through the molten salt electrolyte to the liquid metal cathode where they are deposited. A solid steel cathode is used to selectively deposit uranium from blanket fuel.

The fission products remain behind in the molten salt electrolyte and liquid metal anode (i.e., cadmium). Thus, the principal waste streams in the electrorefining process are the molten salt electrolyte and cadmium metal waste and ANL was advised that these streams should be considered as "high-level wastes", consistent with the definition in 10 CFR Part 60 (i.e., extraction wastes from fuel reprocessing).

The molten salt waste stream is treated with a liquid cadmium/lithium mixture to extract residual actinides from the salt waste. Rare earth fission products also distribute preferentially in the liquid cadmium/lithium mixture. The treated salt (non-TRU) would then be mixed with cement and disposed of in an on-site engineered, near-surface repository. We advised ANL that the salt/cement waste form would fit the definition of high-level waste and should be planned to be disposed of in a geologic repository. We also advised ANL of the proposed modifications to 10 CFR Part 61 which may require greater-than-class-C wastes to be disposed of in a geologic repository. ANL was further advised to consider alternatives to solidification of the salt in cement inasmuch as this would result in a significant increase in the volume of the waste and ANL should be evaluating methods which result in volume reduction (e.g., treatment of the waste stream through zeolite or other suitable resin). T. Johnson was informed of the developmental work by P. Macedo (Catholic University) on glass resin beads.

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The highly contaminated cadmium metal waste stream from the electrorefiner would be combined with the TRU-contaminated cadmium/lithium mixture extracted from the molten salt processing stream and passed through a retort to distill off the cadmium which can then be recycled to the electrorefiner. The residue from the retort, including undissolved cladding hulls, would then be encapsulated in a copper matrix and outer container in a manner similar to the Swedish KBS-3 program. Disposal of this waste would be in a high-level waste geologic repository.

Secondary waste streams from IFR fuel reprocessing include what are expected to be non-TRU, low-level metal wastes consisting primarily of fuel assembly hardware (e.g., end fittings, spacer grids, etc.). This waste would be decontaminated and all sodium would be removed prior to compaction (if possible) and placement in a container. ANL had planned to dispose of this waste in an on-site near surface repository but was again advised of the state responsibility for low-level waste disposal. ANL was also advised that if the waste is classified as greater-than-class-C waste, it may require disposal in the geologic repository, consistent with the proposed changes to 10 CFR Part 61.

ANL seemed pleased with the outcome of the meeting and we reiterated our availability as contacts for continued interaction as plans for the IFR progress.

/s/

Richard A. Weller, Section Leader
Materials Engineering Section
Technical Review Branch, HLWM

Enclosures:
As stated

cc: M. Tokar, LLWM
R. Grill, RES
T. Clark, FC
G. Lear, NMSS

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ENCLOSURE 1

IFR MEETING AGENDA

Overview of IFR Fuel Cycle .....L. Burris
Description of IFR Process Wastes.....T.R. Johnson
Proposed Waste Treatment.....T.R. Johnson
Proposed Waste Forms for Disposal.....T.R. Johnson
Comments and Discussion

IFR MEETING ATTENDEES

NRC	ANL
Rick Weller	Terry Johnson, Chemical Technology Div., ANL
Mike Tokar	Les Burris, Chemical Technology Div., ANL
Dick Grill	
Tom Clark	
George Lear	