Department of Energy
Washington, DC 20585

June 5, 2008

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. John Fulton
Chief Executive Officer
CH2M HILL Hanford Group, Inc.
2440 Stevens Drive
Richland, Washington 99352

NEA-2008-02

Dear Mr. Fulton:

This letter refers to the Department of Energy's (DOE) investigation into the facts and circumstances associated with the July 27, 2007, spill of radioactive waste in the vicinity of the S-102 retrieval pump discharge at the Hanford Tank Farm. The results of the onsite investigation were provided in an Investigation Report dated March 5, 2008. An enforcement conference was held on April 16, 2008, with you and members of your staff to discuss these findings. A summary of the conference is enclosed.

Based on our evaluation of the evidence in this matter, including information provided by you and your staff during the enforcement conference, DOE has concluded that violations of 10 C.F.R. Part 830, *Nuclear Safety Management*, and 10 C.F.R. Part 835, *Occupational Radiation Protection*, have occurred.

DOE views this event as highly significant, and notes that it was only mere chance that prevented personnel from being directly contaminated by significant quantities of tank waste during the course of the event. DOE is concerned by both the longstanding engineering lapses underlying the event, and the deficiencies in appropriate recognition and response from the 8-hour time period between detection of the High Radiation Area until determination that a spill had occurred. Accordingly, DOE is issuing the enclosed Preliminary Notice of Violation (PNOV) with nine violations and a proposed civil penalty in the amount of $302,500.

The majority of the proposed violations have been categorized as Severity Level II, based on their associated significance. DOE is particularly concerned, however, by the missed opportunities to identify the design flaw underlying the event; these opportunities included the original design review and comment process, the response to the 2006 assessment of

Tank Farms documented safety analyses, and the response to the Tank C-202 personnel contamination event. Although DOE acknowledges that CH2M HILL Hanford Group, Inc., (CHG's) performance over the past 18 months (exclusive of the subject event) has shown apparent improvement, DOE is also concerned by the history of significant radiological events at the Tank Farms over the past 3 years, and CHG's consequent inability to effectively resolve the underlying issues. For these reasons, the quality improvement violation has been escalated to Severity Level I. Finally, the assessment program violation was categorized as Severity Level III in recognition of its lesser significance.

In calculating the civil penalty, no mitigation was provided for timely self-identification of the violations due to the event's self-disclosing nature. With respect to your investigation and corrective actions upon determination that a spill had occurred, DOE found your event investigation to be detailed and thorough, and found your corrective actions to be appropriate. Full mitigation (50 percent) was applied to the Severity Level II citations in recognition of these positive elements. Mitigation for corrective actions was not applied to the quality improvement violation since the basis of the citation relates to inadequacy of corrective actions.

DOE remains concerned, however, regarding the sustainability of your corrective actions, particularly in light of potential distractions posed by the upcoming contract bid and award process. Consequently, you are requested to report on the effectiveness of your corrective actions to the Office of Enforcement and the Office of Environmental Management staff at Headquarters within 6 months of your receipt of this letter. Your report should address the following:

- the status of your corrective actions and the results of your evaluations as to their effectiveness;
- your assessment of CHG's ability to recognize and respond to a future upset condition, as well as the basis for that assessment; and
- your assessment of CHG's ability to effectively identify and address quality problems in a timely manner, including the basis for that assessment.

In addition, DOE notes that several of the violations involve CHG's radiation control program, regulated under 10 C.F.R. Part 835, and that these violations would reside in the occupational health area but for the nuclear safety dimension. As a result, we suggest, because we believe it would be particularly productive, for you to review the effectiveness of worker safety and health program elements that are in place at your facility to protect workers from hazards.

Pursuant to 10 C.F.R. § 820.24, *Preliminary Notice of Violation*, you are required to respond within 30 days of the date of this letter and to follow the instructions specified in the enclosed PNOV. After reviewing your response to the PNOV, including any proposed additional corrective actions entered into the Noncompliance Tracking System and in

consideration of your report on the effectiveness of corrective actions, DOE will determine whether further enforcement action is necessary to ensure continuing and effective compliance with DOE nuclear safety requirements. DOE will continue to monitor the completion of corrective actions until these matters are resolved.

Sincerely,

Arnold E. Guevara
Director
Office of Enforcement
Office of Health, Safety and Security

Enclosures

cc: Craig Anderson, CHG
Richard Azzaro, DNFSB

Preliminary Notice of Violation

CH2M HILL Hanford Group, Inc.
Hanford Tank Farms

NEA-2008-02

As a result of the Department of Energy's (DOE) investigation into the facts and circumstances associated with the spill of approximately 85 gallons of radioactive waste in the vicinity of the S-102 retrieval pump discharge, multiple violations of DOE nuclear safety requirements were identified. The violations included: (1) a violation of a technical safety requirement (TSR), (2) inadequacies in procedures, (3) failure to follow procedures during activities leading up to the spill event, (4) failure to follow procedures in response to the spill event, (5) occupational radiation protection deficiencies, (6) failure to adequately train personnel, (7) failure to incorporate design requirements, (8) failure to correct known problems adverse to quality, and (9) failure to proactively identify spill event precursors through management assessments. The associated violations have been grouped and categorized as one Severity Level I violation, seven Severity Level II violations, and one Severity Level III violation, for a combined proposed civil penalty of $302,500.

In accordance with 10 C.F.R. § 820, Appendix A, *General Statement of Enforcement Policy*, the violations are listed below. Citations specifically referencing the quality assurance criteria of 10 C.F.R. § 830.122 also represent a violation of 10 C.F.R. § 830.121(a), which requires compliance with those quality assurance criteria.

VIOLATIONS

I. Technical Safety Requirement Violation

Title 10 C.F.R. § 830.201 states that DOE contractors must "Perform work in accordance with the safety basis for a hazard category 1, 2, or 3 DOE nuclear facility and, in particular, with the hazard controls that ensure adequate protection of workers, the public, and the environment."

Contrary to this requirement, CH2M HILL Hanford Group, Inc. (CHG) failed to perform work in accordance with the Tank Farm safety basis. Specifically, HNF-SD-WM-TSR-006, *Tank Farms Technical Safety Requirements*, revision 6, section 3.1.2, requires that Tank Farm waste transfer systems have either an operable service water pressure detection system or an operable backflow preventer. This TSR limiting condition of operation (LCO) goes on to state that "This requirement is applicable to non-waste transfer systems (e.g., service water, raw water, diluent systems) that are PHYSICALLY CONNECTED to an ACTIVE WASTE transfer pump not under administrative lock." However, the S-102 dilution water supply line did not have an operable service water pressure detection system and did not have an operable backflow

preventer in place while physically connected to the active S-102 waste transfer pump. This resulted in a violation of TSR LCO 3.1.2. This violation of TSR LCO 3.1.2 has existed since S-102 waste transfer activities (interim stabilization) began in 2001. On July 27, 2007, during an attempt to remove a waste plug in the S-102 tank pump, radioactive waste under pressure was introduced into a dilution water supply pipe that was physically connected to the waste transfer pump. This pump exerted enough pressure to burst the dilution water supply hose and release radioactive waste in the vicinity of the S-102 retrieval pump discharge.

This violation constitutes a Severity Level II violation.
Proposed Civil Penalty - $27,500

II. Procedural Inadequacies

Title 10 C.F.R. § 830.122(e)(1) states that DOE contractors are to "Perform work consistent with technical standards, administrative controls, and other hazard controls adopted to meet regulatory or contract requirements, using approved instructions, procedures, or other appropriate means."

Contrary to this requirement, multiple examples were noted in which procedures necessary for personnel to perform assigned duties were either not in place or inadequate to effectively control the activity. Specific examples are listed below.

A. CHG uses an informal Delta Hazards and Operability Analysis (HAZOP) process to analyze changes in designs to ascertain previously unidentified hazards and other potential problems resulting from the design changes. However, this process is not governed by procedure and there is no formal process to document the results of the analysis. The informal Delta HAZOP analysis applied to the changes in S-102 pump design discussed some but not all of the design changes, and the results of the analysis were neither documented nor reported to CHG management.

B. CHG procedure TFC-ENG-CHEM-C-11, *Process Control Plans*, revision C-6, dated April 12, 2007, defines the requirements for preparing Process Control Plans. To delineate the process controls for the S-102 retrieval operations and the technical basis for those controls, CHG prepared RPP-17043, *Process Control Plan for Saltcake Dissolution in Tank 241-S-102*. The S-102 Process Control Plan was originally a simple duplication of the existing S-112 Process Control Plan, and stated that since a high percentage of the tank waste could be dissolved with water, S-102 was an excellent candidate for the saltcake dissolution process. However, this is in contradiction to the actual conditions in the tank and the S-102 functions and requirements document, which states that saltcake dissolution technology is not a candidate for S-102 waste retrieval due to the presence of sludge in addition to saltcake. In addition to this fundamental flaw in the S-102 Process Control Plan, several other deficiencies were noted:

- No controls are mentioned for the creation of a pool within the waste at the bottom of the tank.
- The operation of the sparge line or the camera is not discussed.
- The loss of pump operation is not adequately addressed.
- Manual rotation of the pump in the event of a pump plug is not discussed.

- Electrical "bumping" of the pump motor in the event of a pump plug is not discussed.
- The Operations Plan section is not included in the plan as required by TFC-ENG-CHEM-C-11, attachment B, section 4.0.

C. CHG procedure TO-420-905, *Perform 241-S-102 Waste Retrieval Pumping*, revision C-24, dated July 26, 2007, provides operating instructions for dissolving, retrieving, and transferring waste from Single-Shell Tank 241-S-102 to Double-Shell Tank 214-SY-102. This operation instruction was in use at the time of the spill event. The following is a partial list of inadequacies found in this procedure:

- The electrical bumping of the pump motor was not defined within the procedure or by reference to a maintenance instruction.
- The manual rotation of the pump motor was not defined within the procedure or by reference to a maintenance instruction.
- The procedure and data sheet provide no direction on whether contact or general area radiation dose rate measurements are required, or when open window measurements should be taken.
- Step 3.3.5 contains a warning associated with the manipulation of valve V-104 but does not specify which V-104 valve (S02B-WT-V-104 or SYSP-RW-V-104).
- Steps 4.3.1 and 5.0 allow the shift manager or operating engineer to determine which sections, subsections, tasks, and activities of the procedure to perform, but no further guidance is provided on the conduct of operations.
- Step 5.3.1 directs the operator to section 4.3 to complete applicable field preparations; however, section 4.3 does not indicate which procedure step to go to after completion.
- It is not clear when steps 5.3.2 thru 5.3.8 are required to be performed.
- Step 5.3.36.2 allows three attempts to start the transfer pump but gives no guidance on the number of allowed attempts to start the pump in reverse.
- The procedure requires that the sparge water isolation valve be closed. However, the procedure never directs operators to open the valve in order to supply sparge water to the S-102 pump.

D. CHG Procedure TFC-MAINT-C-01, *Tank Farm Contractor Work Control*, revision M-4, dated July 19, 2007, defines work management from initiation of a work request through work order closeout. Section 4.2.1 addresses troubleshooting activities and states that with shift manager approval, maintenance or operations personnel are to "investigate the problem and determine the need for a troubleshooting plan." However, no further direction or guidance is provided on how this determination is to be made.

Collectively, these violations constitute a Severity Level II violation.
Proposed Civil Penalty - $27,500

III. Failure to Follow Procedures (Pre-Event)

Title 10 C.F.R. § 830.122(e)(1) states that DOE contractors are to "Perform work consistent with technical standards, administrative controls, and other hazard controls adopted to meet regulatory or contract requirements, using approved instructions, procedures, or other appropriate means."

Contrary to this requirement, multiple examples were noted in which procedural requirements necessary for personnel to perform assigned duties were not followed in activities immediately preceding the spill event. Specific examples are listed below:

A. CHG procedure TFC-MAINT-C-01, *Tank Farm Contractor Work Control*, revision M-4, dated July 19, 2007, sections 4.1.1.5 and 4.1.1.6, requires the field work supervisor (FWS) and workers to use the worksite hazard analysis (WHA) to walk down the work and ensure that the work and hazards are identified, controlled, and understood. In response to a ground fault indication on the S-102 pump's variable frequency drive (VFD) control panel, a maintenance crew was formed to troubleshoot the problem. However, the maintenance crew used a general hazards analysis, which does not address electrical hazards, in lieu of the required WHA. In addition, the work control procedure, section 4.1.1.8, requires that activities performed by the FWS and workers be recorded in the work record. However, these troubleshooting activities were not recorded in the work record as required.

B. CLO-W0-07-0035, *Instrument Technician Standing Minor Work Instructions*, section 2.2.1, states that "If it is determined that trouble shooting is required, generate a trouble shooting plan." However, the maintenance crew assigned to troubleshoot the possible ground fault on the S-102 VFD motor did not prepare this troubleshooting plan as required.

C. CHG procedure TFC-MAINT-C-01, *Tank Farm Contractor Work Control*, revision M-4, dated July 19, 2007, section 4.1.1, defines a minor work activity as one that involves routine, repetitive tasks that may be accomplished using verbal direction. Just after the completion of the troubleshooting of the S-102 VFD pump motor, a second maintenance crew was formed to manually rotate the S-102 pump. However, this maintenance activity was categorized as minor work even though it did not meet the definition in the work control procedure. Specifically, the work was a multi-craft job requiring the use of special tools and specific training. In addition, section 4.8 requires that the shift manager approve the release of work. However, the maintenance work involving the manual rotation of the pump was not released by the shift manager as required. Finally, section 4.1.1.8 requires that activities performed by the FWS and workers be recorded in the work record. However, the work associated with manually rotating the pump was not recorded in the work record as required.

D. CHG procedure TO-420-905, Checklist 2, *Pre-Transfer Valve Alignment*, requires that the sparge water isolation valve be checked and initialed to verify that the valve is in the closed position. Operators performing the checklist in the month of July 2007 initialed the checklist, indicating that the valve was closed when checked. However, interviews with CHG personnel indicated that this valve is seldom closed and that the checklist has shown the valve closed when it was actually open.

E. CHG procedure TO-420-905, section 5.3.21, requires operators to ensure that valve V-106 is open before beginning a waste transfer from Single-Shell Tank S-102 to Double-Shell Tank SY-102. However, several hours prior to the S-102 spill event, operators assumed that the valve had been opened and commenced waste transfer operations. The S-102

pump was immediately shut down on indication of high discharge pressure and a pump motor current increase. The CHG investigation showed that V-106 was in fact closed and had not been opened as required by the procedure.

F. CHG procedure TFC-ENG-FACSUP-C-04, *Process Memos*, revision B-4, dated May 18, 2006, addresses the use of process memos for communicating technical direction to operating personnel. Section 4.1.1 of the procedure states that process memos are not to include any steps or activities that are not already included in an approved procedure. However, process memo PM-CO-07, *Startup and Operation of the New Seepex Pump – Revised*, dated July 25, 2007, contains specific operational guidance for operators that is not included in operating procedure TO-420-905, *Perform 241-S-102 Waste Retrieval Pumping*, revision C-24, dated July 26, 2007. For example, the process memo provides operations personnel with guidance on what to do if the pump needs to be shut down because of problems with the VFD motor, and when to use or not to use the S-102 pump auto-reverse function including the duration of and motor speed during pump reversal.

Collectively, these violations constitute a Severity Level II violation.
Proposed Civil Penalty - $27,500

IV. Failure to Follow Procedures (Event Response)

Title 10 C.F.R. § 830.122(e)(1) states that DOE contractors are to "Perform work consistent with technical standards, administrative controls, and other hazard controls adopted to meet regulatory or contract requirements, using approved instructions, procedures, or other appropriate means."

Contrary to this requirement, multiple examples were noted in which procedural requirements necessary for personnel to perform assigned duties were not followed in activities immediately following the spill event. Specific examples are listed below:

A. CHG Abnormal Operating Procedure (AOP) TF-AOP-020, *Response to Placing Personnel and Equipment in a Safe Condition*, revision B-0, section 2.0, dated November 7, 2006, defines conditions requiring entry into the AOP. Section 2.1.1 defines an AOP entry condition to exist when "Notification by the First Line Manager (FLM) of exceeding void limit of Radiological Work Permit; work outside of approved work scope; or unexpected hazards are identified". On July 27, 2007, at approximately 2:15 a.m., a health physics technician (HPT) entered the S-Farm to perform routine radiological surveys. As the HPT approached the S-102 pump, the gamma radiation levels were measured at close to 200 millirem per hour (mrem/hr) at about 12 feet from the S-102 riser extension enclosure. This discovery voided radiological work permit (RWP) CO-001, revision 5, which was in use to conduct the radiological surveys. However, the HPT did not enter and execute the requirements of TF-AOP-020 upon discovery of this unexpected hazard as required.

B. CHG AOP TF-AOP-006, *Response to High Radiation*, revision C-3, section 3.1.2, requires the shift manager to ensure that the Hanford Fire Department is notified when there are increasing or unanticipated radiation levels within the Tank Farms. However, when informed of the unexpected high radiation exposure rates (200 mrem/hr) near the S-102 riser extension enclosure, the cognizant shift manager did not notify the Hanford Fire Department as required.

C. CHG procedure TF-OPS-025, *Performance of Radiological Control Investigative Surveys*, revision A-7, dated February 22, 2007, is to be used to perform radiological control investigative surveys to assess the radiological status of an area. Section 2.1.4 states that work performed using this procedure will be authorized by the shift manager through the release of an Investigation Survey Request (ISR). At approximately 10:00 a.m. on July 27, 2007, a work crew was authorized to perform an investigative radiological survey to determine whether tank waste had spilled. However, this survey was conducted using CHG AOP TF-AOP-006, *Response to High Radiation*, even though CHG does not consider this AOP to be a stand-alone, work-governing document. Furthermore, the ISR required by TF-OPS-025 was not prepared to support the survey as required.

Collectively, these violations constitute a Severity Level II violation.
Proposed Civil Penalty - $27,500

V. Occupational Radiation Protection Deficiencies

Title 10 C.F.R. § 835.603 states that "Each access point to radiological areas and radioactive material areas (as defined at § 835.2) shall be posted with conspicuous signs bearing the wording provided in this section."

Title 10 C.F.R. § 835.603(b) states that "The words 'Caution, High Radiation Area' or 'Danger, High Radiation Area' shall be posted at each high radiation area." Title 10 C.F.R. § 835.2 defines a *High Radiation Area* as "any area, accessible to individuals, in which radiation levels could result in an individual receiving an equivalent dose to the body in excess of 0.1 rems (0.001 Sv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates."

Title 10 C.F.R. § 835.104 states that "Written procedures shall be developed and implemented as necessary to ensure compliance with this part, commensurate with the radiological hazards created by the activity and consistent with the education, training, and skills of the individuals exposed to those hazards."

Contrary to these requirements, CHG failed to post a High Radiation Area (HRA) in a timely manner, and CHG personnel failed to adhere to established radiation protection procedures. Specific examples are listed below:

A. A HRA measuring 200 mrem/hr was identified in the vicinity of the S-102 tank at approximately 2:15 a.m. on July 27, 2007. Although access points to the area were placed under continuous observation, the area was not posted as an HRA until approximately 21 hours after initial identification.

B. RWP CO-001, revision 5, was the RWP in use at the time the HPT discovered the 200 mrem/hr HRA near the S-102 riser extension enclosure while conducting routine radiological surveys on the morning of July 27, 2007. This RWP lists the types of radiological areas in which work using this RWP can be performed, but does not include work activities conducted in HRAs. Upon discovery of the HRA, the HPT exited the S-Farm to obtain a second radiation detection instrument to confirm the previous reading.

The HPT then reentered the S-Farm to conduct the confirmatory surveys using RWP CO-001. However, the HPT's reentry into a known HRA violated RWP CO-001, which was not intended for use in known HRAs.

C. CHG procedure TF-RC-003, *Eberline Model RO-20 Ion Chamber Operation and Source Checks*, revision A-1, dated July 3, 2007, provides direction on the use of the RO-20 radiation detection instrument. Sections 5.3.5 and 5.3.6 of this procedure require the user to point the instrument's open window toward all possible sources of radiation, and to perform window open (beta-gamma) and window closed (gamma) radiation measurements. However, during the initial and confirmatory survey measurement on the morning of July 27, 2007, the HPT conducting the initial survey and the subsequent confirmatory survey used only closed-window measurements.

Collectively, these violations constitute a Severity Level II violation.
Proposed Civil Penalty - $27,500

VI. Failure to Train Personnel

Title 10 C.F.R. § 830.122(b)(1) states that DOE contractors are to "Train and qualify personnel to be capable of performing their assigned work."

Contrary to this requirement, CHG failed to assure that personnel were adequately trained to recognize radiological hazards and to perform assigned maintenance activities as evidenced by the following:

A. RPP-17307, *Shielding Analysis for 241-S-102 Retrieval*, revision 0, dated July 31, 2003, defines the estimated exposure rates for the above-grade portions of the progressive cavity pump and the associated shielding that is needed. Section 4.2 states that the estimated exposure rates at 30 cm (12 inches) from the surface of the riser extension shield box will range from 40 to 80 mrem/hr.

During the subject event on July 27, 2007, the measured radiation dose rates significantly exceeded those predictions; however, this condition was not recognized as anomalous by radiological control and engineering personnel. While conducting routine radiological surveys in the S-Farm, the HPT observed gamma radiation level readings of close to 200 mrem/hr at about 10 to 12 feet from the S-102 riser extension. This exposure rate not only exceeds the 80 mrem/hr at 1 foot upper exposure rate for normal operations, but also greatly exceeds the normal exposure rate, considering that the 200 mrem reading was taken at 10 to 12 feet from the source of the radiation. The actual exposure reading and its distance from the riser extension should have prompted CHG to quickly recognize that an abnormal condition had occurred near the S-102 tank. However, this determination was not made until about 8 hours had passed. The fact that CHG personnel did not recognize the implications of the high exposure reading at that distance indicates that CHG radiological and engineering personnel were not adequately trained in the S-102 retrieval process and in the results and ramifications of the shielding analysis.

B. On July 27, 2007, a millwright, an electrician, an operating engineer, a first line supervisor, and a HPT were formed into a maintenance crew to manually turn the S-102 pump shaft in the reverse direction in an attempt to remove a waste plug in the pump. To accomplish this activity properly, the millwright needed a torque wrench and special socket to torque the pump shaft to a maximum of 280 ft-lb. Informal training on the hardware and torque limit had been provided previously to two of three millwrights, but not to the millwright assigned to perform the task on July 27, 2007. Unaware of the specific tooling and specification, this millwright was preparing to manually rotate the pump shaft with a pipe wrench until an electrical engineer, who was at the jobsite by chance, informed him that he believed a torque specification had been developed. Upon further inquiry, the millwright was informed of the special tooling requirements and specification needed to perform the manual reversal of the S-102 pump shaft. CHG's failure to provide the millwright with proper training could have led to serious damage to the S-102 pump and the resultant potential for radiological exposure during subsequent pump replacement maintenance activities.

Collectively, these violations constitute a Severity Level II violation.
Proposed Civil Penalty - $27,500

VII. Failure to Incorporate Design Requirements and Validate the Adequacy of Design Products

Title 10 C.F.R. § 830.122(f)(2) states that DOE contractors are to "Incorporate applicable requirements and design bases in design work and design changes."

Contrary to this requirement, CHG failed to assure that all design bases requirements were incorporated into the original pump design and that subsequent changes made to the pump design were adequately analyzed. Specific examples are listed below:

A. CHG procedure TFC-ENG-DESIGN-P-17, *Design Verification*, was used to review and approve the design of the Seepex pumps. The review was performed by a subcontractor. A primary tool used to review and approve the design of the Seepex pumps was the Design Requirements Compliance Matrix (DRCM). Section 4.1.1.3 of the procedure states that DRCM shall, as a minimum, document the design assumptions and documented safety analysis (DSA) assumptions, and project technical assumptions that would impact design or deployment; the necessary actions to avoid, mitigate or eliminate technical assumptions, and how the technical assumptions are verified. However, the DRCM for the S-102 Seepex pumps did not identify the potential for pressurization of the dilution water supply line during reverse flow operations, and thus did not address the need for backflow prevention as required by HNF-SD-WM-TSR-006, *Tank Farms Technical Safety Requirements*, revision 6, section 3.1.2.

B. The CHG Closure Operations organization used an informal Delta HAZOP process for analyzing design changes to identify newly introduced or previously unidentified hazards and other potential problems. On July 2, 2007, CHG performed a Delta HAZOP for the modified S-102 Seepex 2 pump. However, this Delta HAZOP was not adequate in that it failed to evaluate all of the changes made to the pump design. Specifically, the Delta HAZOP did not discuss changing the software to triple the reverse speed of the pump

motor from 15 Hertz (Hz) to 45 Hz and moving the dilution line discharge port from inside the suction screen to the pump suction cavity. A more thorough and complete review of these changes could have led CHG to challenge the conclusion that the dilution waste water supply line was not "physically connected" to an active waste transfer pump.

Collectively, these violations constitute a Severity Level II violation.
Proposed Civil Penalty - $27,500

VIII. Failure to Identify and Correct a Problem Adverse to Quality

Title 10 C.F.R. 830 § 122(c) states that DOE contractors are to: (1) "Establish and implement processes to detect and prevent quality problems;" (2) "identify, control, and correct items, services, and processes that do not meet established requirements;" and (3) "identify the causes of problems and work to prevent recurrence as a part of correcting the problem."

Contrary to these requirements, CHG processes to identify, control, and correct items that do not meet established requirements and to identify and correct causes and work to prevent recurrence were not effective in identifying and correcting the longstanding design issue associated with the S-102 pump and associated service water supply line.

In translating the Tank Farms DSA and TSR requirements into Tank S-102 specific design and operating instructions, CHG engineers and safety basis personnel did not consider the dilution water supply line attachment point at the pump suction side to be within the waste transfer route, since the attachment point was not on the normal pump discharge, which was pressurized during normal waste transfer operations. Further, they did not recognize that the pump suction side could be pressurized during reverse operations. These observations led CHG to conclude that the dilution water supply line was not "physically connected" to an active waste transfer pump. On this basis, CHG incorrectly concluded that the dilution water supply line did not require one of the backflow prevention systems discussed in TSR LCO 3.1.2. The failure to install a backflow prevention system was one of the primary causes of the radioactive waste spill on July 27, 2007.

Specific missed opportunities to identify and correct the failure to install the backflow prevention system include the following:

A. During the review and comment process (around October 2002) for the original transfer pump design, the following written comment was made by a CHG employee, "If the inlet screen were to become severely plugged, is there any protection against pushing the waste up the dilution line and out of the riser extension when operating the progressive cavity pump in reverse?" This comment calls into question CHG's conclusion that the dilution water supply line was not "physically connected" to an active waste transfer pump. CHG's response was, "The water line can be run simultaneously," which suggests that the existing water pressure would be sufficient to prevent waste from entering the water line. However, underlying this response is an acknowledgement that the water dilution line is "physically connected" to an active waste transfer line and that existing water pressure is the mitigative control. CHG's failure to fully evaluate the employee's concern represents a missed opportunity to identify the incorrect conclusion that the dilution water supply line was not "physically connected" to an active waste transfer pump.

B. In December 2004, the original S-102 Seepex 1 pump was used to pump waste from the tank. Due to low waste retrieval rates, this Seepex pump was replaced with a Gorman-Rupp pump in May 2005. This pump was used until it failed in March 2006. The original Seepex 1 pump was then brought back on line and was used until it failed in March 2007. In July 2007, the modified Seepex 2 pump was installed and operated until the time of the event. During each of these changes in S-102 pump equipment, the unreviewed safety question (USQ) process was used to evaluate whether the changes could be accommodated within the safety basis. Although the USQ process is not intended to perform or re-perform hazard evaluations, hazard evaluations do serve as input to the USQ process. As noted, the hazard evaluations and associated design reviews for the S-102 pumps did not challenge CHG's conclusion that the dilution water supply line was not "physically connected" to the active waste transfer pump. Thus, the failure of the CHG USQ process to detect this problem results from the fact that the USQ determinations were performed using inadequate input from the hazard evaluation and previously discussed design review processes. However, a technically inquisitive USQ evaluator could reasonably be expected to question the validity of the not "physically connected" conclusion, especially given the relevant changes in the modified S-102 Seepex 2 pump installed in July 2007.

C. On September 21, 2005, CHG initiated a task to remove the hoses from the bulkhead fittings of Tank C-202, where waste removal had been completed, and to install them on Tank C-201. During this job evolution, CHG workers were contaminated when the hoses and fittings were removed from the bulkhead (this event is captured in Preliminary Notice of Violation (PNOV) EA-2006-06 issued to CHG on November 16, 2006). In response to this event, CHG conducted a root cause analysis. The CHG root cause analysis determined that "The Engineering Design of the Mobile Retrieval System was LTA [less than adequate] in that the hazard analysis did not recognize the potential to introduce waste into the air line. The primary issue identified was a LTA hazard analysis. Specifically, the analysis did not recognize the potential for migration of waste from the tank into the air line, which resulted in the missed opportunity to apply engineering or administrative controls to the system to mitigate the potential for waste material presence or release."

The underlying issues that led to this event are considered to be similar to those associated with the S-102 spill event. Specifically, the failure of the CHG hazards analysis process to adequately identify and mitigate potential leak paths for tank waste is viewed as a primary contributor to both events. The narrowly scoped extent-of-condition review associated with the 2005 multi-personnel contamination event represents a missed opportunity to identify the incorrect conclusion that the dilution water supply line was not "physically connected" to an active waste transfer pump.

D. In March 2006, an external assessment was performed on the implementation of the Tank Farms DSA. The assessment concluded that the CHG safety basis clarification process was not implemented via an approved procedure. The primary concern was that the CHG clarification process could be used to *interpret* a TSR requirement, rather than *clarify* it. Interpretation of a TSR requirement requires DOE approval. However, CHG corrective actions to address this finding focused solely on the process, and did not review prior clarifications to determine whether any did in fact constitute interpretation of a DSA or

TSR. If this historical review had been conducted, it could have called into question the validity of the CHG functional interpretation that the dilution water supply line was not "physically connected" to an active waste transfer pump.

Collectively, these violations constitute a Severity Level I violation.
Proposed Civil Penalty - $110,000

IX. Failure to Proactively Identify Spill Event Causes Through Management Assessments

Title 10 C.F.R. 830 § 122(i) states that DOE contractors are to "Ensure managers assess their management processes and identify and correct problems that hinder the organization from achieving its objectives."

Contrary to this requirement, CHG management assessments of S-102 tank closure activities failed to effectively identify and correct problems contributing to the S-102 tank spill event.

From January 2006 through July 2007, CHG Closure Operations conducted 40 management assessments and 620 management observation program assessments. CHG management assessments evaluate how well management processes are meeting organizational objectives and customer expectations and requirements. Management observation program assessments provide direct management oversight at the activity level and provide input to the management and independent assessment processes. CHG's evaluation of S-102 spill event assessment performance concluded that the "Closure Operations management observations only address a specific task, activity, or work element and not the entire review of the governing procedure. Only one percent of the management observations address procedure adherence." Further, the evaluation concluded that "While no specific assessment conducted over the past 18 months could have reasonably identified the technical issues/deficiencies related to the S-102 event, the assessment program should have identified some of the contributing causes of this event."

DOE agrees that the CHG management assessment process would not have been expected to reveal the incorrect conclusion that the dilution water supply line was not "physically connected" to an active waste transfer pump. However, given the significant number of management observation program assessments and management assessments performed over this time period and the significant weaknesses noted in CHG procedures and their implementation, an effective CHG management assessment program should have identified many of the contributing causes related to the S-102 spill event.

This violation constitutes a Severity Level III violation.
No proposed Civil Penalty

REPLY

Pursuant to the provisions of 10 C.F.R. § 820.24, CHG is hereby required, within 30 days after the date of filing this PNOV, to submit a written reply by overnight carrier to the following address:

Director, Office of Enforcement
Attention: Office of the Docketing Clerk
270 Corporate Square Building
U.S. Department of Energy
19901 Germantown Road
Germantown, MD 20874-1290

Copies should also be sent to the Assistant Secretary for Environmental Management and the Manager of the DOE Office of River Protection, as well as to my office. This reply should be clearly marked as a "Reply to a Preliminary Notice of Violation" and should include the following for each violation: (1) any facts, explanations, and arguments which support a denial that a violation has occurred as alleged; (2) facts that demonstrate any extenuating circumstances or other reasons why the proposed remedy should not be imposed or should be mitigated; and (3) full and complete answers to any questions set forth in the Notice. Copies of all relevant documents shall be submitted with the reply. The reply shall include a discussion of the relevant authorities which support the position asserted, including rulings, regulations, interpretations, and previous decisions issued by DOE. Corrective actions that have been or will be taken to avoid further violations should be delineated with target and completion dates in DOE's Noncompliance Tracking System. If CHG agrees to comply with the proposed remedy and waives any right to contest the Notice or the remedy, this PNOV will constitute a Final Order upon the filing of the reply.

If CHG agrees to comply with the proposed remedy in its reply, the penalty of $302,500 must be paid within 60 days after the reply is filed by check, draft, or money order payable to the Treasurer of the United States (Account 891099) and mailed to the Director, Office of Enforcement, Attention: Office of the Docketing Clerk, at the above address. If CHG should fail to reply within the time specified, the Director, Office of Enforcement, will request that a default order be issued against CHG. If additional mitigation of the proposed civil penalty is requested, CHG should address the adjustment factors described in 10 C.F.R. § 820, appendix A, section IX.3.

Arnold E. Guevara
Director
Office of Enforcement

Washington, DC
this 5th day of June 2008

CH2M HILL Hanford Group, Inc.
Radioactive Waste Spill in the Vicinity of the S-102 Retrieval Pump Discharge

Enforcement Conference Summary

April 16, 2008

On April 16, 2008, the Department of Energy's (DOE) Office of Enforcement held an Enforcement Conference with CH2M HILL Hanford Group, Inc. (CHG) senior management in Germantown, Maryland. The conference was held to discuss apparent violations identified in the Office of Enforcement Investigation Report that was provided to CHG on March 5, 2008.

Mr. Arnold Guevara, Director, Office of Enforcement, presided over the conference, and provided introductions and an overview of the conference's purpose and objectives.

The CHG presentation was opened by the President and Chief Executive Officer, Mr. John Fulton. Mr. Fulton opened with an overview of the CHG presentation. Mr. Ryan Dodd, Vice President, Retrieval and Closure Operations, then gave a description of the event evolution to include a discussion on S-102 pump evolution and design changes, detection of the high radiation readings in the S-Tank Farms, initial response activities, remedial corrective actions, post-event investigations, and direct/root causes to the event. Mr. Fulton then continued the CHG presentation with a discussion of the CHG corrective actions taken in response to the event. Mr. Fulton's presentation addressed the development of a comprehensive Corrective Action Plan to include corrective actions developed in response to the CHG investigation findings, the DOE Type A investigation findings, and the Office of Environmental Management (EM) report findings. Mr. Fulton continued his presentation and discussed specific corrective actions in the areas of engineering programs, conduct of operations, radiological protection and industrial hygiene, emergency management, work control, management systems, and health effects monitoring. Mr. Fulton concluded his discussion of CHG corrective actions by providing a current status of event-related corrective actions.

Mr. Fulton then provided two points of clarification related to the Office of Enforcement Investigation Report. The first issue was related to the use of silver shield gloves. CHG asserted that there was no plan to have workers contact waste during the July 27, 2007, 10:00 a.m. entry into the S-Tank Farm. Thus, the use of silver shield gloves was not required.

The second issue was related to the posting of the area around the spill as a High Radiation Area (HRA). CHG asserted that access to the area was controlled by operators posted at the access points throughout the incident, and that the access points were posted once the emergency conditions were stabilized. Office of Enforcement staff acknowledged that access to the area was controlled during the incident, as stated in the Office of Enforcement Investigation Report. 10 C.F.R. Part 835 does provide an exception to posting radiological areas when the area is

positively controlled by a knowledgeable individual; however this exception only applies up to 8 continuous hours. Office of Enforcement staff noted that in this case, the access points to the HRA were not posted for a period of approximately 21 hours subsequent to identification.

Mr. Fulton continued by addressing the safety significance of the spill event and stated that "we understand that we were fortunate not to have sustained more serious consequences." Mr. Fulton addressed several ongoing CHG initiatives directed at continuous improvement in their management and operations of the Tank Farms. Mr. Fulton also presented several charts to support the CHG position that corrective actions have been effective in addressing the causes of events and that performance continues to improve.

Mr. Fulton concluded the CHG presentation by providing rationale for enforcement discretion and penalty mitigation. These were based on the thorough and comprehensive causal analyses performed and the prompt and thorough corrective action plan that was developed. Mr. Fulton stated that he made immediate notification to the Director, Office of Enforcement, at the time of the event, and that this event was promptly reported into the Noncompliance Tracking System.

Mr. Guevara concluded the conference by indicating that DOE would consider the information presented in its enforcement deliberations. The conference was then adjourned.

Enforcement Conference List of Attendees

CH2M HILL Hanford Group, Inc.
Radioactive Waste Spill in the Vicinity of the S-102 Retrieval Pump Discharge

April 16, 2008

DOE – Office of Enforcement

Arnold Guevara, Director
Anthony Weadock, Acting Director, Office of Price-Anderson Enforcement
Richard Day, Enforcement Officer
Kevin Dressman, Enforcement Officer

DOE – Office of River Protection

Delmar Noyes, Assistant Manager, Tank Farm Project
Patrick Carier, PAAA Coordinator

DOE – Office of Environmental Management

Ken Picha, PAAA Coordinator
Terry Krietz, PAAA Coordinator

DOE – Office of the Under Secretary

Richard Lagdon, Chief Nuclear Safety Officer

CH2M HILL Hanford Group, Inc.

John Fulton, President and Chief Executive Officer
Ryan Dodd, Vice President, Retrieval and Closure Operations
Herbert Berman, Vice President and Chief Engineer
Craig Anderson, Director PAAA