

**IDAHO NATIONAL LABORATORY (INL)  
BIDDERS TOUR SCRIPT  
FOR ARGONNE NATIONAL LABORATORY – WEST (ANL-W)  
FEBRUARY 17, 2004**

This script establishes the outline for the ANL-W bidders tours for February and March 2004. The script provides an outline for topics and key points to be addressed during the tour, and is not intended to be read aloud verbatim. All items and key points on the outline will be addressed during the tour or the working lunch presentation. This tour script, the working lunch presentation and related background material will be provided to the INL Source Evaluation Board (SEB) to be posted to the SEB's website. General facility, equipment and process information will be provided according to the outline, but are not scripted word for word. Program information will be provided to bidders only according to the outline. Questions and answers will be provided according to the SEB directions to bidders and tour presenters. The outline is provided below in the order in which the ANL-W facility tours will be conducted.

## **TREAT and TREAT Warehouse** – prior to entry ensure:

- tour log and accountability
- no prohibited items, especially cameras (including cell phone cameras) or recording devices
- safety reminder to stay with tour and follow directions
  
- TREAT high bay south of the reactor – key points:
  - o Reactor purpose, fuel type, method of cooling
  - o Reactor capabilities
    - Type B reactor
    - Up to 17GW pulse; pulse widths as narrow as 60-80 msec
    - Steady state power levels
    - Test loop capability
    - Hodoscope
    - Neutron radiography
    - Casks
    - TREAT Upgrade fuel storage
  - o TREAT DSA – key points
    - Cat II Nuclear
    - Allows non-reactor experiments in TREAT facility
    - RCRA permitted treatment and storage facility
    - Requires upgrade before reactor startup
  - o Key missions: DTRA training
- TREAT Warehouse
  - o Purpose, construction
  - o DSA – Cat III Nuclear Facility
  - o HUP Storage features
- On Return to gatehouse point out TREAT Control Room
  - o Old equipment; no longer supported
  - o Would require upgrade before reactor restart
  - o Hantavirus concerns
- Unique features:
  - o Reactor – unique pulse testing and real time neutron (hodoscope) and neutron radiography capability
  - o DSA supports a wide variety of nuclear facility experiments – has made TREAT high bay attractive for many programs in past

## **Working Lunch**

- Provide facility overview and orientation
- Ensure metal items are minimized prior to visiting PA
- Ensure S. Mousseau ready for access to PA
- Hospitality break

## ZPPR, FMF and 792

- **ZPPR**
  - Show Safeguards Cat I vault door (door secured – no vault entry)
    - Purpose/mission: safely store ZPPR fuel and other SNM
    - Activities: storage and SNM inventory
    - Provide no information about specific security measures
  - Workroom
    - Purpose
      - SNM handling, RPS/HS activities in support of Near Term Mission
  - ZPPR Cell
    - Purpose/Mission: Maintain ZPPR in Standby condition and support RPS/HS
    - F-5 RTG storage
    - Reactor construction and operation; cell construction
    - NTM Glovebox – for assembly and test of RTGs for a classified customer. Mission schedule not supported by 792/792A construction schedule. When 792/792A complete, similar RTGs, if any will be made in 792A.
- **ZPPR DSA**
  - Vault/Workroom – Cat II Nuclear
  - Cell – Cat III Nuclear
  - ZPPR BIO currently under DOE review; NTM BIO to be submitted
  - DBA is reactor fire
  - ANL-E CS experts perform criticality hazards analyses of ZPPR processes and storage configurations in the ZPPR vault. ANL-E also provides CS analytical support for process changes in the ZPPR facility.
- **Unique features:**
  - Reactor
    - one of largest split table reactors in world still capable of supporting critical experiments
    - stable temperature provides very precise neutronics measurements
    - extensive existing store of experimental data
    - fuel is unique

- **FMF**
  - Purpose/mission: Support AFCI and RPS/HS
  - South Room
    - Furnace Room – supported HEU vulnerability remediation until this year
    - Gloveboxes – supported HEU vulnerability remediation and AFCI program (EMT waste form qualification (ceramic/metal))
  - North Room
    - AFCI Glovebox – fuel specimen fabrication
    - Radiography room
    - Safeguards Cat I Vault Door (door secured – no vault entry)
    - NDA
  - FMF DSA
    - Current approved DSA
    - Cat II Nuclear
    - ANL-E CS experts perform criticality hazards analyses of FMF processes and storage configurations in the FMF vault. ANL-E also provides CS analytical support for FMF process changes.

On way back from PA point out the EML –

- Radiological Facility
- SEM/TEM capability

## Analytical Laboratory

- **Purpose Mission:**
  - Support ANL-W reactor fuel cycle and environmental missions with process and process and R&D analytical capabilities
  - Environmental analysis, operational analysis, and radiochemistry support for the site and other DOE Programs
- **Safeguards Cat III**
- **DSA**
  - Cat III Nuclear
  - ANL-E personnel contributed to the new AL DSA (hazard classification and analysis, accident consequence analysis, response to DOE questions)
- **6 Air Atmosphere Hot Cells**
  - Remote handled analytical chemistry capability, including state of the art instrumental methods of analysis
  - Pneumatic transfer system between AL, FCF, and HFEF
  - ANL-E (CMT) collaborated on development of some analytical methods used to characterize performance of EMT processes, e.g. determining extent of electrolytic reduction of oxide fuels (a current AFCI work activity)
  - collaboration with ANL-E on validation of the MTG tracking system code
- **Gloveboxes for analyses not requiring shielding**
  - E.G. - Ceramic waste form development, collection of thermal data (material heat transfer properties) on advanced fuels (this is the glovebox on the north behind the hot cells)
  - E.G. - Actinide containing samples (east box), pyrophoric/hygroscopic materials (west box)
- **Casting Lab** – show from door
  - Purpose/mission: Engineering lab for fabricating advanced fuels and preparing them for irradiation.
  - Unique capabilities – TRU material processing and fuel specimen fabrication. Arc furnace
- **NDA lab** - show from door: NDA (gamma interrogation) of fissile materials - Up to drum size objects
- **Unique AL capabilities**
  - Carbon-oxygen-nitrogen analysis (Cell 3)
  - Shielded inductively coupled plasma atomic emission spectroscopy (Cell 6)
  - Atomic absorption spectrometry (total of five: Cell 5 and RCRA lab in B-wing)
  - Thermal ionization and isotope dilution spectrometry (B-wing; south side, western most door)
  - Beta, Gamma and alpha spectrometry (B-wing; south side)
  - Inductively coupled plasma mass spectrometry - for isotopic analyses at the trace level, including higher actinides (B-wing; east end by NDA lab)
  - X-ray diffraction and X-ray fluorescence (B-wing; south side across from casting lab)

## FCF

- **Purpose/mission:** treat the inventory of stored sodium-bonded spent fuel from the EBR-II using electrometallurgical treatment technology
- Describe the EMT process and show air and argon cells
- DSA
  - o Cat II Nuclear
  - o *Criticality Hazard Analysis* – ANL-E performed the original analyses of spent fuel treatment process steps and storage configurations. They continue to provide analytical support for all proposed process changes.
  - o *Facility Safety Analysis* - ANL-E performed much of the accident analysis that is the basis for the FCF Final Safety Analysis Report. They continue to provide support by preparing and/or reviewing USQ determinations.
  - o *Material-at-risk Analysis* - ANL-E performed much of the thermal analysis that is the **basis for the ignition temperature assumed for potentially pyrophoric materials** that result from process steps in the treatment of EBR-II spent fuel. They continue to provide support by analyzing proposed changes to process conditions.
- **Unique features:**
  - o Only location in US performing EMT on SNF to recover U and treat SNF for disposition

## Point out areas where ANL-E support is important to ANL-W success:

- **Analyses:**
  - o *Statistical Analysis for in-cell balances* - developed the statistical basis for **verifying the accuracy of the in-cell balances used for material accountability**. They continue to provide support for maintaining the software that allows operators to interact with the balances.
  - o *Reactor Physics Analysis* - developed the reactor physics model of the EBR-II reactor core that **calculates the isotopic composition of spent Mk-III fuel**. They are **currently modifying the model to calculate the isotopic composition of spent Mk-II fuel**
  - o *Structural and Seismic* - performed and /or reviewed seismic and structural analysis for some of the modifications made to the FCF in the early 1990s and developed the basis for **seismic analysis of process equipment in FCF**. They are currently **designing structural upgrades** for the facility.
  - o
- **Computer code development:**
  - o Material Control and Accountability developed the **material control and accountability software used in FCF** - continue to support management of the database and for changes and improvements needed to support fuel treatment.
  - o *Thermal Analysis* - performed much of the original **thermal analysis of the process equipment** and storage configurations developed for the treatment of EBR-II spent fuel. They continue to provide support by analyzing proposed changes in storage configurations and processes.
  - o *Electrochemical Process Modeling* - developed **mathematical models of the electrometallurgical processes used to treat EBR-II fuel**. They continue to provide support by modeling proposed changes to those processes.
- **Equipment development:**

- *Electrorefiner* - Chemical Engineering Division (CMT) personnel developed the electrometallurgical process used to treat EBR-II spent fuel and they continue to develop **process improvements to recover transuranic elements and to increase throughput**. They use specially designed laboratory-scale and engineering-scale equipment installed in gloveboxes in Bldg 205.
  - designed and qualified the electrorefiners and associated handling equipment used in FCF to treat EBR-II spent fuel. They continue to provide support by designing equipment improvements and by consulting to resolve equipment problems.
- *Cathode Processor* - developed the **high-temperature vacuum distillation furnace**, commonly called the cathode processor, which is used to remove salt from the electrorefiner products produced in FCF. They continue to provide support by investigating improved **crucible materials**, including testing of those materials in an **engineering-scale prototype cathode processor** in Bldg 308 in Illinois.
  - designed and qualified the cathode processor and associated handling equipment used in FCF. They continue to provide support by designing equipment improvements, which they test in the prototype cathode processor in Bldg 308, and by consulting to resolve equipment problems.
- **UCl<sub>3</sub> Production**

ANL-E CMT personnel developed a chlorination process to **produce UCl<sub>3</sub>**, which is used as a chemical oxidant in the FCF electrorefiners, when a commercial source of this material could not be located. They installed engineering-scale **chlorination equipment in a glovebox** in Bldg 205 and continue to produce UCl<sub>3</sub>, as necessary, to meet the processing needs of FCF.

## **EBR-II**

Containment entry to show size and material condition.

Stop at turbine deck.

Show 2.4KV and 13.8 KV switchgear to illustrate how EBR-II supports site infrastructure.

## HFEF

- Purpose/mission:
  - o Perform post-irradiation examination of reactor fuels, and
  - o Characterize and package spent fuel and radioactive waste, including high-level waste for ultimate disposition in a geologic repository.
  - o Characterize, core drill, repackage and treat drums of contact-handled TRU waste in the (WCA)
- Safeguards Cat IV facility – performs some classified work (e.g. TPBARs)
- Unique Features:
  - o Can handle full length commercial fuel elements
  - o Designed for repair w/o manned entry

## DSA

- Nuclear Cat II facility Criticality Hazard Analysis
- ANL-E personnel performed the original analyses of all spent fuel treatment waste form process steps and storage configurations in HFEF & provide analytical support for proposed process changes.
- ANL-E personnel prepared the recent revision to the HFEF SAR, including the potential hazard evaluation, classification and analysis. They also preparing and/or reviewing USQ determinations.

## ANL-E support important to ANL-W:

- **Analyses:**
    - o Thermal Analysis - recently performed thermal analysis of the storage configurations developed for the handling of EBR-II spent fuel cladding to support the hazard assessment.
    - o Waste Form Performance Modeling - developed simplified mathematical models to evaluate the performance of waste forms in the proposed Yucca Mountain repository. They continued to use these models to evaluate the effects of separating various fission and activation products from the waste forms.
  - **Computer Codes:**
    - o Material Control and Accountability - expanded the material control and accountability software used in FCF to also track nuclear material in HFEF. They continue to provide support for management of the database and for changes and improvements needed to support waste form production.
  - **Equipment:**
    - o Metal Waste Furnace - developed a conceptual design for an alternative engineering-scale metal waste furnace based on the cathode processor configuration used in FCF. They also provided support for a design developed at ANL-W by testing metal waste crucible configurations and materials in the prototype cathode processor in Bldg 308.
- **Waste Form Qualification**

CMT personnel developed the ceramic and metal waste forms for the fission and activation products that are separated from uranium by electrometallurgical treatment of spent fuel. They also performed much of the testing to qualify the waste forms as acceptable for placement in the proposed Yucca Mountain repository. They continue to perform long term tests under various simulated repository conditions.

## **Outside Tour**

**FASB** – Show location

**RTP** – Proposed location just west of HFEF; proposed to share HFEF truck lock and cask transport

**SCMS** – remove Na/NaK contamination from EBR-II components; now RCRA TSD used to support a wide variety of RCRA treatment missions. SAP, Aquaset and other methods used to treat hazardous constituents to pass TCLP.

High bay door will be open.

**SPF** – Show truck lock and processing building

**RSWF** – Show location

**RLWTF** – Uses ANL-W developed shielded hot air drum evaporators to evaporate non-hazardous rad wastes. SHADES are simple and cheap; easily constructed from 55 gal drum, culvert, piping and cement. Disposal at RWMC as LLW

**ORSA/ RSSF** - ORSA (Outside Radioactive Storage Area) is a radioactive materials storage facility. Contains RSSF, for which RCRA closure is in progress

**CESB** – Stores EBR-II components in west section; contaminated material handling, including RCRA treatment and storage in east side.

**EDL** – Show location