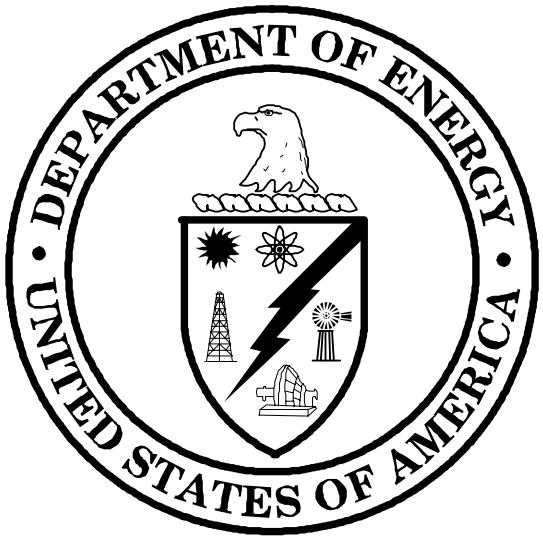
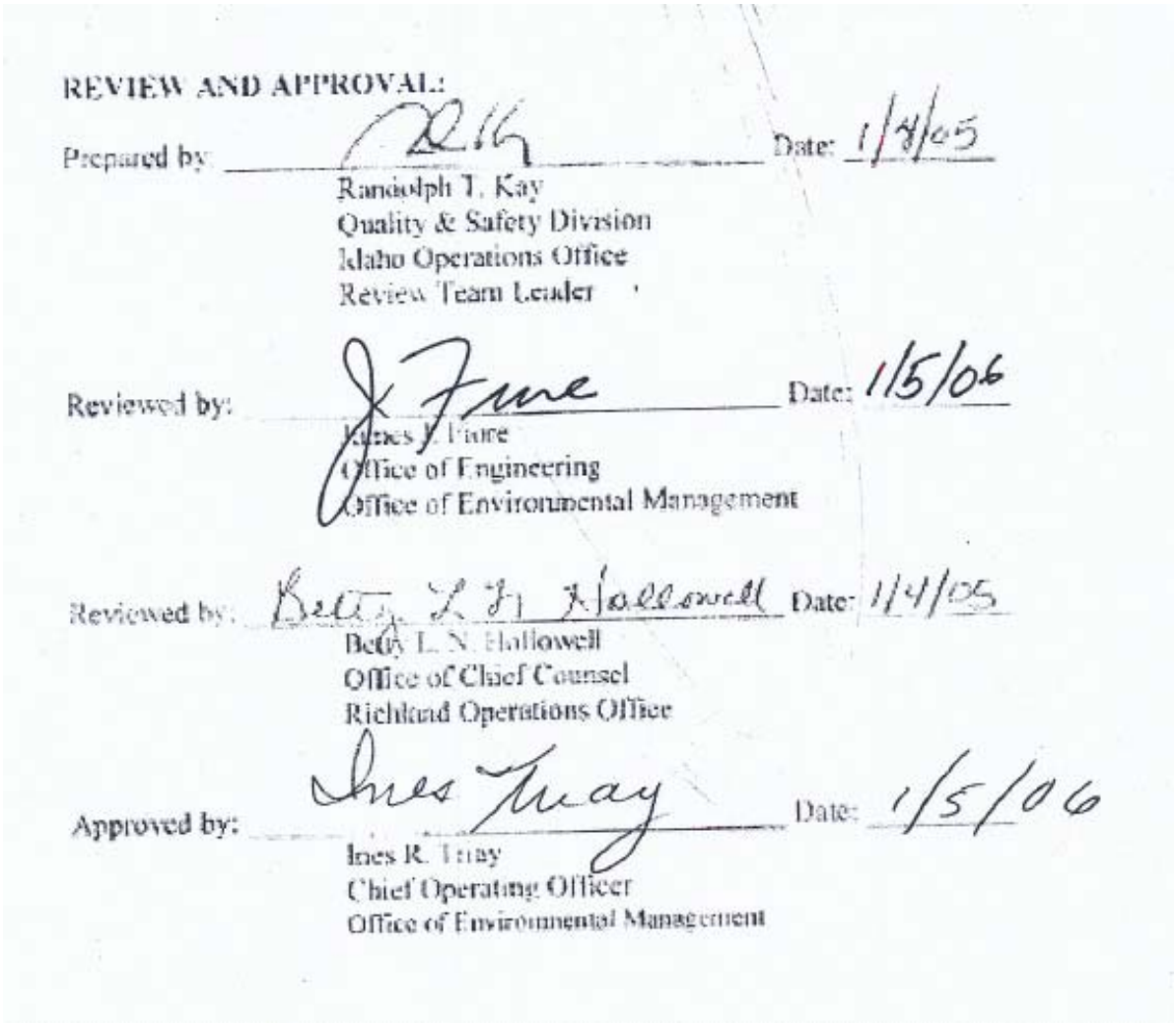


Report of the Review of the Hanford Solid Waste Environmental Impact Statement (EIS) Data Quality, Control and Management Issues

January 2006

Hanford Solid Waste Environment Impact Statement (EIS)
Data Quality, Control and Management Issues

Review Report



REVIEW AND APPROVAL:

Prepared by: _____ Date: 1/4/05
Randolph T. Kay
Quality & Safety Division
Idaho Operations Office
Review Team Leader

Reviewed by: _____ Date: 1/5/06
James J. Fiore
Office of Engineering
Office of Environmental Management

Reviewed by: _____ Date: 1/4/05
Betty L. N. Hallowell
Office of Chief Counsel
Richland Operations Office

Approved by: _____ Date: 1/5/06
Ines R. Triay
Chief Operating Officer
Office of Environmental Management

Contents

Executive Summary

As part of the litigation involving receipt of offsite waste and the HSW EIS, the Court allowed the State of Washington a limited amount of discovery pertaining to iodine-129, technetium-99, and groundwater analyses. While compiling information to respond to the State discovery request, Battelle discovered three data quality issues within the data sets used for the cumulative groundwater impact analysis: As a result of these data quality issues, a team was commissioned to review the HSW EIS for additional data quality issues as well as any programmatic problems which might have contributed to errors found in the HSW EIS.

The team sampled three areas of the HSW EIS looking for additional data quality issues.

- Groundwater Pathway Analysis
- Human Health and Safety Analysis
- Transportation Analysis

The team also reviewed three programmatic areas that were key in the development of the HSW EIS.

- Richland Operations Office QA Program
- Battelle's HSW EIS Project QA Program
- Software Quality Assurance

The results of the review are as follows:

Programmatic QA issues were identified in both the Richland Operations Office and Battelle's implementation of QA requirements. The lack of formal data verification and validation processes along with the absence of QA oversight activities by both the contractor and Federal agency led to the data inaccuracies found in the HSW EIS.

From the samples taken, 8 additional (for a total of 11) groundwater pathway data quality issues, 50 transportation data quality issues, and 5 human health and safety data issues were identified. It should be noted that a sample of data was reviewed representing a fraction of the total body of information. As such, the data quality errors identified in this report may not be the total data quality errors contained in the HSW EIS.

Recommendations

Richland Operation Office

It is recommended that for future EIS activities, the recommendations of the NEPA Contracting Reform Guidance issued by the Office of NEPA Policy and Assistance be used to develop the scope of work.

It is recommended that the oversight of the RL NEPA program/Contractor NEPA program be included in the Office oversight plan to ensure compliance of the NEPA program with applicable requirements. The Document Manager position training and experience requirements needs to be documented in the RL FRAM. In addition, the Document Manager qualification requirements should be added to the RL NEPA QA plan.

It is recommended that the RL NEPA QA plan be revised to include Document Manager qualification requirements, verification and validation requirements, and record processing requirements. The RL NEPA QA plan needs to be approved and issued as a controlled document so affected personnel have access to the plan.

It is recommended that DOE perform an evaluation of the Battelle corrective action management system for adequacy, implementation, and effectiveness of the overall programmatic process to identify specific weaknesses and provide guidance to Battelle in repairing the process.

It is recommended that DOE perform a formal root cause analysis to identify corrective actions to prevent recurrence.

Battelle

It is recommended that future EIS scope statements be revised to indicate the minimum level of QA management control processes that are required on EIS projects.

It is recommended that for future EIS projects, formal designation of responsibilities, delegation of authority, and identification of an appropriate independent reporting structure for the Battelle Project Quality Assurance Officer be done, which would appropriately convey the importance and independence of this necessary independent oversight role.

It is recommended that minimum required training needs for project personnel be identified and specified in future Battelle EIS PMPs.

It is recommended that unique documents and media, currently maintained as project records, be either moved to an adequate records facility, or that an adequate fire-rated file cabinet be obtained for their storage.

It is recommended that the RIDS be reviewed and those file categories which provide evidence of quality for the EIS be designated as such, and appropriate disposition controls be placed on those files.

It is recommended that Battelle quality oversight organizations include future EIS projects in their routine planning and schedule for periodic internal audits and surveillances.

It is recommended that phrasing regarding the need for a quality assurance program based on applicability of PAAA be either deleted from or refined in the SBMS procedures and future EIS PMPs to avoid misinterpretation.

It is recommended that Battelle perform a formal root cause analysis to identify corrective actions to prevent recurrence.

Software Quality Assurance

Designation of an upper-tier requirements source for software quality planning and implementation is recommended. Existing planning documentation includes satisfactory details of the types of life-cycle documents applicable to the SAC.

It is recommended that future groundwater assessments follow the DOE process for technical definition, including generation, review and approval of a Technical Guidance Document (TGD). This document is

similar in content to a TRD and has been completed for the use of Revision 1 of the SAC in performing the next composite analysis.

It is recommended that Battelle generate a summary document that includes references to all life-cycle documentation and documentation addenda, as applicable. The summary will assist in making document versions available for use, reference within the configuration management system, identification for modification and management as impacted by change control, and to allow for traceability of document versions to associated SAC versions.

It is recommended that Battelle generate a memo or other document to cross reference location of information on existing document references and completing these forms for future assessments, as appropriate, and for future software development. Existing software life-cycle documentation was created by multiple authors and under several contracts.

It is recommended that Battelle generate, maintain and circulate (to key project staff) a software inventory that shows current versions of software code configuration items. Generation, maintenance, and circulation of an inventory of data files is also recommended to manage and report configuration of these files. Inventories of code versions and data files will provide users with summaries of information already being tracked in CVS and by the configuration manager.

It is recommended that Battelle assemble a reference list of all software module, integration, and suite validation testing efforts for SAC Revision 0 in one document, including a review of completed testing and a determination of testing adequacy.

Groundwater Pathway Analysis

Re-perform the source release and groundwater pathway portion of the Alternatives Analysis and Cumulative Analysis using an updated and uniform (to the extent possible) set of agreed upon assumptions and parameters. Ensure consistent transfer of assumptions to input files, consistent use of data between modeling modules, and consistent transfer of output data to an updated report. Reanalysis is necessary to support a defendable EIS alternative selection and cumulative analysis conclusions. Updated assumptions will address the issue of evolving inventory estimates. Agreement on a uniform set of assumptions for the AA and CIA will avoid potential discrepancies between these analyses.

Transportation and Human Health and Safety Analysis

Perform an evaluation to determine the significance of the data quality errors identified during this review.

1.0 BACKGROUND

Battelle began supporting DOE-RL in the preparation of the Hanford Site Solid Waste Environmental Impact Statement (HSW-EIS) in December 1996. The HSW-EIS was a Hanford site specific EIS that was required as follow-on from the Records of Decision (RODs) issued on DOE's Programmatic Waste Management EIS. It was needed to evaluate Hanford alternatives for:

- The storage, treatment, and/or disposal of existing and anticipated quantities of solid low-level waste and mixed low-level waste;
- Storage, processing, certification, and shipment of transuranic waste; and
- Disposal of immobilized low-activity waste produced during the treatment of Hanford tank waste.

Scoping activities occurred in 1997/1998. Initial analysis on the EIS was conducted in 1999 leading to a number of working drafts and reviews. In January 2002, approval authority for the EIS was delegated to the Manager at RL. In April 2002 RL approved the first draft HSW-EIS for public review. In responding to public comments in August 2002 RL committed to preparing a revised draft HSW-EIS. In April 2003, the revised draft EIS was issued for a second public comment period. In January 2004 DOE issued the Final HSW-EIS (a five volume, ~4000 page document that underwent a 7 month review prior to issuance). In June of 2004 DOE issued the RODs associated with this EIS. Each version of the HSW-EIS was a built on and updated the analyses in the previous versions. Each version underwent extensive internal and external document reviews prior to public release (including detailed technical reviews by a DOE NEPA panel composed of technical, programmatic, and legal experts from RL).

As part of the revised draft HSW-EIS a decision was made in August/September 2002 to use the System Assessment Capability (SAC) modeling tool (and the data associated with the recently issued Initial Assessment) as a means to perform the cumulative groundwater impacts analysis portion of the HSW-EIS. The cumulative impacts calculations are only one part of dozens of impact calculations included in an EIS. The SAC tool had been in development for a number of years and the prototype run (called an initial assessment) was completed in 2002. A document describing the approach, results and lessons learned in this initial assessment was published in September 2002.

The SAC tool, used for groundwater cumulative impact analysis, is a collection of models representing waste site inventories, contaminant release and environmental transport of the contaminants, and impacts of the contaminants on receptors. It is complemented with a set of data representing disposals and discharges at Hanford, the Hanford Site environment, and human health and ecological impact model parameters.

2.0 REVIEW APPROACH

The focus of this review was identification of programmatic and data quality issues as they relate to the HSW EIS. This was done through quality assurance reviews comparing modeling assumptions, approaches, input data, and results against descriptions in the HSW EIS and HSW EIS reference documents. Programmatic reviews focused on the RL QA program, Battelle QA program and Software Quality Assurance program issues related to the HSW EIS.

The objectives of this review was to:

- Identify the type and pervasiveness of programmatic and data quality issues.
- Recommend areas where additional reviews should be performed.
- Recommend course(s) of action to address programmatic and data quality issues.

It should be noted that a sample of data was reviewed representing a fraction of the total body of information. As such, the data quality errors identified in this report may not be the total data quality errors contained in the HSW EIS.

Review of the models and codes used as part of the HSW EIS was not within the scope of this effort. In addition, the validity of assumptions used in the HSW EIS was not reviewed unless contradicted by technical bases contained in the HSW EIS or HSW EIS reference documents.

The DOE review team was composed of people with relevant quality assurance technical expertise and certification, data management expertise, software quality assurance expertise, and technical expertise related to groundwater modeling. The DOE review team was augmented by DOE-RL staff that reviewed the transportation and human health data quality. Battelle provided data and information as requested to support the DOE review team.

3.0 SUMMARY

A review was conducted at the Richland Operations Office on the HSW EIS in Richland, Washington from September 19 to October 7, 2005. The primary objective of this review was to identify data quality, control and management issues as they are related to the HSW EIS.

This report is broken into two distinct subject areas:

- Programmatic Issues
- Data Quality Issues

The following programmatic issues were identified as a result of the review:

Richland Operations Office

The RL NEPA program was assessed to determine compliance with applicable DOE Directives and to uncover weakness in the program that could have contributed to the data errors uncovered before and after the review. The review discovered that the lack of federal QA oversight of the HSW EIS project and the lack of qualified federal staff trained in the NEPA EIS development process contributed to the data errors. Additionally, failure by RL to comply with the DOE Directives on Quality Assurance and NEPA Program Requirements added to the lack of clear contractor direction and verification activities needed to minimize errors in the final HSW EIS.

Battelle

The Battelle HSW EIS Project was assessed to determine if adequate quality assurance controls were implemented to assure the quality of the HSW EIS data. Under its overall management and operating contract with DOE, Battelle is required to implement an appropriate QA program; it failed to implement an appropriate QA program for its work on the HSW-EIS. Therefore, Battelle did not rigorously implement appropriate programmatic quality controls for maintenance of data quality and consistency on the HSW EIS project. Although Battelle was awarded the task of supporting the HSW EIS project based on expertise in environmental impact analysis and corporate knowledge of regulatory requirements and DOE orders, it is surprising to the reviewer that Battelle accepted this task apparently without consideration of the inadequacies of the documents assigning the task, and without subsequent implementation of an adequate quality assurance program to meet the intent of the applicable DOE orders in effect at the start of this project (DOE O 5700.6C "Quality Assurance" and DOE O 451.A "National Environmental Policy Act Compliance Program"). When DOE O 414.1A "Quality Assurance" superseded DOE O 5700.6C, neither the contract nor the SOW was revised to reflect this change in quality program requirements. The project was given a minimal level of QA program involvement, limited to only one element of a standard QA program as described by DOE O 5700.6C. The QA program elements, which were applied, were not adequate to identify the subsequent data quality issues. Neither management nor independent assessments were conducted during the HSW EIS development process nor were documented processes specifically developed to verify or validate the HSW EIS data. Without controls in place to assure data quality, errors have been discovered during the course of this review. Although a Quality Engineer has recently been assigned to perform oversight activities for this project, the assignment comes too late to effectively resolve programmatic inadequacies, which have existed from the beginning.

Software Quality Assurance

An evaluation of software quality assurance planning and software management was performed for the System Assessment Capability (SAC), Revision 0. Software life-cycle documentation was reviewed as follows: software quality assurance plans, software requirements, software design, software test plans, software test reports, and user manuals. Information satisfying basic requirements for scope of specific life-cycle documents was found distributed through various documents which were prepared by several contractors, however, scope of software life-cycle documentation was adequately defined and determined to be adequate for the SAC application. Software configuration management and software change control were included in the evaluation. Configuration management is accomplished using an electronic file management system, which was determined to adequately control software versions for modules comprising the SAC application. Software run logs and change control logs were reviewed. Software verification and validation (V&V) documents were reviewed. V&V test cases and test reports were found included in module design folders and were determined to be adequate. Module testing and testing of integration of modules into the SAC application were determined to be adequate from a best-practices viewpoint.

The following data quality issues were identified as a result of the review:

Groundwater Pathway Analysis

The groundwater pathway portions of the Alternative Analysis and the Cumulative Analysis were reviewed according to the criteria of the review plan. Eleven discrepancies are summarized in the body of the report. Six discrepancies are associated with the waste source releases, and five discrepancies are associated with transport of contaminants in groundwater. Of the discrepancies, four represent reporting errors in the HSW EIS document itself (not in the analysis). Of the seven discrepancies within the

analysis, four may lead to under-prediction of contaminant concentrations as reported in the HSW EIS and three may lead to over-prediction. The discrepancies found indicate shortcomings in consistent use of assumptions and data, not in modeling approaches or models used. Differences also exist between assumptions used in the Groundwater Alternatives Analysis and the Cumulative Impacts Analysis (see review results).

Transportation Analysis

The RL Transportation sub team reviewed data, which produced the number of accidents, number of fatalities, and Latent Cancer Fatalities associated with the alternatives considered in the HSW EIS. The review consisted of examination of a selective sample of the data entered into worksheets, data generated from worksheets, and transfer of that data to the Final HSW EIS. Generally the information was associated with the volumes of waste (by waste type), the distance to be transported, and the populace of traveled routes. A total of 1,190 entries were examined; 50 issues were identified. These observations include mislabeled electronic files in the project records, potential errors in references, data inconsistencies between HSW EIS Appendixes, and data transcription/editorial errors. Some of the identified issues were repeated in a number of locations, so the number of unique issues is actually lower. Others were the result of configuration management issues where multiple data quality issues resulted from a single configuration management issue (e.g. the use of an early version of a source input data table).

Human Health and Safety

The RL Health Effects sub team reviewed selected data related to the health effects resulting from releases of radionuclides to the groundwater and to the Columbia River. The primary sources of data used to arrive at health effects were data from the ground water files and dose factors that were created using the Multimedia Environmental Pollutant Assessment System (MEPAS) code. Of the over 12,000 combinations of data, the team reviewed selected elements from approximately 120 combinations and identified 5 discrepancies. The discrepancies included: 1) one instance of incorrectly “cutting and pasting” data from the groundwater files for multiple radionuclides and several waste forms, (this represents 13 columns of data covering 20,000 years in ten year increments), 2) two incorrect numbers extracted from a groundwater file, 3) mislabeled graph, 4) one incorrect data line on the graph, and 5) four instances of the number of latent cancer fatalities differing by a single digit on a single table.

4.0 REVIEW RESULTS

4.1. Richland Operations Office

The HSW EIS Project scope was not adequately specified. The NEPA Contracting Reform Guidance document was issued by DOE in December 1996 as a result of Environmental Impact Statements costing too much, preparation time often too long, and document quality often too low. The reform guidance recommends that DOE develop “very specific” statements of work that contain “clearly-stated, results oriented” performance criteria and measures. The reform guidance also recommends that the NEPA QA plan be transmitted to the contractor to ensure quality assurance requirements are adequately defined. The statement of work for the development of the HSW EIS predated the NEPA Contracting Reform Guidance, but was not revised in light of it. As a result, the scope of work was a one-sentence statement asking Battelle to provide support for development of the HSW EIS. The DOE NEPA QA Plan was transmitted

to the contractor but never implemented by RL or Battelle, which contributed to a lack of definitive QA requirements being used in the preparation of the HSW EIS.

Federal oversight was inadequate to ensure requirements were being followed and that adequate verification activities were being performed and documented. DOE Directive O 414.1 "Quality Assurance" requires that DOE organizations develop a Quality Assurance Program that addresses the 10 criteria specified in the QA Directive. Criterion 7 "Procurement" requires that DOE organizations "establish and implement processes to ensure that approved suppliers continue to provide acceptable items and services." Federal QA oversight activities were not performed to ensure that Battelle was providing controls to identify errors in the HSW EIS.

The Document Manager was not qualified nor adequately trained to perform his duties as required by DOE Directive O 451.1B "NEPA Compliance Program". The Document Manager assigned to the HSW EIS had no prior NEPA EIS experience and was not formaly trained in NEPA requirements. The NEPA Contracting Reform Guidance recommends education resources to be used for the NEPA Document Manager. Documented training was not provided to the Document Manager at any time during the development of the HSW EIS. DOE Directive O 414.1 Criterion 2 "Personnel Training and Qualification" requires that each DOE organization "train and qualify personnel to be capable of performing assigned work." There was no evidence that the Document manager was trained or qualified to perform the function of NEPA Document Manager.

The NEPA QA plan was never issued as a controlled document or revised since 1994. DOE Directive O 451.1B "NEPA Compliance Program" requires a NEPA QA Plan to be developed for each Field Element. The RL NEPA QA plan was developed in 1994 and is based on the superceded QA Directive 5700.6C. The RL NEPA QA plan was never approved or distributed as a controlled document. Although evidence was found to indicate the NEPA QA Plan was transmitted to the HSW EIS Project it was not effectively implemented. There is no documented evidence that the provisions of the RL NEPA QA Plan were executed, which include Management Assessments, Independent Assessments, Inspection and Acceptance Testing.

4.2. Battelle

Under its overall management and operating contract with DOE, Battelle is required to implement an appropriate QA program; it failed to implement an appropriate QA program for its work on the HSW-EIS. DOE Order 5700.6C *Quality Assurance* was in effect in 1996 at the time this project was begun, but Battlle did not effectively implement it. In addition, although it was included in the M&O contract between DOE and Battelle, when DOE Order 414.1 *Quality Assurance* superseded DOE O 5700.6C on November 24, 1998 and was subsequently reissued on September 29, 1999 as DOE Order 414.1A, this new order was again not effectively implemented by Battelle. Without the management systems mandated by either of these orders, an adequate quality assurance program with appropriate quality assurance management controls was not rigorously implemented within this project. The Scope Sheet issued by DOE to Battelle for this project on December 4, 1996 contains only a one-sentence scope statement: "Provide DOE-RL initial planning and technical support for the preparation of the Hanford Solid Waste EIS." The scope statement has not undergone revision by DOE-RL in the nearly 9 years since being issued. There is no reference to applicable DOE Orders nor to regulatory requirements for implementation of a QA program. There is no statement requiring implementation of a quality assurance program. Under the usual process for management of DOE projects and contractors, an SOW is developed by the responsible DOE office, not the contractor. For this project, however, since DOE-RL did not provide an appropriate SOW for this project, Battelle project personnel

developed a Statement of Work within the HSW EIS PMP. Project personnel were unable to provide any documentation of review or approval of this SOW by DOE-RL. This situation violates the requirements contained in 10 CFR 830.120 for quality program controls to be implemented on all DOE nuclear-related work as well as the requirements in DOE Order 451.1 *National Environmental Policy Act Compliance Program* for development by DOE of a QA program plan for EIS development. Although it is commendable that Battelle project personnel took initiative in developing a SOW to compensate for the lack of adequate direction from DOE-RL, and given Battelle's corporate expertise in environmental impact analysis and knowledge of regulatory requirements and DOE orders, it is surprising to the reviewer that Battelle began this project without implementation of an adequate quality assurance program to fully meet the intent of the applicable DOE orders in effect at the start of this project (DOE O 5700.6C "Quality Assurance" and DOE O 451.A "National Environmental Policy Act Compliance Program") and as required by the M&O contract.

The current revision and six historical revisions of the Battelle QA Program Description (QAPD) were reviewed. The documentation of this program indicates a steady pattern of refinement and improvement and, if it had been fully implemented on the HSW EIS project from the beginning, would have served to provide the minimum level of quality management controls needed to comply with the NEPA quality requirements. Some tweaking of control processes might be needed, particularly in the areas of graded approach and corrective action management, to fully comply with 10 CFR 830.7 and 830.120 Subpart A requirements, but overall the documented program appears satisfactory.

Although the Battelle HSW EIS PMP has from the beginning included a Quality Assurance section (Section 6), it is inadequate as a QA plan to direct implementation of appropriate QA management controls. The description is very brief and highly general in nature and does not include specific requirements for overall project quality assurance, data verification and validation, nor software quality assurance. With the exception of Section 7.0 *Records Management* of the Battelle HSW EIS PMP which invokes the Standards Based Management System (SBMS) procedures for records, laboratory record books, and document control, the required QA program elements listed in 10 CFR 830.122 are not addressed. The Battelle HSW EIS PMP has been routinely maintained, and revisions dated April 2003, July 2003, October 2003, February 2004, and September 2005 were reviewed during this assessment. Although each revision has steadily refined and expanded on the technical requirements for this project, there were no changes to Section 6 until the September 2005 revision. This revision does include a new Appendix N *Project Quality Assurance Plan Template*, however this template does not adequately describe all the quality assurance elements required by 10 CFR 830.122. Major subject areas that are now included are:

- Project Organizational Planning
- Personnel Training and Qualification
- Quality Improvement
- Documents and Records
- Work Processes
- Performance Design of Hardware and Software
- Procurement, Inspection, and Acceptance Testing
- Management Assessment

Each of these major subject areas is further broken down into questions, which appear to be intended to designate which procedures in the SBMS are applicable to the project and a

responsible individual. The resulting list of procedures and responsible individuals does not fulfill the intent of a QA plan, which is to describe the quality system management controls and methods of implementation for a project

The project organization chart contained in the Battelle PMP does not include designation of an independent quality assurance function until the most recent revision issued in September 2005. This is the first instance found where a Software Quality Assurance engineer has been formally assigned to perform Software Quality Assurance functions (Battelle HSW EIS PMP Revision 5, September 2005, Section 6 *Quality Assurance*; and Section 3.0 *Roles, Responsibilities, Accountabilities and Authorities* and organization chart). However, the SQEs role is limited to two elements of Software Quality Assurance only (impact calculations and modeling results), and there is no indication in the organization chart that there is any reporting chain or coordination role between the SQE and the Battelle Quality Assurance Manager. This same revision of the Battelle PMP is also the first to identify the Battelle QAM as a member of the Battelle HSW EIS Steering Committee, but without explanation of his responsibilities and authorities beyond scheduling and supporting assessments and project reviews. The roles, responsibilities and authorities of these individuals need to be clearly defined, including either expansion of the QAEs authority or designation of another individual outside of the technical operations chain of command to perform oversight of quality-related activities such as independent audits/surveillances and corrective action evaluation and closeout.

Qualification requirements of personnel generating and collecting data or performing data manipulations have not been established. The Battelle HSW EIS PMP December 2002 revision does not address this element. Although the Battelle HSW EIS PMP September 2005 revision's Attachment N includes questions regarding training and qualification, these elements are marked as "not applicable." Training database printouts were reviewed for ten individuals working on the EIS. Consistency in types of training and frequency of refresher training provided to individuals performing similar functions was lacking, and this is believed to be a result of the lack of specified minimum project-level training.

Requirements for Quality Assurance records contained in DOE Order 414.1 have not been implemented. Although project personnel are maintaining a set of documents as an "administrative record," neither the records themselves nor the conditions they are being maintained in meet the standards for maintenance of quality records. They are kept in regular non-fire-rated file cabinets in a room that does not meet National Archives and Records Administration (NARA) standards for all government records as required by 36 CFR 1220 through 36 CFR 1234, and although the room can be locked and the key is in the project manager's control, access is not limited to only formally authorized personnel. The HSW EIS Records Inventory and Disposal Schedule (RIDS) do not identify any of these documents as quality-related. Discussions with the Battelle project manager resulted in the information that although none of the Administrative Records have been transmitted to DOE for longer-term retention, much of this documentation is available as back-up files on the computer network or in public reading rooms. This gives a certain amount of confidence that in the event of loss of these particular copies, replacements may be located. However, there are a sizeable number of original documents in one file cabinet and electronic media such as CDs and one computer hard drive throughout all of the file cabinets that have no known duplicates or backup copies.

The Records Inventory and Disposition Schedule and File Index were reviewed. There is a category identified on the RIDS for Quality Assurance records, however, none of the project records have been designated as such. The file folders designated for the Quality Assurance records were pulled, and it is apparent that the Battelle project manager has started to use this category for records of assessments performed on this project.

When the reviewer requested objective evidence of oversight activities that had been performed on the HSW EIS project, project personnel presented the following assessment reports for review as evidence:

- Integrated Quality, Environment, Safety & Health Management System, Quality and Integrated ES&H Programs Self-Assessment and Program Improvement Plan FY-2005, Revision 1, August 2005. Performed by the Battelle IES&H organization to evaluate the overall laboratory quality assurance program. This report did not include sufficient information to indicate that the Battelle HSW EIS had been included in the evaluation and should not be used as objective evidence as such.

- A Self-Assessment of Peer Review Processes across the Pacific Northwest National Laboratory, May 2004. This unsigned, unapproved report is a superficial discussion of the use of peer review at Battelle, does not meet the minimum intention of either 10 CFR 830.122 nor DOE Order 414.1 for an assessment report, and is not adequate to serve as evidence of performance of assessments for the HSW EIS project.

- ETD Data Quality Review; June 23, 2005. Performed by the Battelle Independent Oversight Department to evaluate causes of data quality issues associated with seven different projects. The Ground Water Modeling project, which supports the HSW EIS work, was specifically included in this review. There were 12 recommendations, which resulted from this review. While this review is acceptable as evidence of performance of a management assessment within the last year, it does not meet the criteria for performance of an internal audit by Battelle.

- Project personnel were unable to present any other internal assessment reports beyond these three. Without any further evidence to the contrary, the conclusion must be drawn that a planned, effective, and thorough internal assessment process has not been implemented on this project, and since 2004, only a marginal level of activity has taken place.

Corrective action control was reviewed through examination of the Action Tracking System entries for ATS # 5957. The actions tracked under this number were those, which resulted from findings contained in the report for the DOE-RL Assessment of Pacific Northwest National Laboratory Safety Software Quality Assurance A-04-SED-Battelle-007. The files presented as providing evidence of closure did not contain evidence of the following actions:

- Evaluation of significance of the conditions
- Evaluation of extent of the conditions
- Evaluation of the impact of the conditions
- Identification of root cause for significant conditions
- Detailed corrective action plans showing milestones, completion dates, and responsible individuals

The responses seen were superficial in nature and, since the report reporting the deficiencies had been issued in June, 2004, over a year ago, could not be considered as providing evidence of effective and timely corrective action.

Multiple instances were found within project documents (PMP, SBMS procedures) of statements indicating that if a project is not subject to PAAA, then a quality assurance program is not required. One example is as follows:

SBMS standard "Project Management Section 1. Documenting Project Planning Information": "Project managers must demonstrate to their PLMs that they have effectively planned the project prior to the start of work by … documenting a quality assurance plan for Price-Anderson Amendments Act (PAAA)-related projects."

The use of PAAA as the determining factor for establishment of a quality assurance program for a project does not comply with the requirements found in either 10 CFR 830 Subpart A nor DOE Order 414.1. Discussion was held with Battelle management who expressed assurances that this language was not intended to be used as the determining factor for establishment of a quality program, but was intended to emphasize the need for extra care by project management to assure compliance to requirements. However, the statements found are misleading in that they could be interpreted as allowing a project not subject to PAAA to be conducted without a quality assurance program.

4.3. Software Quality Assurance

An evaluation of software quality assurance planning and management was performed for the System Assessment Capability (SAC), Revision 0. Software Documentation Plans were reviewed as developed by Pacific Northwest National Laboratory (Battelle) using guidance from the Standards Base Management System (SBMS). Plans included details of the scope of life-cycle documents required for development and documentation of the SAC software suite; however, the SBMS did not indicate the source of upper-tier requirements used as guidance. The documentation identified under the guidance is satisfactory from a best-practices viewpoint, but without stated source requirements, a determination of the adequacy of documentation, with respect to upper-tier requirements, cannot be made.

A review of software life-cycle documents was performed for the SAC Revision 0. The evaluation included a review of the following software life-cycle documents:

- Assessment Description, Requirements, Software Design, and Test Plan – BHI-01365, Draft A
- Configuration Management Plan,
- Design Documents Volumes 1 and 2,
- Module Development Folder, and
- Users Instructions

The review of software life-cycle documentation determined that a Technical Requirements Document (TRD) was not completed for SAC Revision 0. Content of the Groundwater/Vadose Zone Integration Project System Assessment Capability (Revision 0) Assessment Description, Requirements, Software Design, and Test Plan – BHI-01365 document is comparable to that of a TRD, except that review and approvals by DOE are not included. The use of TRD's approved by DOE (and subsequently referred to as Technical Guidance Documents [TGD's]) did not come into effect at the Hanford site until FY05, several years after the SAC Revision 0 was used for the initial assessment and the cumulative impacts analysis for the HSW EIS.

Other forms, per guidance from SBMS, were not completed. Forms not completed included Software Testing and Review Forms, Results Traceability Forms, and Software Release Forms. Information usually presented on these forms was generated and was found distributed among several existing documents for SAC Revision 0.

An evaluation of software configuration management and software change control was performed for the SAC Revision 0. The evaluation included a review of the SAC Configuration Management Plan, the change control log, and Software Configuration Change Request/Approval Forms. Run logs and data files were determined to be included in the existing scope of configuration management. Including run logs and data files in configuration management provides documentation of all SAC code runs of specific code versions, including associated data files that are unique to specific SAC code runs. This provides for management and documentation of software codes and data files so that analyses can be re-run to duplicate original results or for generation of new results using specific code versions that include minor changes to data files based on the original code/data file analysis combinations. Software configuration is managed using the concurrent versioning system (CVS), an open source software package used to control code versions, automatically assign version numbers, and track differences between code versions. Use of this software application to manage configuration is satisfactory.

Software verification and validation documentation was reviewed. A sample of Module Development Folders was examined and was determined to include code listings, module test cases, and test results. Module Development Folders were also determined to include test cases and results of integration of individual modules into the suite and internal hand-off of data within the suite. Per interviews with the computer resource manager, it was determined that module development testing was performed on platforms separate from the production environment. Integration testing was performed in the production environment with file names uniquely identified to allow communication between other modules and still maintain separation of test files from production codes. Software validation included an initial assessment that was performed to demonstrate “proof-of-principle” capability of the code suite. This initial assessment was evaluated by peers and determined to be a “versatile tool to inform decision makers of impacts of the Hanford Site as a total system.” The peer evaluation was reviewed during this HSW-EIS audit and was determined to qualify as a software validation step for Revision 0 of the SAC. Per interview with the SAC Development Project Manager and the Computer Resource Manager, it was determined that testing was performed by multiple persons and under several contracts. Test records and software code has been submitted to Battelle and DOE records centers.

4.4. Groundwater Pathway Analysis

4.4.1 Process

The review of the HSW EIS groundwater pathway analysis used the following five criteria areas from the review plan:

3.1 What assumptions were listed for producing data packages, what assumptions were chosen, and how were these assumptions selected, validated and approved?	3.2 What did the HSW EIS Project documents indicate would be implemented regarding modeling assumptions (e.g., Mann PA for IDF groundwater)?	3.3 What was the actual input data for the model data input models? How does this data compare to the assumptions? Was there a requirements document for the HSWEIS?	3.4 What was the actual data output generated from the model(s)? What did the output data indicate? Was there validation of the output data with respect to the input data and assumptions? Did the output data include the input data?	3.5 How do the assumptions (3.1.), actual input data (3.3.) and actual output data (3.4.) compare to what is reported in the HSW EIS?

In addition, eleven aspects were considered as listed in the review plan: Kds; infiltration; diffusion from waste; release mechanisms for waste; vadose zone transport mechanisms; diffusion in the aquifer; dispersivity in the aquifer; inventory amounts, location, and inventory release; flow fields; waste inventory; and modeling source term. During the review these aspects were broadly interpreted to be more inclusive. For example, even though the time frame for source releases was not specifically identified in the review plan, it was found to be relevant and was included in release mechanisms.

The above five criteria, and eleven aspects were evaluated with respect to the Alternatives Analysis (AA) and the Cumulative Impact Analysis (CIA). Review of the AA and the CIA included review of data for specific waste sites (Low Level Burial Grounds, etc.) for both the alternatives analysis for solid waste disposal, and the cumulative analysis of effects from these waste sites in addition to existing and past disposal and releases.

During the review, data in 62 separate modeling files were viewed. Approximately 20 documents were reviewed. Seven individuals were interviewed.

4.4.2 Technical Findings

- Regarding the above criteria, eleven discrepancies were found to exist in the groundwater pathway analysis. These discrepancies are summarized in the table below. Six discrepancies are associated with the waste source releases, and five discrepancies are associated with transport of contaminants in groundwater. Of the discrepancies, four represent reporting errors in the HSW EIS document, not in the analysis itself. Of the seven discrepancies within the analysis, four likely lead to under-prediction of contaminant concentrations as reported in the HSW EIS and three lead to over-prediction (see discussion in table).

- The discrepancies found indicate shortcomings in consistent use of assumptions and data.

- No EIS-specific documentation was found regarding agreement on, or approval of the assumptions to be used in the groundwater pathway analyses. Some documentation exists from prior to the EIS effort when site personnel sought input and a level of agreement among regulators and stakeholders on groundwater pathway assumptions. EIS-specific documentation was lacking regarding consistent transfer of groundwater

pathway assumptions to input files, consistent use of data between modeling modules, and consistent transfer of output data to the report.

- In addition to the discrepancies called out in the table below, there exist differences between assumptions used in the AA and the CIA. These differences are described in Appendix L of the HSW EIS and some are due to the decision to use the initial assessment data of the SAC as the basis for the HSW EIS CIA. In addition, some differences exist in Kds, infiltration, and some release parameters that are not directly attributable to differences in the AA and CIA approaches. These differences indicate selection of assumptions at different points in time during evolution of base knowledge and plans and development of the CIA and AA in different contexts without full integration in the EIS. Of particular concern, but not resolved by this review are differences in inventory assumptions that are not fully explained in the text of the EIS. For example, the differences of ~2000 Ci Tc-99 and ~60 Ci of I-129 between AA and CIA assumptions are called out but not fully explained in the text. Further, the text and interviews indicates inventory estimates have evolved over time and continue to evolve. This review did not attempt to determine what inventory assumptions should have been used at a particular point in time. This review identifies differences between inventories reported and those used in the CIA, and notes that the differences between AA and inventory assumptions are not fully documented in the HWS EIS

Table of discrepancies found in the groundwater pathway Alternatives Analysis (AA) and Cumulative Impacts Analysis (CIA).

It should be noted that a sample of data was reviewed representing a fraction of the total body of information. As such, the data quality errors listed below may not be the total data quality errors contained in the HSW EIS.

Discrepancy	Effect
Waste Source – Inventory[1] CIA. EIS Table L.1 lists inventories not used in the analysis including differences of: Tc-99 & I-129 in 200E of < 0.1 Ci magnitude; Tc-99 in 200W of >100s Ci magnitude; U at 200W of >1000s Ci magnitude. The model used values consistent with the reference document titled "An Initial Assessment of Hanford Impacts Performed with the System Assessment Capability."	The HSW EIS report contains inventory amounts that were not used, or intended to be used in the modeling analysis. This was a reporting error in the EIS table and is not an error in the analysis itself.
Waste Sources – Diffusion[1] CIA: Tc-99 model runs used the minimum range value of 1.58×10^{-4} cm^2/yr instead of the intended median value of 1.02×10^{-3} cm^2/yr. This only affected analyses of cement sources containing Tc-99.	For cement sources containing Tc-99, the analysis predicts flux from the source that is slightly lower than intended (flux is proportional to the square root of diffusion), and therefore the predicted EIS contaminant concentrations in groundwater are may be slightly lower than they would have been had the intended diffusion values been used.

Waste Sources - Diffusion[1] CIA: I-129. Typo discrepancy. The report should read 3.15 x 10^{-5} cm^2/yr.	The HSW EIS report contains an incorrect I-129 diffusion value. This was a reporting error in the EIS table and is not an error in the analysis itself.
Waste Sources - Area/Volume (A/V) [1] CIA: The A/V ratio used for Tc-99 and U-238 cement source stochastic model runs (0.0019 cm^{-1}) was one order of magnitude lower than intended.	This error occurred in a portion (stochastic case, Tc-99 and U-238) of the model runs for cement sources. For this portion, the predicted EIS contaminant concentrations are probably substantially lower than they would have been if the intended values had been used (predicted concentrations are proportional to A/V and only about 10% of the intended A/V was used)
Waste source - Area/Volume (A/V) [1] CIA: The A/V ratio (.00378 cm^{-1}) reported in EIS Table L.2 should read 0.021 cm^{-1}.	The HSW EIS report contains an incorrect Area/Volume ratio value. This was a reporting error in the EIS table and is not an error in the analysis itself.
Waste Source – Release Timeframe[1] CIA: Timeframe for release of I-129 for a portion of model runs (median case of I-129) prematurely ended in 3050, ~1000 years simulation time, instead of the intended 10,000 years.	For a portion of the I-129 CIA model runs, the predicted EIS contaminant concentrations may be lower than they would have been had the entire intended release time frame been used. However, without rerunning the simulation it cannot be known whether the maximum (peak) concentration would change and it is the peak concentration that much of the conclusions are based. Clearly more I-129 would be released to the vadose zone and more I-129 would be available for transport within the groundwater, but the effect on peak concentration is unknown at this time.
Groundwater - Recharge[1] AA & CIA: Discrepancy between area recharge assumption (intended) and what was used. The values used were ~60% of what was intended.	The simulated water surface was lower than intended, and certain flow paths (particularly in 200E) do not represent the intended condition. The predicted EIS contamination values are probably slightly higher than they would have been had the intended values been used, although the effect of changed flow paths on concentration levels is difficult to predict without reanalysis.
Groundwater – Dispersion AA: For the ocal-scale model runs, runs used to evaluate the effect of three different disposal locations on the Central Plateau there was a discrepancy between intended longitudinal (10m) and transverse (2m) dispersivity and what was used (95m and 19m). The regional scale values were incorrectly applied to the local grid scale.	For the local-scale model runs, predicted EIS contaminant values lower than they would have been had the intended values been used.
Groundwater – Dispersion AA: For the local-scale model runs, 200W, there was a discrepancy between intended transverse (2m) dispersivities and what was used (1m). However, the 1m is within range of the typical modeling practice of using D_Ts that are 10-30% of D_L values.	The contaminant concentrations reported for the 200W local-scale model runs are probably only slightly higher and have a slightly narrower extent of dispersed plume than they would have been had the intended values been used.

Groundwater - Kds AA: All Kds in files checked were within 0.0 - 0.6 mL/g range. However, one single groundwater (CFEST) model run used a Kd value of 0.53 that, while in range, was ~10% lower than the intended value of 0.6. The reviewer looked for repeat and related discrepancies and found none.	For releases that were based on this file, the predicted contaminant travel times are probably slightly faster than had the intended value been used, and predicted peak concentrations probably slightly higher.
Groundwater – Porosity[1] AA: Porosity. The porosity values reported in Appx G of the EIS for two units (Hanford Unit 1 and Ringold Unit 5) were not the intended values used in the model. The values used were 0.07 for the Hanford unit and 0.21 for the Ringold unit.	The HSW EIS report contains incorrect values for porosity for two units. This was a reporting error in the EIS and is not an error in the analysis itself.
[1] Item was previously self-identified by Battelle.	

4.5. Transportation Analysis

Traced mileage from TRAGIS used as input to RADTRAN5. Reviewed 11of 52 TRAGIS output files and found 2 inconsistencies.

Reviewed Dose rates for different waste types from "A Resource Handbook on DOE Transportation Risk Assessment" DOE/EM/NTP/HB-01 July 2002, Table 6.2, Page 66 as input into RADTRAN5. Reviewed 3 of 52 RADTRAN5 input files and found no data quality issues.

Reviewed all quantities of Low Level, TRU, and Mixed Low Level waste volumes shipped to Hanford from other sites from EIS Table C.1 and transferred to analyst's spreadsheet. Reviewed all 118 entries and found 7 data quality issues.

Reviewed 11 TRAGIS output files and compared state-by-state mileages to analyst's worksheet and found no data quality issues. Each output file contained 6-15 input entries to the analysts worksheet.

Reviewed RADTRAN5 output of impact results of various types to input into the analyst's spreadsheet. Found 5 instances where incorrect RADTRAN5 files were in the Project Record or not included in the Project Record. The universe was 50 RADTRAN5 output files for off-site waste generators.

Reviewed shipment capacity on spreadsheet for various types of material, LLW, MLLW, and TRU (CH, RH). Checked 48 different site/waste type combinations and found no issues. Analyst uses an 85% filling capacity for each container; however, no documented basis for this assumption was found, although the assumption was documented in the HSW EIS, Appendix H.

Reviewed Spreadsheet output for input to Table H.16, Radiological Transportation Impacts for Offsite Shipments. Total universe was 306 data entries and 3 issues were identified.

Reviewed output from Spreadsheet to Table H.18, Non Rad Transportation Impacts for Off Site Shipments, total number of accidents upper and lower bounds. Reviewed 103 data entries and identified 2 issues.

Reviewed output from Spreadsheet to Table H.18, Non Rad Fatalities for Lower and Upper bound emissions LCFs. Reviewed all 103 data entries and identified 1 issue.

Reviewed output from Spreadsheet to Table 5.26 Off site transportation impacts by Alternative. Reviewed all 96 data entries, with no data quality issues found.

Reviewed information transferred from worksheet to Table 5.25 Summary of Potential Rad and Non Rad Transportation Impacts Hanford Only Waste Volumes, All Alternative Groups. Reviewed 84 of 84 entries on the table and found 1 inconsistency.

Reviewed transfer of data from the Technical Information Document, to the analyst's worksheet to determine number of shipments and found it to be consistent (i.e., no inconsistencies within the 48 data points). The associated information is found in Table H.2, Shipping Data for Alternative Group A, Hanford Only. However, the same information was found to be inconsistent in Appendix B of the HSW EIS. One inconsistency was found in the universe of 48 data points.

Reviewed data in Appendix B against Table H.3, Shipping Data for Alternative Group B, Hanford Only Waste Volume, and found 3 data inconsistencies in 45 total data points.

Reviewed data in Appendix B against Table H.4, On Site Shipping Data for the No Action Alternative, and found 2 data consistency issues in 37 total data points.

Reviewed data in Appendix B, Page B.94, Stream 11, against the Technical Information Document, Page A.64, Table for Stream 11, and found one inconsistency within 37 entries.

Reviewed transfer of data from the Technical Information Document to EIS, Appendix B, Tables 5 - 13. Data consistency issues were found in Tables B 8, 9, 10, and 12. The Technical Information Document was identified to likely have typographical errors, as some of the data presented in the TID was in a nonsensical format.

Reviewed the Technical Information Document to Appendix B, flow diagrams, pages 51 – 56, 5 of 100 flow diagrams were checked with no data quality issues identified.

EIS Table 5.33, and Table H.28 have data quality issues in volumes of Gravel/Sand, Silt/Loam, Basalt, and Asphalt. Reviewed all 85 entries and found 22 data consistency issues. All are related to the use a previous version of the resource requirements presented within the HSW EIS.

4.6. Human Health and Safety

4.6.1 General

Several files contained offsets ranging from 40 to 350 years for data when "cut and pasted" from groundwater files into Health effects files. These apparent differences were explained based upon the following: All groundwater files assume start of activities in the mid 1940s and post 1996 waste data sheets were offset by 40 years. Projected waste was offset by another 40 years. Grouted materials were assumed to begin to deteriorate after an additional 300 years.

The MEPAS model was run to establish dose factors used. MEPAS calculations were performed in 2000 and at that point in time the software was still DOS based. Battelle explained where the input data came from but for the review team did not validate the data source. The MEPAS

output files were reviewed to verify that the dose factors summary sheet was accurate. No data quality issues were identified.

4.6.2 Drinking Water Dose Figures (Appendix F)

Reviewed the determination of Maximum Annual Drinking Water Dose calculated in sheet Rad Sum2W from DWAnal_2W_B_H.xls and found no data quality issues. Compared the calculated maximums to those presented in Table 5.88 (Hanford Only) in Volume 1, Section 5.11.2.1.2, with no data quality issues identified. Also reviewed the determination of Maximum Annual Drinking Water Dose calculated in sheet Rad Sum2Ese from DWAnal_2W_D1_H.xls and found no data quality issues. Compared the calculated maximums to those presented in Table 5.104 (Hanford Only) in Volume 1, Section 5.11.2.1.4.1, with no data quality issues identified.

4.6.3 Resident Gardener Dose Tables (Appendix F)

1km_well_Alt_B_results_ungrted_grted_MLLW.xls for Alternative B, Upper Bound, 200 West location, resident gardener dose, was compared to Calculations in GW-Well_Doses_Alt_B.xls, sheet AGB-U_200W. No differences noted. Also reviewed the summary tables generated in the AGB_U_200W spreadsheet from GW_Well_Dose_Alt_B.xls and compared them to parts of Table F.68 in Appendix F. No discrepancies were identified. Reviewed the summary tables generated in the NA-Hanford_200W spreadsheet from GW_Well_Dose_NA.xls and compared them to parts of Table F.137 in Appendix F. The Probability of an LCF for 1988-1995, 200 West Area Resident Gardener appears to be miss-stated as 8E-06 in Appendix compared to the 9.4E-6 found in the spreadsheet. The Probability of an LCF for Pre1970 LLW, 200 West Area Agricultural + Sauna appears to be miss-stated as 8E-07 in Appendix compared to the 9.0E-7 found in the spreadsheet. The Probability of an LCF for Pre1970-1988, 200 West Area Agricultural + Sauna appears to be miss-stated as 5E-07 in Appendix compared to the 6.4E-7 found in the spreadsheet. The Probability of an LCF for Pre1988-1995, 200 West Area Agricultural + Sauna appears to be miss stated as 1E-05 in Appendix compared to the 1.6E-5 found in the spreadsheet. (Number 5 in Summary)

4.6.4 Maximum Annual Drinking Water Dose Tables (Appendix F)

1km_well__buried_no_action.xls (Summary) for the No Action Alternative was compared to data in GW_Well_Doses_NA.xls, 1988-1995 LLW. Values for Tc-99 and I-129 (max concentration) Sheet NA-Hanford_200E differed from those found in the 1km file. Battelle confirmed that these numbers are in error. (Number 2 in Summary) No differences were found in Sheet NA-Hanford_200W. Examined the calculation in DWAnal_2E_D1_H to sum TC-99 concentrations and found no logic problems. Compared selected Cat 1 inventory values in 1km_well__Alt_B_results_ungrted_grted.xls, to DWAnal_2W_B_U.xls and found no discrepancies. Compare the Proj Cat 1 inventory values in 1km_well__Alt_D1_results_ungrted_grted.xls, to DWAnal_2W_D1_U.xls and found no discrepancies. Compared unit transport factors in the upper bound case for Cat 3, MLLW, grouted MLLW, Proj Cat 3 and Projected Melter MLLW sources between the DWAnal_2E_D1_U.xls and the 1km_well__Alt_D1_results_ungrted_grted.xls files and found discrepancies where 13 columns of data were incorrectly “cut and pasted.” Also reviewed the summary tables generated in the Rad Sum2Enw spreadsheets from DWAnal_2E_D1_H.xls and DWAnal_2E_D1_U.xls. They were compared to Table 5.103 in Section 5.11.2.1.4.1 with no discrepancies identified.

4.6.5 Dose to Resident Gardener/Sauna Figures (Appendix F)

Spot checked the dose to resident gardener with sauna (200W, Hanford Only) between All Water_NA.xls and Analy_2W_NA_H.xls and found no discrepancies. Compared the chart produced for Hypothetical Resident Gardener with Sauna/Sweat Lodge from All water_NA.xls to Figure 5.43 in section 5.11.2.1.6 in Volume 1. The Lower Bound Volume chart did not match the chart and data provided in the All Water_NA.xls file (one incorrect data line on the graph). Also noted that the caption under Figure 5.43 is incorrectly identified as "Upper Bound Waste Volumes" while only "Lower Bound Waste Volumes "appear in the chart. (Numbers 3 & 4 in Summary).

4.6.6 Downstream Population Drinking Water Dose Tables (Appendix F)

Reviewed the Downstream_Dose_Feb_04.xls file and the river_flux_Alt_B_results_ungrted_grted_MLLW_rev2.xls files and found no data quality issues. Spot checked the Dose Factors identified by Battelle to those used in DWAnal_2W_B_H.xls and Anal_2W_NA_H.xls and found no data quality issues. Also reviewed the Alt_B_U spreadsheet from Downstream_Dose_Feb_04.xls matched the data presented in Table 5.87 in Section 5.11.2.1.2 and found no data quality issues.

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. Richland Operation Office

It is recommended that for future EIS activities, the recommendations of the NEPA Contracting Reform Guidance issued by the Office of NEPA Policy and Assistance be used to develop the scope of work.

It is recommended that the oversight of the RL NEPA program/Contractor NEPA program be included in the Office oversight plan to ensure compliance of the NEPA program with applicable requirements.
The Document Manager position training and experience requirements needs to be documented in the RL FRAM. In addition, the Document Manager qualification requirements should be added to the RL NEPA QA plan.

It is recommended that the RL NEPA QA plan be revised to include Document Manager qualification requirements, verification and validation requirements, and record processing requirements. The RL NEPA QA plan needs to be approved and issued as a controlled document so affected personnel have access to the plan.

It is recommended that DOE perform an evaluation of the Battelle corrective action management system for adequacy, implementation, and effectiveness of the overall programmatic process to identify specific weaknesses and provide guidance to Battelle in repairing the process.

It is recommended that DOE perform a formal root cause analysis to identify corrective actions to prevent recurrence.

5.2. Battelle

It is recommended that future EIS scope statements be revised to indicate the minimum level of QA management control processes that are required on EIS projects.

It is recommended that for future EIS projects, formal designation of responsibilities, delegation of authority, and identification of an appropriate independent reporting structure for the Battelle Project Quality Assurance Officer be done, which would appropriately convey the importance and independence of this necessary independent oversight role.

It is recommended that minimum required training needs for project personnel be identified and specified in future Battelle EIS PMPs.

It is recommended that unique documents and media, currently maintained as project records, be either moved to an adequate records facility, or that an adequate fire-rated file cabinet be obtained for their storage.

It is recommended that the RIDS be reviewed and those file categories which provide evidence of quality for the EIS be designated as such, and appropriate disposition controls be placed on those files.

It is recommended that Battelle quality oversight organizations include future EIS projects in their routine planning and schedule for periodic internal audits and surveillances.

It is recommended that phrasing regarding the need for a quality assurance program based on applicability of PAAA be either deleted from or refined in the SBMS procedures and future EIS PMPs to avoid misinterpretation.

It is recommended that Battelle perform a formal root cause analysis to identify corrective actions to prevent recurrence.

5.3. Software Quality Assurance

Designation of an upper-tier requirements source for software quality planning and implementation is recommended. Existing planning documentation includes satisfactory details of the types of life-cycle documents applicable to the SAC.

It is recommended that future groundwater assessments follow the DOE process for technical definition, including generation, review and approval of a Technical Guidance Document (TGD). This document is similar in content to a TRD and has been completed for the use of Revision 1 of the SAC in performing the next composite analysis.

It is recommended that Battelle generate a summary document that includes references to all life-cycle documentation and documentation addenda, as applicable. The summary will assist in making document versions available for use, reference within the configuration management system, identification for modification and management as impacted by change control, and to allow for traceability of document versions to associated SAC versions.

It is recommended that Battelle generate a memo or other document to cross reference location of information on existing document references and completing these forms for future assessments,

as appropriate, and for future software development. Existing software life-cycle documentation was created by multiple authors and under several contracts.

It is recommended that Battelle generate, maintain and circulate (to key project staff) a software inventory that shows current versions of software code configuration items. Generation, maintenance, and circulation of an inventory of data files is also recommended to manage and report configuration of these files. Inventories of code versions and data files will provide users with summaries of information already being tracked in CVS and by the configuration manager.

It is recommended that Battelle assemble a reference list of all software module, integration, and suite validation testing efforts for SAC Revision 0 in one document, including a review of completed testing and a determination of testing adequacy.

5.4. Groundwater Pathway Analysis

Re-perform the source release and groundwater pathway portion of the Alternatives Analysis and Cumulative Analysis using an updated and uniform (to the extent possible) set of agreed upon assumptions and parameters. Ensure consistent transfer of assumptions to input files, consistent use of data between modeling modules, and consistent transfer of output data to an updated report. Reanalysis is necessary to support a defendable EIS alternative selection and cumulative analysis conclusions. Updated assumptions will address the issue of evolving inventory estimates. Agreement on a uniform set of assumptions for the AA and CIA will avoid potential discrepancies between these analyses.

5.5. Transportation and Human Health and Safety Analysis

Perform an evaluation to determine the significance of the data quality errors identified during this review.

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

Appendix A
Personnel Contacted

Name	Organization	Role	Telephone	Email
Jim Fiore	DOE-EM	Review Team Sponsor	240-252-0346	James.fiore@em.doe.gov
Randy Kay	DOE INL	Review Team Leader	208-390-9853	kayrt@id.doe.gov
Jim Schuetz	DOE CBFO/CTAC	Review Team	505-234-7181	jschvet@wipp.carlsbad.nm.us
Ava Holland	DOE CBFO	Review Team	505-234-7423	ava.holland@wipp.ws
Mat Johansen	DOE NNSA-LASO	Review Team	505-665-5046	mjohansen@doeal.gov
Matt McCormick	DOE-RL	AMCP	509-373-9971	matthew_s_mccormick@rl.gov
Al Hawkins	DOE-RL	RL Team Coordinator	509-376-9936	Albert_R_Al_Hawkins@rl.gov
Charlie Kasch	DOE-RL	Human Health Team	509-376-5183	Charles_K_Kasch@rl.gov
Joanne Shadel	DOE-RL	Human Health Team	509-376-2100	Joanne_R_Shadel@rl.gov
Dennis Anderson	DOE-RL	Traffic & Transportation Team	509-373-9549	Dennis_L_Anderson@rl.gov
Carolyn Ballard	DOE-RL	Traffic & Transportation Team	509-372-1276	Carolyn_F_Ballard@rl.gov
Michael Collins	DOE-RL	Document Manager	509-376-6536	michael_s_collins@rl.gov
Al Hawkins	DOE-RL	QA Representative	509-376-9936	albert_r_al_hawkins@rl.gov
Betty Hollowell	DOE-RL	Chief Council’s Office	509-376-7311	betty_l_n_hollowell@rl.gov
Bob Carosino	DOE-RL	Chief Council's Office	509-376-2024	robert_m_carosino@rl.gov
Charlie Kasch	DOE-RL	QA Manager	509-376-5183	charles_k_kasch@rl.gov
Cliff Ashley	DOE-RL	Software QA	509-376-1056	clifford_a_ashley@rl.gov
Marla Marvin	DOE-RL	Chief Council's Office	509-376-1975	marla_k_marvin@rl.gov
Paul Dunigan	DOE-RL	NEPA Compliance Officer	509-376-6667	paul_f_jr_dunigan@rl.gov
Tom Ferns	DOW-RL	Deputy NEPA Compliance Officer	509-376-7474	Thomas_w_ferns@rl.gov
Julie Erickson	PNSO	Deputy Manager PNSO	509-372-4005	julie.erickson@pnso.science.doe.gov
Carrie Swaford-Bennett	PNSO	QA Manager	509-372-4931	c.swafford-bennett@pnso.science.doe.gov
Dave Biancosino	PNSO	EM Oversight	509-372-4084	david.biancosino@pnso.science.doe.gov
Julie Turner	PNSO	PNSO Lab Oversight	509-372-4015	julie.turner@pnso.science.doe.gov
Wayne Johnson	Battelle	Project Manager	509-372-4791	wayne.l.johnson@pnl.gov
Aleta Busselman	Battelle	Project Management SBMS SME	509-372-4114	aleta.busselman@pnl.gov
Bob Bryce	Battelle	Battelle Modeling Team	509-373-3586	rw.bryce@pnl.gov
Charley Kincaid	Battelle	Battelle Modeling Team - Cum Lead	509-373-3596	charley.kincaid@pnl.gov
David Engel	Battelle	Battelle Modeling Team	509-375-2307	dave.engel@pnl.gov

Name	Organization	Role	Telephone	Email
Dennis Strenge	Battelle	Human Health Lead	509-375-6944	d.l.strenge@pnl.gov
Don Boyd	Battelle	Deputy Laboratory Director for Operation	509-375-2149	don.boyd@pnl.gov
Doug Ray	Battelle	Chief Research Officer	509-375-2500	doug.ray@pnl.gov
Gene Freeman	Battelle	Groundwater Modeling	509-375-6502	eugene.freeman@pnl.gov
Kathy Rhoads	Battelle	Technical Document Manager	509-375-6832	kathleen.rhoads@pnl.gov
Kevin Soldat	Battelle	ESHS Project Line Manager	509-375-6810	kelvin.soldat@pnl.gov
Larry Kimmel	Battelle	QA SBMS Subject Matter Expert	509-376-9203	larry.kimmel@pnl.gov
Marcel Bergeron	Battelle	Groundwater Alternatives Analysis	509-372-6104	marcel.bergeron@pnl.gov
Paul Eslinger	Battelle	Battelle Modeling Team	509-372-4392	paul.w.eslinger@pnl.gov
Phil Daling	Battelle	Transportation Lead	509-376-0650	phil.daling@pnl.gov
Steve Cooke	Battelle	Legal	509-375-2891	steven.cooke@pnl.gov
Terry Walton	Battelle	EM Sector	509-372-4548	terry.walton@pnl.gov
Will Nichols	Battelle	Battelle Modeling Team	509-372-6040	will.nichols@pnl.gov
Yevonne Deaton	Battelle	Quality Engineer	509-375-3706	yevonne@pnl.gov
Randy LaBarge	Battelle	ETD QA Manager	509-375-6664	randy.labarge@pnl.gov
Sandi Snyder	Battelle	Human Health	509-375-6684	Sandra.synder@pnl.gov

Appendix B
Documents Reviewed

#	Item	Date	Rev.	Comments
1	Software Documentation Plan (9401e030, 10/97)	25-Apr-00	0	Groundwater / Vadose Zone Integration Project
2	Software Assessment Capability (SAC) Configuration Management Plan	Oct-00	--	--
3	No. CT-03-5018-AAM State of Washington's Second Set of Interrogatories and Request for Production of Documents	--	--	unsigned version
4	Groundwater Conceptual Model – Appendix D	30-Sep-99	--	--
5	Inventory conceptual model – Appendix A	30-Sep-99	--	--
6	Preliminary System Assessment Capability Concepts for Architecture, Platform, and Data Management	30-Sep-99	--	--
7	Release Conceptual model – Appendix B	30-Sep-99	--	--
8	Groundwater / Vadose Zone Integration Project System Assessment Capability (Revision 0) Assessment Description, Requirements, Software Design, and Test Plan – BHI-01365, Draft A, May 2000	30-Sep-99	Draft A	--
9	Uncertainty Alternatives – Appendix G	30-Sep-99	--	--
10	SAC Rev. 1 Data Control Block Flow Diagram	--	--	--
11	Vadose zone modeling of dispersed waste sites in the framework of an integrated stochastic environmental transport and impacts assessment code for the Hanford Site (477/0201/9)	26-May-04	--	Paper gives "History Matching" software validation of SAC code and expert review and validation of SAC code
12	SAC Change Request Log	--	--	--
13	SAC Rev.0 Design Document (Chapters 1 thru 15)	Mar-00	--	--

#	Item	Date	Rev.	Comments
14	Users Instructions for SAC Rev. 0 Computer Codes (PNNL-13932 Volume 1)	Jun-02	--	--
15	Users Instructions for SAC Rev. 0 Computer Codes (PNNL-13932 Volume 2)	Jun-02	--	--
16	Computing Resource User List for “paper” SAC volume folder	9/21/2005	--	Sample of users list showing access control to folders on the SAC sever; “paper” folder is a folder containing user applications for viewing results of a run
17	Presentation of Groundwater (Alternative Analysis) Issues Identified	9/20/2005	--	Power Point given by Marcel Bergeron
18	Alternative Analysis HSW-EIS Scope and Technical Approach	9/20/2005	--	Power Point given by Marcel Bergeron
19	Final Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement Richland, Washington – Summary	Jan-04	--	--
20	Development, Review, and Publication of the Hanford Site Solid Waste Program Environmental Impact Statement	9/19/2005	--	Power Point given by Wayne Johnson
21	System Assessment Capability (SAC) Code History and Development	9/19/2005	--	Power Point given by Charley Kincaid
22	SAC (Cumulative Analysis Issues) Issues Identified	9/19/2005	--	Power Point given by Charley Kincaid
23	HSW-EIS Groundwater Analysis Corrective Action Plan	7/21/2005	1	--
24	Module Development Folder for the “STOMP” Application	--	--	Noted that this documentation includes source code listing and integration code lines
25	Results Traceability Forms	--	--	Note that these forms are suggested by the SBMS for software classification applied to SAC but none of these forms were completed for SAC Rev 0 but the content of the forms is available in run script files
26	Power point presentations with software inventory type information	--	--	Note that there is not a formal inventory listing but versions and code configuration items are available in the CVS configuration tracking system
27	Software Release Forms	--	--	Note that that these forms are suggested by the SBMS for software classification applied to SAC but none of these forms were completed for SAC Rev. 0
28	Software Testing and Review Forms	--	--	Note that that these forms are suggested by the SBMS for

#	Item	Date	Rev.	Comments
				software classification applied to SAC but none of these forms were completed for SAC Rev. 0
29	Software Configuration Change Request/Approval Forms	--	--	These forms were completed for the 119 changes specifically related to SAC and a Log of the SCRs is generated and maintained by the software configuration manager
30	Software Design Description Systems Assessment Capability (SAC Rev 0a)	--	--	These two volumes of design description were examined as presented by Will Nichols at a meeting in his office
31	Software Documentation Plan (2.11/9401e010.doc)	30-Aug-05	3.1	Hanford Site-Wide Assessment Program
32	Hanford Site-Wide Assessment Project System Assessment Capability Software Configuration Management Plan	8/30/2005	3	This is the Configuration Management Plan for SAC Rev. 1 including the revised method of software management based on lessons learned from SAC Rev. 0 discoveries
33	Software Configuration Change Request (SCR) Form	--	3	This document is related to the SAC Rev. 1 effort
34	Data Configuration and Communication Management Plan	30-Aug-05	1	This document is related to the SAC Rev. 1 effort
35	Data Change Request	--	1	This document is related to the SAC Rev. 1 effort
36	SAC Assessment Documentation Plan	30-Aug-05	3	This document is related to the SAC Rev. 1 effort
37	Application Log for Assessment (template) System Assessment Capability, Rev. 0 - 38 Computer Codes	29-Aug-05	0	This document is a template to be used for SAC Rev. 1 assessments
38	FIN Plan Scope Sheet containing scope statement for Battelle's support of the HSW EIS (Scope Sheet)	12/4/96	--	--
39	Project Management Plan (PMP)–	12/02, 04/03 07/03, 10/03 02/04, 09/05		Hanford Site Solid Waste Program – Environmental Impact Statement Preparation Support
40	Current Records Inventory and Disposition Schedule and File Index dated 8/31/05	--	--	--

#	Item	Date	Rev.	Comments
41	Printout of Standards Based Management System sections on Records management Internal auditing Quality Problem reporting Project management Stopping and Restarting Work (Safety Rights and Responsibilities)			
42	Printout of the PNNL QA Program description revisions March 2005 February 2004 March 2003 April 2002 January 2001 January 2000 December 1997	--	--	--
43	E-mails Cooke to Marvin et al, 08/03/2005, Subj: New EIS Discrepancies Middleton to LaBarge et al, 02/07/2002, Subject: Review of SAC	08/03/05 02/07/02	--	--
44	Assessment/Audit Reports • PNNL Independent Oversight audit "ETD Data Quality Review," R. Johnson et al, 06/23/2005 • Organization unknown, "A Self-Assessment of Peer Review processes across the Pacific Northwest National Laboratory," author unknown, May 2004 • PNNL IES&H "Integrated Quality, Environment, Safety and Health Management System Quality and Integrated ES&H Programs Self-Assessment and Program Improvement Plan FY-2005," Revision 1, R. T. Steele et al, 08/2005 • DOE-RL "Assessment of Pacific Northwest National Laboratory Safety Software Quality Assurance, June 1 – 9, 2004," A-04-SED-PNNL-017, Revision C. A. Ashley et al, June 2004	See Text	--	--

#	Item	Date	Rev.	Comments
45	Action Tracking System file printout for Action # 5957 • Table of attachments showing status • DOE-RL Assessment plan "Assessment of Pacific Northwest National Laboratory (PNNL) Safety Software Quality Assurance," unsigned undated copy • PNNL "Factual Response to US Department of Energy Richland Operations Office Assessment of Pacific Northwest National Laboratory Safety Software Quality Assurance June 1-9, 2004," A-04-SED-PNNL-007, July 2004, author unknown • Unknown organization "Issues Surrounding NQA-1 Requirements from Hanford Contractors," author unknown, date unknown • Table of unknown source "Attachment 1: Master List of Safety system Computer Codes," author unknown, date unknown • Table of unknown source "Attachment 2 – SQA Extent of Condition assessment – RC Schrotke," author unknown, date unknown • Table of unknown source "Attachment 3 – SQA Extent of Condition Assessment – TL Almeida," author unknown, date unknown • IRMS Self Assessment Plan "Software Implementation Assessment Plan to Determine Project Adherence to SBMS Requirements," G. R. Johnson (unsigned), February 2005 • Incomplete untitled table of unknown source with columns titled "Software Application Category," "Software Development Requirements for Software to be Used for PNNL Operations (i.e. funded by PNNL Overhead funds)," "Software Development Requirements for Software for External Customers (i.e., funded by DOE Direct Funding, including work for other Hanford Contractors)" • E-mail Swafford-Bennett to Kimmel, Subject: "RE: Software QA Actions (proposed language)," 12/28/2004	See Text	--	--

#	Item	Date	Rev.	Comments
46	Training database printouts for • D. L. Strenge • K. Rhoads • P. W. Eslinger • C. T. Kincaid • M. P. Bergeron • Y. C. Deaton • R. W. Bryce • W. E. Nichols • W. Perkins • W. L. Johnson			
47	Letter Report - GW/VZ Integration Project Preliminary System Assessment Capability Concepts for Architecture, Platform, and Data Management –	9/30/1999		
48	Appendix A- Inventory Conceptual Model			
49	Appendix B - Release Conceptual Model			
50	Appendix C - Vadose Zone Conceptual Model			
51	Appendix D - Groundwater Conceptual Model			
52	Appendix E - Columbia River Conceptual Model			
53	Appendix F - Risk and Impact Conceptual Model			
54	Appendix G - Uncertainty Analysis Alternatives			
55	"Addendum to Composite Analysis for Low-Level Waste Disposal in the 200 Area Plateau of the Hanford Site". PNNL-11800-Addendum 1, Pacific Northwest National Laboratory, Richland, Washington.	2001		Bergeron M. P., E Freeman, S. K. Wurstner, C. T. Kincaid, F. M. Coony, D. Strenge, R. Aaberg, P. Eslinger
56	An Initial Assessment of Hanford Impact Performed with the System Assessment Capability. PNNL-14027, Pacific Northwest National Laboratory, Richland, Washington.	2002		Bryce, R. W., C. T. Kincaid, P. W. Eslinger, and L. F. Morasch (eds.)
57	Transient Inverse Calibration of the Site-Wide Groundwater Flow Model to the Hydraulic Impacts of the Unconfined Aquifer System from Hanford Operations, Southeastern Washington–1943-1996. PNNL-13447, Pacific Northwest National Laboratory, Richland, Washington.	2001		Cole C. R., M. P. Bergeron, S. K. Wurstner, P. D. Thorne, S. Orr, and M. McKinley

#	Item	Date	Rev.	Comments
58	CFEST-SC, Coupled Fluid, Energy, and Solute Transport Code, Super Computer Version, Documentation and User's Manual. Battelle, Pacific Northwest Laboratories, Richland, Washington.	10 June 05		Cole CR, SB Yabusaki, and CT Kincaid
59	Groundwater/Vadose Zone Integration Project Methods Used to Assemble Site-Specific Waste Site Inventories for the Initial Assessment. BHI-01570, Rev 0, Bechtel Hanford, Inc., Richland, Washington.	2002		Coony, F. M.
60	Methods Used to Assemble Site-Specific Waste Site Inventories for the Initial Assessment. BHI-01570, Rev.0, Bechtel Hanford, Inc., Richland, Washington.	24 June 05	Rev 0	Coony: FM Coony.
61	Ecological Characterization Data for the 2004 Composite Analysis, PNNL-14884	1 November 04		Downs JL, MA Simmons, AA Stegen, AL Bunn, BL Tiller, SL Thorsten, and RK Zufelt
62	User Instructions for the Systems Assessment Capability, Rev. 1, Computer Codes Volume 3: Utility Codes. PNNL-14852 Volume 3, Pacific Northwest National Laboratory, Richland, WA.	26 June 05	Rev. 1	Eslinger P.W., R.L. Aaberg, C.A. Lopresti, T.B. Miley, W.E. Nichols, and D.L. Strenge
63	User Instructions for the Systems Assessment Capability, Rev. 1, Computer Codes Volume 1: Inventory, Release, and Transport Modules. PNNL-14852 Volume 1, Pacific Northwest National Laboratory, Richland, WA.	26 June 05	Rev. 1	Eslinger P.W., T.B. Miley, D.W. Engel, WE. Nichols, L.H. Gerhardstein, D.L. Strenge, C.A. Lopresti, and S.K. Wurstner
64	SAC Rev. 1 Requirements and Code Development Activities	1 October 02	Rev. 1	Eslinger, Nichols
65	User Instructions for the Systems Assessment Capability, Rev. 0, Computer Codes. Volume 2: Impacts Modules. PNNL-13932-Volume 2, Pacific Northwest National Laboratory, Richland, Washington.	24 June 05	Rev. 0	Eslinger, P.W., C. Arimescu, D.W. Engel, B.A. Kanyid, and T.B. Miley
66	User instructions for the Systems Assessment Capability, Rev. 0, Computer Codes. Volume I: inventory, Release and Transport Modules. PNNL-13932-Volume 1, Pacific Northwest National Laboratory, Richland, Washington	24 June 05	Rev. 0	Eslinger, P.W., D.W. Engel, L.H. Gerhardstein, CA. Lopresti, WE. Nichols, DL. Strenge
67	Recharge Data Package for the Immobilized Low-Activity Waste 2001 Performance Assessment. PNNL-13033, Pacific Northwest National Laboratory, Richland, Washington	1999		Fayer, M. J., E. M. Murphy, J. L. Downs, F. O. Kahn, C. W. Lindenmeier, and B. N. Bjornstad
68	Groundwater. Prentice-Hall, Inc., Englewood Cliffs, New Jersey.	1979		Freeze, R. A., and J. A. Cherry
69	Draft User's Manual, CFEST-96 Flow and Solute Transport, Constant/Variable Density, Computationally Efficient, and Low Disk PC/Unix Version.	19 June 05		Gupta SK
70	Hanford Site Solid Waste Program - Environmental Impact Statement Preparation Support, Project Management Plan	4 Feb. 04	Rev. 4	Johnson, W.L.
71	Hanford Site Solid Waste Program - Environmental Impact Statement Preparation Support, Project Management Plan	3-Jul-03	Rev. 2	Johnson, W.L

#	Item	Date	Rev.	Comments
72	Hanford Site Solid Waste Program - Environmental Impact Statement Preparation Support, Project Management Plan	5-Sept-05	Rev. 5	Johnson, W.L
73	Hanford Site Solid Waste Program - Environmental Impact Statement Preparation Support, Project Management Plan	3-Oct-03	Rev. 3	Johnson, W.L
74	Hanford Site Solid Waste Program - Environmental Impact Statement Preparation Support, Project Management Plan	2-Dec-02		Johnson, W.L
75	Technical Scope and Approach for the 2004 Composite Analysis of Low Level Waste Disposal at the Hanford Site, PNNL-14372	2004		Kincaid et al.
76	Composite Analysis for Low-Level Waste Disposal in the 200 Area Plateau of the Hanford Site. PNNL-11800, Pacific Northwest National Laboratory, Richland, Washington.	1998		Kincaid, C. T., M. P. Bergeron, C. R. Cole, M. D. Freshley, N. L. Hassig, V. G. Johnson, D. I. Kaplan, R. J. Serne, G. P. Streile, D. L. Strenge, P. D. Thorne, L. W. Vail, G. A. Whyatt, and S. K. Wurstner.
77	Tank Farm Contractor Operation and Utilization Plan, Volume I. HNF-SD-WM-SP-012, Rev. 4, Numatec Hanford Corp., CH2M HILL Hanford Group, Inc., DMJMH&N, Richland, Washington.	2002		Kirkbride, R. R., G. K. Allen, B. A, Higley, T. M. Hohl, S. L. Lambert, R. M. Orme, D. E. Place, J. A. Seidl, R. S. Wittman, J. H. Baldwin, J. N. Strode, J. A. Reddick, and L. M. Swanson
78	Geographic And Operational Site Parameters List (Gospl) For The 2004 Composite Analysis, PNNL-14725	2004		Last GV, WE Nichols, and CT Kincaid
79	Hanford Immobilized Low-Activity Waste Performance Assessment: 2001 Version. DOE/ORP-2000-24 Rev. 0, U.S. Department of Energy, Office of River Protection, Richland, Washington.	2001		Mann, F. M., K. C. Burgard, W. R. Root, R. J. Puigh, S. H. Finfrock, R. Khaleel, D. H. Bacon, E. J. Freeman, B. P. McGrail, S. K. Wurstner, and P. E. LaMont
80	Diffusion and Leaching of Selected Radionuclides (I-129, Tc-99, and U) through Category 3 Waste Encasement Cement Concrete and Soil Fill Material: Progress Report for 2001. PNNL-13639, Pacific Northwest National Laboratory, Richland, Washington.	2001		Mattigod, S. V., G. A. Whyatt, R. J. Serne, P. F. Martin, K. E. Schwab, and M. I. Wood
81	River Data Package For The 2004 Composite Analysis, PNNL-14824	2004		Rakowski et al.
82	Unpublished Appendix B, Release Data for initial Assessment Performed with the System Assessment Capability	2001	Rev. 0	Riley and LoPresti
83	Release Data Package For The 2004 Composite Analysis, PNNL-14760	2004		Riley and LoPresti
84	Groundwater/Vadose Zone Integration Project:Hanford Soil Inventory Model. BHI-01496, Rev 0, Bechtel Hanford Inc., Richland, Washington.	2001		Simpson, B. C., R. A. Corbin, and S. F. Agnew
85	Hanford Soil Inventory Model. BFI-01496, Rev.0. Bechtel Hanford, Inc., Richland, Washington.	1-Mar-2001		Simpson, BC, RA Corbin, and SF Agnew.
86	Performance Assessment for the Disposal of Low-Level Waste in the 200-East Area Burial Grounds. WHC-SD-WM-TI-730, Rev. 0, Westinghouse Hanford Company, Richland, Washington.	1996		Wood, M. I., R. Khaleel, P. D. Rittmann, S. H. Finfrock, T. H. DeLorenzo, and D. Y. Garbrick

#	Item	Date	Rev.	Comments
87	Original Electronic Prep and Risk Approval Form	18-Sept-97		
88	Project Management Plan for the Preparation of an Environmental Impact Statement (EIS) For Solid Waste Management Activities	1-Dec-98		
89	BHI-01365, Draft A - System Assessment Capability (Revision 0) Assessment Description, Requirements, Software Design, and Test Plan	1-May-00	Rev. 0	Electronically available at \\SAC\Share\code\config\Software-DocumentationPlan\archive \rev.0.0
90	System Assessment Capability Configuration Management Plan Rev 0.0	1-Oct-00	Rev. 0	Electronically available at \\SAC\Share\code\config\Software-DocumentationPlan\archive \rev.0.0
91	PNNL-10427 - An Initial Assessment of Hanford Impact Performed with the System Assessment Capability	1-Sept-02		
92	Draft Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement, Richland, Washington, SUMMARY, DOE/EIS-0286D	2-Apr-02		
93	Draft Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement, Richland, Washington, Volume 1 - Sections 1 through 7, DOE/EIS-0286D	2-Apr-02		
94	Draft Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement, Richland, Washington, Volume 2 - Appendixes A-I, DOE/EIS-0286D	2-Aprl-02		
95	Technical Guidance Document for Composite Analysis of Low-Level Waste Disposal at the Hanford Site, DOE-RL-2005-66	30-Jun-05		
96	Draft Corrective Action Plan, Rev. 1	21-Jul-05		For the Quality Data Issues Identified for the HSW EIS
97	PAAA NTS Report	25-Aug-05		For the Quality Data Issues Identified for the HSW EIS
98	DOE-RL NEPA procedures and requirements for data management, data control, data quality			
99	NEPA Quality Assurance Plan, as required by DOE O 451.1B			Not Approved or Issued
100	FH. 2004. Hanford Site Solid Waste Environmental Impact Statement Technical Information Document HNF-4755, Rev. 2, Fluor Hanford, Inc., Richland WA			TID

Appendix C
Technical Data

Review file list – Groundwater pathway analysis

RANSAC:/home/ANALYSIS2/SWEIS/SWEIS-regional/proj-200E-kd0/baseline/mixed/lpi
RANSAC:/home/ANALYSIS2/SWEIS/SWEIS-regional/proj-200E-kd0/baseline/mixed/l3i
RANSAC:/home/ANALYSIS2/SWEIS/SWEIS-regional/proj-200E-kd0/baseline/mixed/ctl
RANSAC:/home/ANALYSIS2/SWEIS/SWEIS-regional/proj-200E-kd0/baseline/Post-1988-buried/lpi
RANSAC:/home/ANALYSIS2/SWEIS/SWEIS-regional/proj-200E-kd0/baseline/Post-1988-buried/l3i
RANSAC:/home/ANALYSIS2/SWEIS/SWEIS-regional/proj-200E-kd06/baseline/mixed/lpi
RANSAC:/home/ANALYSIS2/SWEIS/SWEIS-regional/proj-200E-kd06/baseline/mixed/l3i
RANSAC:/home/ANALYSIS2/SWEIS/SWEIS-regional/proj-200E-kd06/baseline/mixed/ctl
RANSAC:/home/ANALYSIS2/SWEIS/SWEIS-regional/proj-200E-kd06/baseline/Post-1988-buried/ctl
RANSAC:/home/ANALYSIS2/SWEIS/SWEIS-regional/proj-200W-kd06/baseline/Pre-1970/ctl
RANSAC:/home/ANALYSIS2/SWEIS/SWEIS-regional/proj-200W-kd06/baseline/mixed/lpi
RANSAC:/home/ANALYSIS2/SWEIS/SWEIS-regional/proj-200W-kd06/baseline/mixed/l3i
RANSAC:/home/ANALYSIS2/SWEIS/SWEIS-regional/proj-200W-kd06/baseline/mixed/ctl
RANSAC:/home/ANALYSIS2/SWEIS/SWEIS-regional/proj-200W-kd06/baseline/megatrench/ctl
RANSAC:/home/ANALYSIS2/SWEIS/SWEIS-regional/proj-200W-kd06/baseline/ERDF/ctl
RANSAC:/home/ANALYSIS2/SWEIS/SWEIS-regional/proj-200W-kd06/baseline/Post-1988-buried/ctl

hsw-EIS3-median/218-W@T6-12/I129
hsw-EIS3-median/218-W@S6-3/I129
hsw-EIS3-median/218-W@W-7/I129
hsw-EIS3-median/218-E@A6-4/I129
hsw-EIS3-median/218-E@B6-11/I129
hsw-EIS3-median/218-E@B6-11/V238

w-7/Tc99/1/vader/table
w-7/I129/1/vader/table
w-7/U238/1/vader/table
241-C-105/I129/1/vader/table
241-C-105/I129/1/vader/table
218-E-15/Tc99/vader/table
218-E-15/I129/vader/table
218-W@T6-12/U238/01/vader/table
218-W@T6-12/I129/01/input/table
218-W-7/U238/01/vader/table
216-2-9/I129/?/input/table (various)

218-W-7/U238/11/input
218-W@6-3/U238/11/input
241-C-105/Tc99/11/input
241-C-105/Tc99/11/output
241-C-105/Tc99/15/output

241-C-105/Tc99/15/input
218-W@S6-3/Tc99/15/input
218-W@S6-3/Tc99/15/output
218-W@S6-3/U238/15/input
218-W@S6-3/U238/15/output

soil_debris_rel_6_m_15_6m_18_6m_trenches.xls - 0.5 cm/yr, kd=0
soil_debris_rel_6_m_15_6m_18_6m_trenches.xls - 0.01 cm/yr, kd=0
soil_debris_rel_6_m_15_6m_18_6m_trenches.xls - 0.5 cm/yr, kd=0.6
soil_debris_rel_6_m_15_6m_18_6m_trenches.xls - 0.01 cm/yr, kd=0.6
soil_debris_rel_6_m_15_6m_18_6m_trenches.xls - 0.5 cm/yr, kd=0.6 - deeper trench
soil_debris_rel_6_m_15_6m_18_6m_trenches.xls - 0.01 cm/yr, kd=0.6 - deeper trench
Soil_Debris_Cement_releases.xls (various)
I-Solubility_Calculation_alt_grpABC.xls

200e/kd0/e-12b-in-0.0-0.50.10
200W/kd0-6/W-5-in-0.6-0.50.10
200W/kd0/W-5-in-0.6-0.50.10
200e/kd-0/lbv_2007_1mw-pvr/input.lpi
200W/kd-0/llw-post-07/input/l3i
200W/kd0/burd-post-88.input.lpi
200W/kd0-6/burd-post-88.input.lpi
200W/kd0-6/llw-post-07/input