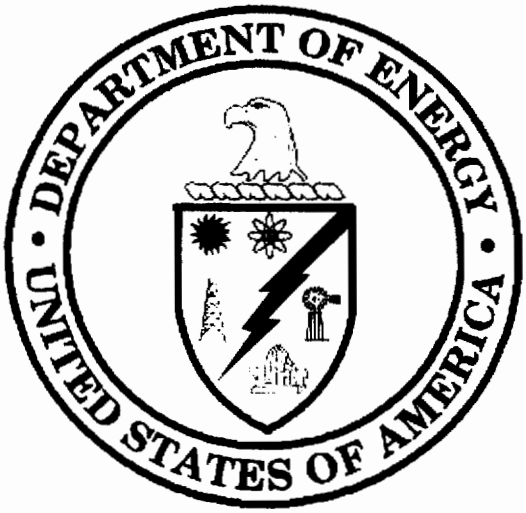

Report of the Review of the Hanford Tank Closure & Waste Management Environmental Impact Statement (EIS) Quality Assurance Follow Up

November 2008

Hanford Tank Closure and Waste Management Environment Impact Statement (EIS)

Review Report

REVIEW AND APPROVAL:

Prepared by: _____ Date: _____
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Office of Environmental Management

Approved by: _____ Date: 2/19/09
Frank Marcinowski
Deputy Assistant Secretary for Environmental Compliance.
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1.0 BACKGROUND

In January 2003, DOE started to prepare the Tank Closure EIS which included closure of the 149 underground SSTs and newly available information on supplemental treatment for the LAW. In January 2004, DOE issued the Hanford Solid Waste EIS and a ROD (69 FR 39449), which addressed ongoing solid waste management operations, and announced DOE's decision to dispose of Hanford and offsite LLW and MLLW in a new Integrated Disposal Facility in the 200-East Area of Hanford.

Washington State Department of Ecology had previously joined an existing lawsuit brought by Columbia Riverkeeper [Civ. No CT-03-5044-AAM and CT-03-5018] seeking to prevent shipments of TRU, TRU-mixed, LLW and LLMW to the Hanford Site. When the final HSW EIS and Record of Decision were issued, Washington State amended its complaint to also challenge the Hanford Solid Waste EIS. During the lawsuit (State of Washington v. Bodman [Civil No. 2:03-cv-05018-AAM]) while preparing responses to discovery requests from Ecology, DOE discovered several differences in groundwater analyses between the HSW EIS and its underlying data. DOE immediately notified the Court and Washington State and, in September 2005, convened a team of DOE experts in quality assurance and groundwater analysis, as well as transportation human health and safety impacts analysis, to conduct a quality assurance review of the HSW EIS. The team completed its *Report of the Review of the Hanford Solid Waste Environmental Impact Statement (EIS) Data Quality, Control and Management Issues, January 2006 (hereafter referred to as the Quality Review).*

DOE and Ecology subsequently announced a Settlement Agreement ending the NEPA litigation on January 9, 2006. The agreement is intended to resolve concerns about HSW EIS groundwater analyses and to address other potential concerns about the HSW EIS, such as those identified in the Quality Review. The Agreement expanded the scope of the existing TC EIS to provide a single, integrated set of analyses that will include all waste types analyzed in the HSW EIS (LLW, MLLW, and TRU waste). The expanded EIS was renamed the TC & WM EIS. Pending finalization of the TC & WM EIS, the HSW EIS remains in effect to support ongoing waste management activities at Hanford (including shipping waste off site such as TRU waste shipments to WIPP) in accordance with applicable regulatory requirements. The Agreement stipulates that when the TC & WM EIS has been completed, it will supersede the HSW EIS. Until that time, DOE can not rely on HSW EIS groundwater analyses for decision-making, and DOE will not import offsite waste to Hanford, with certain limited exemptions as specified in the Agreement.

In October of 2006 EM issued a *Report of the Review of the Hanford Tank Closure & Waste Management Environmental Impact Statement (EIS).* This review focused on reviewing the Tank Closure & Waste Management EIS to ensure that the deficiencies found in the *HSW EIS Data Quality, Review* dated January 2006 did not exist. This review of the Tank Closure & Waste Management EIS focused on those areas which were relevant at the time the review was conducted including 1) personnel training, 2) roles and responsibilities with respect to DOE Order 451.1B and 3) data issues found to date through the existing QA process related to site

data and databases. There were a number of areas which could not be reviewed at the time because the EIS was not far enough along that the information existed to review.

2.0 REVIEW APPROACH

This current review focuses on the outstanding issues which were first identified in the *Report of the Review of the Hanford Solid Waste Environmental Impact Statement (EIS Data Quality, Control and Management Issues,* dated January 2006, which include the following items: 1) review of software quality assurance, and 2) review of QA procedures applied to groundwater, transportation, human health and safety analysis, as well as a 3) review of recommendations made in *Report of the Review of the Hanford Tank Closure & Waste Management EIS* dated October 2006. These areas were picked because groundwater, human health and safety and transportation were the three resource areas where data quality issues had been identified in the *Hanford Solid Waste EIS.* Consistent with the Settlement Agreement between US Department of Energy (Bodman) and Washington Department of Ecology that the TC&WM EIS would re-analyze these resource areas which are sufficiently developed to allow QA review.

The DOE review team will include subject matter experts with respect to EIS development, process methodology, quality assurance and data quality management. SAIC will provide data and information as requested to support the DOE review team. Other site subject matter experts may be identified during the course of the review.
The types of things to be reviewed include;

- TC&WM NEPA Quality Assurance Plan
- TC&WM EIS Software Quality Assurance Procedures
- TC&WM EIS Records Management Procedure/Process
- TC&WM EIS Calculation Package Procedures
- TC&WM EIS Administrative Record Procedure

3.0 SUMMARY

A review was conducted at the Richland Operations Office on the TC & WM EIS in Richland, Washington from October 20 to October 24, 2008. This review focused on processes used to ensure compliance with regulatory and contract requirements.

This report is broken into five subject areas:

- Quality Assurance Programmatic Processes
- Air Analysis Processes
- Groundwater Analysis Processes
- Software Quality Assurance Processes

- Human Health Analysis Processes
- Transportation Analysis Processes

The following is a summary of the QA program processes reviewed:

Office of River Protection

The ORP TC & WM EIS QA program was assessed to determine compliance with applicable requirements and to address weaknesses in the program that could contribute to data errors or loss. The Team found the ORP TC & WM EIS plans and procedures have been updated since the last review conducted in October 2006. Several minor compliance issues were identified and are described in section 4.0 below.

SAIC

The SAIC TC & WM EIS Project was assessed to determine if adequate quality assurance controls were implemented to assure the quality of the HSW EIS data. Under its contract with DOE, SAIC is required to implement an appropriate QA program. SAIC has the required QA program in place and have fully implemented it since the last review conducted in October 2006. Several minor compliance issues were identified and are described in section 4.0 below.

The following is a summary of the Air Analysis/NEPA Processes reviewed:

Although the review was limited by the availability of final air emission calculation packages, there wasn't any indication of significant deficiencies in the completed work or, more importantly, the process used to develop the air emission impacts. SAIC has clearly defined procedures for the development and review of the calculation packages which ensure data is controlled and appropriately incorporated into subsequent air emission analysis.

SAIC has implemented a mature system to control and store EIS records which consists of three separate databases, the DOE Program File, the SAIC Project File, and the EIS Administrative Record. The Administrative Record Coordinator was readily able to demonstrate the storage and retrieval of records; however, data protection could be improved by increasing the frequency of off-site backup. The project has determined that calculation packages should be part of the Project File

The following is a summary of the Groundwater Analysis Processes reviewed:
Review of the TC & WM EIS groundwater modeling analysis emphasized the following four areas:

- procedures and practices used to develop groundwater modeling,
- process controls of input/output among model components,
- documentation of groundwater model input/output process controls, and
- documentation of groundwater modeling uncertainties.

Interviews and observations indicated sound processes and practices were used to develop the modeling analysis and control the input/output processes among model components. However, the review was limited by insufficient documentation in many areas including model development, input/output process controls, and modeling uncertainties.

The following is a summary of the Software Quality Assurance Processes reviewed:

The audit team evaluated software quality assurance activities (SQA) performed and documented by SAIC in the course of generating the Hanford TC&WM EIS document. Interviews were conducted with SAIC personnel October 22 – 24, 2008. Procedures were evaluated for adequacy, and documentation of procedure implementation was reviewed. The audit team determined that SAIC implemented DOE Order 414.1C and International Standard (ISO) 9001 Quality Management consensus standard program per their Quality Assurance Plan (QAP) (RPP 12763 Rev. 3, effective July 7, 2008).

The following is a summary of the Human Health Analysis Processes reviewed

The Human Health portion of the assessment was evaluated based upon the current objective evidence available. As of the date of the assessment, SAIC had completed one calculation package, 110-001-WORKER, Rev 0 "Involved Worker Dose", that falls within the Human Health discipline. The assessment of the Human Health discipline concluded that except as noted within the two Findings in the areas of corrections to documents and the validation of Excel spreadsheet formulas SAIC's process for the preparations, review, approval revision and control of calculations and analyses in the Human Health discipline is adequate, satisfactorily implemented and effective.

The following is a summary of the Transportation Analysis Processes reviewed

The transportation review looked at methods used in the assessment and the impacts evaluated. Selected impacts presented in the transportation appendix were correlated with their derivations in the supporting spreadsheets and computer code outputs. In general, the assumptions, methods, and input data used for the transportation analysis are reasonable and consistent with previous NEPA radiological transportation risk analyses. Some weak points were identified and recommendations made to address them.

4.0 REVIEW RESULTS

4.1. Quality Assurance Program

Office of River Protection

The Office of River Protection's TC & WM Project Quality Assurance Program compliance has improved since the last independent review conducted in June 2006. Several minor issues have been identified but the team has determined that the TC & WM Project Quality Assurance Program complies with the requirements of their QAP.

Training of personnel was assessed to ensure OPR project personnel were qualified to perform their various assign project functions. Training records were reviewed and are listed in appendix B. All training recorded reviewed were complete and no issues were identified.

The control of documents for the ORP Project is performed using procedure NEDP-0002 – Records Management and Document Control. Although the records used are controlled and only the most current revision is available, the details of that process are not well documented in the procedure.

Management and Independent Assessments are performed in accordance with RPP-12763 – The Environmental Impact Statement for Tank Closure and Waste Management: Quality Assurance Plan. An independent QA assessment was conducted in December 2007 and several management assessments have been performed by OPR personnel since the last independent review conducted in June 2006.

An issue was identified on 04/24/2008 during an ORP surveillance of the STOMP Material property review. The data when the calculation package would be complete and the issue resolved was identified during this review. When issues are identified it is required that they be resolved in a timely manner and to ensure that it does not impact the quality of the deliverable.

During the TC&WM EIS review conducted in June of 2006, a recommendation was made that the ORP NEPA program/SAIC NEPA program be included in the ORP oversight plan to insure compliance of the NEPA program. A review of the NEPA program was conducted in June 2006 but no further reviews have been conducted since the June 2006 review.

An interview of the ORP/RL NEPA Compliance Officer was conducted during the review. During the interview it was determined that the NCO has not been performing formal oversight of the NEPA program including the TC&WM EIS due to higher priority work being assigned to him. DOE O 451.1B requires the NCO to Assist with the NEPA process and document preparation. One way to comply with this requirement is to perform document oversight of the project.

SAIC

SAIC's TC & WM Project Quality Assurance Program compliance has improved since the last independent review conducted in June 2006. Several minor issues have been identified but the team has determined that the TC & WM Project Quality Assurance Program complies with the requirements of their QAP.

DOE O 414.1C, Criterion 5 requires the use of approved instructions and procedures to perform work. The control and use of TC&WM controlled documents/procedures is not prescribed in an approved instruction or procedure. The SAIC Corporate procedures

contain the processes necessary to ensure that only current procedures are used. These requirements should be flowed down in to project documents

Training of personnel was assessed to ensure SAIC project personnel were qualified to perform their various assign project functions. Training records were reviewed and are listed in appendix B. All training recorded reviewed were complete and no issues were identified.

Management and Independent Assessments are performed in accordance with SAIC QAAP 18.1 QA Audits, SAIC QAAP 18.3 Surveillances, and SAIC QAAP 18.4 Client Assessments. Samples of recent assessments were reviewed and meet the requirements of the SAIC QAP.

4.2. Air Analysis/NEPA Compliance

AIR:

Many air modeling calculation packages have not been finalized which limited the depth of this review. Only one package involving air modeling was complete, SAIC TC & WM EIS Calculation Package 050-003-R0, Nonradiological Air Quality – Hanford Baseline. Review of this package found that all SAIC required review parameters were not documented as required by SAIC procedure, however, the results should not be significantly affected due to the conservative nature of the input data, modeled parameters, and the AirMod model itself. The conservative nature of the data, model parameters and the model should counter any uncertainties associated with the air emission calculations. Additional review of air modeling calculation packages should be considered when they are finalized to obtain a greater sample before an overall conclusion should be made.

The review of SAIC calculation packages developed to determine air emission impacts revealed that the source or justification of some assumptions were not documented. One package, 050-004-R0, Nonradiological Air Quality Public Impacts Analysis – FFTF Alts 2&3 CON_IRTP, based its emission calculations on an assumption that construction activities at the Idaho National Laboratory would occur on an 8 hr/day, 5 day/week schedule. There was no justification or source for that limitation on construction. Another calculation package, 050-006-RO, TCWM Air Emission Splits, allocates the percentage of activity to occur at the 200-East and 200-West areas without providing a justification for the 50-50 split. The percent activity allotment outputs from this calculation package are used in subsequent packages to determine air emissions. There was no indication that the assumptions are incorrect, only that the reasoning for them was not documented.

NEPA:

SAIC has implemented a mature system to control and store EIS records which consists of three separate databases, the DOE Program File, the SAIC Project File, and the EIS Administrative Record. The Administrative Record Coordinator was readily able to demonstrate the storage and retrieval of records. The procedure, SAIC TC & WM EIS

Administrative Record and Project File, appeared provide sufficient requirements to ensure the identification and retention of necessary information. The majority of items are being digitized and retained electronically with the records being backed up locally and remotely for file protection. However, the remote backup was not being performed at a frequency to ensure all newly entered information was protected. The project should change the remote backup practices to ensure off-site data protection. The Administrative Record Coordinator was able to retrieve requested records by index number, source, and subject matter.

The DOE NDM commissioned Columbia Energy and Environmental Services to perform a review of the Administrative Record and other EIS project files in 2005. Since that time, the NDM has informally reviewed the Administrative Record system by requesting documents by source and subject and comparing the retrievals to her own informal list of documents. The NDM stated that an Administrative Record review is scheduled in the ORP integrated assessment plan to be completed by September 2009 with the assistance of DOE Legal Counsel. Since records not currently in the Administrative Record are being maintained in the DOE Program File or the SAIC Project File, there should not be a problem in obtaining documents for the Administrative Record when the planned review is completed.

Currently, SAIC calculation packages are maintained in the Project File, not the Administrative Record. The calculation packages are the basis for the impact analyses in the EIS. The U.S. Department of Justice, Environment and Natural Resources Division published Guidance to Federal Agencies on Compiling the Administrative Record, dated January 1999 to help determine what information should be included in an administrative record. It states to include documents and materials relevant to the process of making the agency's decision, and specifies one of the categories of information to include in the administrative record is technical information, sampling results, survey information, engineering reports or studies. The calculation packages may fit that description, so it is recommended that they may be considered for inclusion in the Administrative Record. Additional discussions with GC-51 and DOJ may be needed prior to full implementation of this recommendation.

4.3. Groundwater Analysis

Procedures and practices used to develop groundwater modeling. Information provided by SAIC during the QA Review indicate the groundwater modeling has been developed consistent with sound industry practice. However, documentation is not yet available to provide a complete assessment. Specifically, the appendices containing details of the groundwater modeling were not available for review as well as a number of yet-to-be-developed SAIC calculations and analyses packages.

Key aspects of quality control during the development of the groundwater model include:

- Major assumptions and performance specifications were established prior to model development as provided by the US DOE and Washington State Department of Ecology. These include the assumptions and specifications in the

Technical Guidance Document (TGD), March 2005, and DOE notes on Cumulative Impact Methodology, May, 2005.

- Adherence to *SAIC Procedure 05, TC & WM EIS Internal Code Development, Verification, and Maintenance* during development and testing of internal codes such as Blue Dot, RFSrVZ, and WRTifSSA, among others.
- Technical peer review on development of the saturated zone flow field as provided by the Technical Review Group comprised of industry professionals external to Hanford. This group concluded "The TC & WM EIS groundwater modeling team and MTRG view the resulting groundwater flow field to be appropriate for use in the TC & WM EIS." (MODFLOW Flow-Field Development: Technical Review Group, Process and Results Report, November 2007).
- Including aspects of groundwater model development in two SAIC internal quality assessments (Annual project audit AI-2008-02, issued 6/19/08, and Surveillance on control and maintenance of software TCWMEIS-2008-002, issued 5/7/08).
- Internal QA review on MODFLOW calibration results as described in draft calculations and analyses package 200-113 (not complete at the time of review).
- Documentation of processes for development of model aspects such as the development of model grids, hydraulic conductivity estimation, and top of basalt data in completed SAIC calculations and analyses packages (e.g., SAIC calculations and analyses packages 200-066, 200-086, 200-087, 200-088, 200-090, 200-093, 200-094, 200-100, 200-103, 200-104, 200-108, 200-127-131, 200-137, 200-138, 200-146, among others).

Process controls of input/output among model components. Data transfer among the various components of the groundwater pathway model (i.e., input/output interfaces) were assessed during the QA Review to determine if quality control processes were being applied.

Input/output interfaces exist because the TC & WM EIS groundwater modeling utilizes multiple software codes designed to simulate different phases of the groundwater contaminant pathway (i.e., source term, vadose zone, saturated zone, etc). The use of multiple codes in a pathway "chain" is consistent with current good industry practice. However, the use of a "chain" model creates necessity for quality control processes to be applied at the input/output interfaces to better ensure the integrity of the data transferred between model components (e.g., ensure consistent data values as output from the vadose zone contaminant transport model (STOMP) is transferred as input to the saturated zone contaminant transport model (Blue Dot)).

The QA Review found that all input/output interfaces reviewed used quality control processes including the following:

- written checklists designed to ensure integrity of data transfer,
- review of the process by a second individual,
- documented tracking & signature record, and
- change control processes if corrections or reanalysis is needed.

The QA review included visual inspection of a sample of TC & WN EIS groundwater model input and output files related to the following contaminant source areas, data types, and contaminants.

Source areas	Data types	Contaminants
Integrated Disposal Fac. BY Cribs TY Cribs S-Tank Farm T-Tank Farm U pond FFTF	hydraulic conductivities contaminant concentrations dispersivities Van Genuchten parameters contaminant fluxes concentration peak times distribution coefficients (Kds) file names	Tc-99 I-131 U-238 tritium nitrate carbon tetrachloride

The result of the QA Review visual inspection of input and output files found no discrepancies in data among the files viewed. This suggests that the quality control processes used by SAIC for groundwater modeling analysis are effective in ensuring data integrity during input/output processes. Although the QA Review visual inspection was designed to sample a broad range of different file types, it was time-limited and was not intended to include more than a small sample of the entire input/output files used in support of the TC&WM EIS.

Some interfaces (e.g., release to vadose zone, STOMP output-to-Blue Dot input, particle tracking output to aggregation) utilized internal SAIC software modules, developed in accordance with procedures SAIC TC&WM EIS 05, Internal Code Development, Verification, and Maintenance, and SAIC TC&WM EIS 07, Software Configuration Management.

Some interfaces utilized internally-developed software to check the mass balance of the contaminant calculations (e.g., ChkMBt, CmbSSAF, etc.) that were also developed and maintained under SAIC procedures. This step was designed to better ensure the integrity of transfer of contaminant mass through the groundwater pathway transport simulation.

Documentation of groundwater model input/output process controls. The processes for quality control of input/output interfaces (as described above) in the groundwater modeling analysis are insufficiently documented. Of the key input/output processes reviewed, only one was documented in a SAIC calculations and analyses package consistent with SAIC Procedure 04, TC & WM EIS Calculations and Analyses. The SAIC interviewees responded that the processes would be documented in detail in Calculations and Analyses packages in the future, but in most cases the documentation did not yet exist. The EIS development schedule indicates that most analyses will be completed in the near future. Therefore it appears that most groundwater model simulations were performed without sufficiently documented input/output control processes in place. In particular, there is not sufficient documentation that demonstrates consistent processes were applied over time.

Documentation of groundwater modeling uncertainties. Groundwater modeling uncertainties are not yet sufficiently documented.

Multiple forms of documentation are expected to be used by SAIC to address groundwater modeling uncertainty including EIS appendices and calculations and analyses packages. However, the QA review was performed prior to completion of most of the expected documentation and was therefore limited.

Infiltration rates are key modeling parameters having inherent uncertainty. The TGD provides for different sensitivity cases to be simulated. Data values observed by the QA Review team were consistent with the direction of the TGD. **However the appendix addressing the groundwater modeling sensitivity analysis, per direction in the TGD, was not complete and available for review.**

The elevation of the top of the basalt throughout the modeling area is generally well known, but has enough uncertainty in some areas to influence modeling outcomes. The processes used to develop data for the top of basalt elevations are documented in a number of completed calculation and analyses packages. **However, documentation of the sensitivity of the MODFLOW flow field to various interpretations of the top of basalt elevations, particularly at key locations such as the gap near Gable Mountain, has yet to be documented.**

Hydraulic conductivities for the various subsurface material types at Hanford, are key modeling parameters and contain inherent variation. Hydraulic conductivities were treated as "calibration parameters" independently for the STOMP and MODFLOW models. The MODFLOW calibration utilized a Monte Carlo parameter estimation approach that is documented in packages (200-127 through 200-131). **There has yet to be documented a comparison of the hydraulic conductivity values from the MODFLOW and STOMP calibrations with each other, and with the expected range of Hanford reference hydraulic conductivity values.**

Distribution coefficients for grout waste forms relative to a range of radionuclides were provided in the TGD (section 4.5). The TGD did not specify a sensitivity analysis range for distribution coefficients. During the TC & WM EIS analysis, distribution coefficients used for calculating release of technetium and iodine from grout waste were 0.9 and 50 mL/g, which differs from the 0.6 and 30 values listed in the TGD. SAIC indicated the values used were updated after 2005 publication of the TGD, and more closely match the characteristics of the Hanford-specific form of grout compared to the more generic original values. The TGD specifically footnoted technetium and iodine distribution coefficients with "values will be consistent with effective diffusivities from cited studies" which appears to reflect uncertainty in original calculation and a desire to use values consistent with Hanford-specific grout characteristics. SAIC has briefed DOE and Washington State Department of Ecology staff on the updated values consistent with the process in section 4.5 of the TGD ("If other value s are used, a rationale will be provided in advance of the TCEIS."). **The details of the rationale and basis for use of updated**

values different than the TGD has yet to be documented in a completed TC &WM EIS appendix or SAIC calculations and analyses package.

1.4. Software Quality Assurance

Personnel in the Germantown and Richland offices are trained to implement the software management procedures (SAIC TC&WM EIS 05, *TC&WM EIS Internal Code Development, Verification, and Maintenance*; SAIC TC&WM EIS 06, *TC&WM EIS Code Modification, Verification, and Maintenance for Externally Acquired Software*; and SAIC TC&WM EIS 07, *TC&WM EIS Software Configuration Management*), as well as the calculation package procedure SAIC TC&WM EIS 04, *TC&WM EIS Calculations and Analyses*.

The audit team reviewed calculation packages that included documentation of SQA activities for software implemented for the specific calculation. File naming conventions are defined in calculation packages. Software runs are described, including identification of input and output files used. The audit team determined that results from some calculations are stored and reviewed for use as input in subsequent calculation packages and for software implemented under those subsequent calculations.

Software applications used for EIS calculations are listed on the *TC&WM EIS Software Configuration Management* inventory document. The inventory includes developed applications, acquired applications, and applications that are acquired and then modified for EIS calculations. Based on its evaluations, the audit team determined that calculation packages are used to document testing of spreadsheets that receive 100% independent verification of data and/or formulae. The audit team determined that this method of test documentation is adequate for control of these applications, and listing on the *TC&WM EIS Software Configuration Management* inventory document is not required.
The audit team verified that SAIC implements a software verification cover sheet form and an independent code verification checklist form for software verification packages of items listed on the inventory. These forms are attachments A and B, respectively, in SAIC Procedure TC&WM EIS 05. The audit team determined that software verification packages include identification and management of requirements, documentation of software design and implementation, description of algorithms and solution information, description of test cases, and test reporting, and that packages are generated in accordance with procedure. Two completed software verification and validation packages were evaluated (130-002-PFA, *Patch File Aggregator*, and 100-003-SSA, *STOMP Preparation of Particle Tracking Interface Files for Symmetric Sub-Areas*), as well as the draft verification and validation document for the BDIntel (Blue Dot particle transportation) software application.

The audit team determined that parameters for calculations, hard-coded data fields, and software input files are controlled using calculation packages. Management of base assumptions are also controlled using calculation packages. Changes to parameters, data, and assumptions are controlled using the calculation change methodology in the calculation procedure. Addition of data items is made generating a new calculation package to describe the data. Flow field identification data for analyses alternatives are

captured and entered into models using calculation packages. Calculation results are files that can be used as input to other modeling software codes. If flow field or other data need to be formatted or modified to be acceptable by a specific software code, a translation application is created and described using a calculation package that includes testing of the translation code. Testing of code is also documented in calculation packages for uncomplicated codes. Verification packages are generated, reviewed, and approved for complex developed codes, satisfying the requirement allowing application of scope of testing commensurate with the complexity of a software application. These verification packages can be attached to calculation packages. Use of calculation packages to document software testing and software life-cycle documentation must address requirements, design, code implementation, test planning, test reporting, and user manual information to ensure compliance with appropriate upper-tier requirements and to avoid any noncompliance in completed calculation document packages.
SAIC has developed a new transport code called BDIntel (aka Blue Dot), which is written in the Pascal programming language and is based on the RAND3D commercially available code. The SAIC scientists determined and documented the rationale for development of a new code due to the inability of the commercial code to handle specific aspects of the TC&WM flow field and transportation analysis methodology determined necessary to model and describe the unique aspects of the geology of this EIS. The verification and validation package for BDIntel was in the process of completion, but draft documents were reviewed by the audit team during the audit. Complete software testing and software life-cycle documentation must address requirements, design, code implementation, test planning, test reporting, and user manual information to ensure compliance with appropriate upper-tier requirements and to avoid any noncompliance in completed calculation document packages.

The audit team evaluated calculation packages and interviewed personnel regarding well logs and database information for the Hanford flow field. The team determined that discrepancies in data describing the flow field were resolved by revisiting original well log data and recreating the flow field database. SAIC determined that this method was quicker and less costly than reviewing and correcting the existing database, and the result is a more reliable representation of the flow field and flow field data.

The audit team determined from interviews with SAIC personnel that SQA evaluations have been performed for software packages currently being run. Because a large portion of calculation packages and software verification and validation packages is not yet complete, a determination of the effectiveness of procedure implementation cannot be made at this time. SAIC personnel have indicated that software verification and validation documents and software life-cycle documents are scheduled to be completed to coincide with the issue of the draft EIS report. Based on review of draft software documentation, the audit team has determined that the content of the EIS report will address requirements, algorithm, and validation details pertinent to software. Other software-related details appear in calculation package and verification and validation documents. The combination of all of these documents should provide adequate scope of information to demonstrate compliance with upper-tier requirements for SQA. A review

of the draft EIS report and completed calculation and software documents is in order to ensure this compliance and verify implementation of SAIC procedures.

The audit team identified no SQA issues during the evaluation of SAIC efforts to generate the Hanford TC&WM EIS document.

4.5. Human Health

The Human Health portion of the assessment was evaluated based upon the current objective evidence available. As of the date of the assessment, SAIC had completed one calculation package, 110-001-WORKER, Rev 0 "Involved Worker Dose", that falls within the Human Health discipline. The remaining calculation packages were in various stages of completion but had not gone through the internal review cycle and therefore were not included within the sample population for this assessment. The Assessor reviewed three calculation packages to provide complete objective evidence regarding the implementation of procedure SAIC TC & WM EIS 04 Rev 0 "TC & WM Calculation and Analyses" and conducted interviews via teleconference with SAIC personnel that are responsible for implementing this procedure within the Human Health discipline. Two of the calculation packages reviewed were selected at random from the entire population of calculation packages to provide objective evidence pertaining to the revision of calculation packages. These calculation packages were not within the population pertaining to the Human Health discipline.

The assessor determined that calculation package 110-001-WORKER, Rev 0, which pertained to the Human Health discipline, was formatted, as required by the governing procedure and contained all the required sections. The assessor verified that the proper approvals and reviews were performed and documented, that the calculation package included reasonable assumptions, and that these assumptions were adequately identified. Through review of the two randomly selected calculation packages, the Assessor verified that the revision process for calculation packages was being implanted as required.

The Assessor determined that the SAIC implementing procedure SAIC TC & WM EIS 04 Rev 0 "TC & WM Calculation and Analyses" adequately captured the program requirements. Except as noted below, SAIC and therefore the EIS project has satisfactorily implemented the requirements of the procedure that governs calculations and Analyses for calculation within the Human health discipline. Overall, the Assessor determined that SAIC's process for the preparations, review, approval revision and control of calculations and analyses in the Human Health discipline is adequate, satisfactorily implemented and effective.

4.6. Transportation

General comments:

In general, the assumptions, methods, and input data used for the transportation analysis are reasonable and consistent with previous NEPA radiological transportation analyses. A unit risk factor approach was taken for estimation of the incident-free and accident risk

impacts normally calculated using the RADTRAN computer code. Such an approach is reasonable given the complex set of origin and destination pairs and various shipment types required for the analysis. A sample set of calculations (SRS to Hanford, representative of the Waste Management MLLW [truck] shipments as shown in Table H-6) were followed in the QA file to verify proper use of the approach. It is suggested that a complete RADTRAN run specific to this EIS (all links from a given site to Hanford) be performed and compared against the results of the unit risk factor approach as a check for inclusion in the QA file.

National averages for truck and rail accidents are used in the analysis. However, state-specific accident rates are available in the same reference as used for the national rates and should be used. In general, this will have more of an effect on shorter routes with states having accident rates that vary widely from the national average. On the other hand, the routes are representative and are not necessarily the ones that will be used in the future. There is also the uncertainty associated with the accident rates themselves. It is recommended that either the state-specific accident rates be used or a brief discussion on uncertainty associated with the accident rates and the use of state-specific versus national rates be included in the transportation appendix.

It is suggested that dose estimates presented in the transportation analysis only use 2 significant figures, with only 1 significant figure for reported LCFs. The RADTRAN and RISKIND computer codes provide 3 significant figures in their dose output values, but given the uncertainties involved (in the models and the data), it gives the public a false assurance of accuracy. There is even more uncertainty when converting to LCFs.

For nonradiological impacts, the decision not to estimate latent fatalities should be revisited. In Section H.5.2 of the transportation appendix, the statement is made "*The emergence of considerable data regarding minimum threshold values for health risks from chemical constituents of vehicle exhaust has made linear extrapolation to estimate risks from lower exposure levels to vehicle emissions untenable.*" No supporting references are provided and further reference is made to the calculation being dropped in RADTRAN. The statement is almost a direct quote from Section 4.6.2 in an earlier RADTRAN manual (Neuhauser and Kanipe 2000) which also provides no supporting references. (Many EISs never used RADTRAN to perform the calculation in the first place since it is a simple multiplication involving a risk factor and distance and affected population values.) However, there is considerable evidence that associates latent fatalities with increased airborne levels of particulate matter as discussed and referenced in Section 6.2.2 of DOE (2002a). There are many confounding factors involved with the latent fatality issue including the contribution of actual chemical interactions with the airborne contaminants in the lungs, the physical effects of the particulates themselves, and short- versus long-term exposure levels. Nevertheless, there is clear evidence that there is a direct association of premature mortality with airborne particulate matter (PM) (EPA 2005). Also, in an expert study, the majority of experts assumed that there is no minimum threshold for adverse impacts (Industrial Economics 2004, Roman et al. 2008), and many rural areas have high levels of background airborne particulate matter that are comparable to urban areas (Biwer and Butler 1999) where a linear response can be

assumed. A search of the recent literature also shows that adverse health effects can be associated with local traffic emissions (Boothe and Shendell 2008, Medina-Ramon et al. 2008), even in areas with good air quality (Kim et al. 2008).

At a minimum at the present time, I would recommend using the unit risk factors of 1.5×10^{-11} fatalities per kilometer per person per square kilometer and 2.6×10^{-11} fatalities per kilometer per person per square kilometer for truck and rail, respectively, that were used in DOE 2002b and 2008. These values are an attempt at reducing the conservatism in those provided in Biwer and Butler (1999).

Specific Comments:

The unit-risk factors presented in Table H-5 do not look like they are actually used in the risk calculations. They are only used in an example calculation. Load specific (e.g. IHLW, CH TRU, caustic, sodium, etc.) RADTRAN runs were performed and scaled by the transport index to estimate the shipment risk factors provided in Table H-6. The appendix should be revised to reflect this approach. In terms of QA, it would be extremely helpful to document (at the point of use in the calculation spreadsheets) the origins of the unit risk factors (i.e. filename of the RADTRAN output that generated them) or have a cross-reference table with RADTRAN output file correlated with the specific worksheet that uses its risk values.

One problem related to specific comment above is the expanded number of "unit risk factors" that must be tracked and the QA involved. In the spreadsheet "Transportation-TC_EIS-Jan-08.xls," worksheet "I-F-OF," cell S32, is the incident-free value for the associated dose to the crew for shipment of a railcar of HLW from Hanford to Yucca Mountain that relies on unit risk factors in cells D32, G32, J32, and S15. I would expect those latter values to be in the RADTRAN output file "TC-RAIL-HLW-YUCCA.OUT" (dated 4/3/2007). The value in S15 matches an appropriate value in the file, but the others do not. I had previously had a similar problem with the truck route used for Hanford to Yucca Mountain. I requested the appropriate file from SAIC and was sent via fax the RADTRAN output with the values matching the risk factors being used in the spreadsheet calculation. The faxed output had a run date of 4/13/2007, 10 days after the 4/3/2007 version given as part of the electronic QA record. If I am correct, no factors (truck) from the 4/3/2007 version were used in the EIS, same for the 4/3/2007 rail version on disc. Presumably there is something akin to the 4/13/2007 truck hardcopy version for the rail that matches the values found in cells D32, G32, and S32 mentioned above. Either obsolete supporting documents should be deleted from the QA record, or a better method of tracking revisions to supporting data should be implemented.

After performing a few spot checks, it appears that the values for truck rest area stops on the "INL" worksheet of the "Offsite WM transport-08.xls" spreadsheet may be incorrect. It looks like distance values from the rail (rather than truck) route are being used. A similar occurrence shows up in other worksheets (e.g. WV and ORNL). These errors need to be corrected, but they may not affect results presented in the transportation appendix because maximum transport impacts were used. See footnote "h" to Table H-6.

The "Number of Affected Persons" in Tables H-1, H-2, and H-3 are the number of persons within 800 m on either side of a transportation route. These numbers do not match the TRAGIS output. In the appendix, they were calculated using the route segment distances and their associated population densities. This approach is correct if the route is a straight line, but they are not and can lead to double counting of people (which is why they do not match the TRAGIS output). The values generated by TRAGIS are the result of performing the appropriate buffer
operations within a GIS system. Looking at the "Offsite WM transport-08.xls" spreadsheet, the total populations are not used in any calculations. Recommend that Tables H-1, H-2, and H-3 be revised to show the correct number of persons along the routes.

In the draft Appendix H, pg. H-27, line 10, the discussion indicates that no LCF or traffic fatalities are expected because the risk factors are "less than one". In reality, the text should read "less than 0.5" because anything greater than 0.5 would indicate that an LCF or traffic fatality might be expected.

In Tables H-9, H-13, and H-17, it is not clear, what specific type of shipment is responsible for the MEI doses reported. The text references one shipment type for the person in traffic congestion in each case, but it is not clear if that shipment type is responsible for the other impacts shown. Recommend that the shipment types responsible for the doses presented be identified in the tables. In a similar vein, the value of the uniform population density (and a justification) used to estimate the results in Tables H-10, H-14, and H-18 (severe accident impacts) should be given.

5.0 RECOMMENDATIONS

Below are the recommendations of each team member in their area of expertise. These recommendations are based on the results of the review and each team member's knowledge of the subject.

5.1. Quality Assurance

It is recommended that the ORP TC & WM Project develop a documented process to ensure that when issues are identified, they are communicated to the contractor in a timely manner.

It is recommended that a NEPA review be conducted prior to the issuance of the final ORP TC & WM EIS

It is recommended that the ORP TC&WM EIS Project conduct an independent QA review prior to issuance of the final TC & WM EIS.

It is recommended that ORP revise their TC&WM EIS records management procedure to comply with the requirements of DOE O 441.1 C "Quality Assurance."

It is recommended that additional resources be provided to allow the ORP NEPA Compliance Officer more opportunity to conduct more comprehensive oversight of the TC & WM EIS project.

It is recommended that SAIC documents the process of controlling documents to ensure only the most recent revision is used by TC&WM project personnel.

5.2. Air Analysis/NEPA Compliance

SAIC should increase the level of rigor in preparation and review of calculation packages to ensure all changes are initialed and dated, all elements of their package review are documented, and the justifications and/or the sources for the assumptions are included.

Additional independent review of air modeling calculation packages should be considered when they are finalized.

The project should change the remote backup practices of the EIS records to ensure off-site data protection.
The SAIC calculation packages should be considered for inclusion in the administrative record as suggested by the U.S. Department of Justice, Environment and Natural Resources Division Guidance to Federal Agencies on Compiling the Administrative Record.

5.3. Groundwater Analysis

Complete documentation of quality control processes and practices for groundwater modelling with particular emphasis on model development, input/output interfaces among model components, and approaches used relative to model uncertainties.

5.4. Software Quality Assurance

To ensure compliance with appropriate upper-tier SQA requirements and to avoid noncompliance in completed calculation document packages, the audit team recommends that complete software testing and software life-cycle documentation addressing requirements, design, code implementation, test planning, test reporting, and user manual information be included either as separate documents or as attachments to the calculation packages.

The audit team recommends that references to the complete set of life-cycle documents be included in the calculation package documents, or summarized in tabular form in an attachment, in enough detail to demonstrate compliance with SQA requirements.

5.5. Human Health

It is recommended that the "Reviewer Checklist" for calculation package 110-001 WORKER, Revision 0, be completed as required. It is also recommended that calculation packages that have been completed be re-reviewed to ensure all required reviews have been documented. SAIC should conduct employee training to ensure that procedure requirements are understood and followed. Personnel assigned to review the packages for completeness also should be trained so they understand the importance of the final review.

It is recommended that SAIC perform a review of completed calculation packages to ensure that deletions, additions, and corrections are performed in accordance with the requirements of procedure TC & WM EIS 04, Revision 0, "TC&WM EIS Calculations."

5.6. Transportation

It is recommended that Table H-5 and the accompanying discussion be revised to more clearly define the unit risk factor approach for RADTRAN.

It is recommended that the potential latent mortalities from vehicle emissions be estimated and the impacts be included in the analysis.

It is recommended that either state-specific accident rates be used or a brief discussion on uncertainty associated with the use of state-specific vs national rates be included in the transportation appendix.

It is recommended that the minor errors in the transportation spreadsheets "Offsite WM transport-08.xls," "WV" and "ORNL" be corrected. (see specific examples in section 4.6)

6.0 REFERENCES

DOE Directive O 414.1C Quality Assurance

DOE Directive O.451.1B "NEPA Compliance Program"

NEPA Contracting Reform Guidance, December 1996

DOE P 226.1 DOE Oversight Policy

DOE O 251.1A Directives System