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Hydrogeology • Mineral Resources • Waste Management • Geological Engineering • Mine Hydrology

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Mr. Jeff Pohle
Division of Waste Management
Mail Stop 623-SS
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Re: BWIP

Dear Jeff:

This trip report covers the premeetings held Thursday, December 5, 1985 and Sunday, December 8, 1985, and the DOE/NRC consultation meeting held December 9-11, 1985. Dr. Roy Williams, Dr. Dale Ralston, and Mr. Gerry Winter represented Williams and Associates, Inc. at these meetings which were held in Richland, Washington. The premeetings were held in the NRC on-site representative's office (Mr. Bob Cook). The DOE/NRC consultation meeting was held at the Holiday Inn in Richland.

The first premeeting was attended by the representatives for Williams and Associates, Inc. noted above and Mr. Mike Weber (NRC), Mr. Bob Cook (NRC), and Mr. Adrian Brown (Nuclear Waste Consultants). The agenda for the premeeting and the consultation meeting was presented by Mr. Weber. The NRC and NRC consultants' independent findings on the new large scale test plan were discussed. The new test plan is designated as Document # SD-BWI-TP-040 by Stone, Lu, Rogers, and Bryce. A consensus opinion was reached by the group on several topics including baseline, coordination of surface and subsurface testing, the use of a positive displacement pump, interflow in the boreholes after pulling bridge plugs, and the potential interference between the tracer tests and the large scale test.

A second premeeting was held the night of December 8 in Mr. Cook's office. Mr. Mike Weber (NRC), Mr. Bob Cook (NRC), Mr. John Linehan (NRC), Mr. Myron Fliegel (NRC), Mr. Mark Logsdon (NWC), Mr. Mike Galloway (Terra Therma (TT)), Mr. Fred Marinelli (TT), Mr. Paul Davis (Sandia Labs), Mr. Ken Brinster (Sandia Labs), and the representatives from Williams and Associates, Inc. were in attendence. The consensus opinions achieved during the previous premeeting were discussed. A significant period of time was devoted to addressing the question of achieving

potentiometric baseline for testing purposes and calculation of pre-emplacement groundwater travel time. Mr. Cook expressed his opinion on the general problem of QA within the BWIP project. Mr. Weber stated that the consensus opinions about the new test plan would be presented to DOE at the start of the consultation meeting on Monday, December 9.

Mr. Dave Dahlem (DOE) initiated the DOE/NRC consultation meeting December 9 at the Holiday Inn. Mr Dahlem requested that the question and answer period be restricted to the latter part of the meeting on Tuesday. He also stated that the time slot between 2:00 and 2:30 PM was reserved for comments from visitors. Mr. Mike Thompson (DOE) provided additional introduction to the meeting; the introduction included the purpose, objectives, and format for the meeting. An attendence list for the meeting is attached to this report.

Mr. John Linehan (NRC) stated that the test plan as presented in SD-BWI-TP-040 appears to be generally acceptable. Mr. Linehan requested clarification regarding the purpose (i.e. site characterization, site reconnaissance, site recommendation) of the large scale test. He noted that information obtained from the large scale test will ultimately be used for license application; the test and data must meet QA1 as a result of this potential future use of the data. Mr. Linehan expressed a concern that outside groups be allowed the option of commenting after each speaker.

Mr. Thompson noted that Mr. Cook would be absent from the meeting the following day. He suggested that the agenda be modified so that QA could be discussed on this, the first day of the meeting. The suggestion was agreed upon.

Mr. Weber presented the consensus opinions of the NRC group regarding the test plan (SD-BWI-TP-040). The opinions were presented under three general categories; the opinions are summarized as follows. 1. Concern was expressed about the effects that cementing operations in borehole RRL-2A and RRL-6 (Rocky Coulee flow top) could have on test data. The cementing operations may be critical to the tracer injection planned for the Rocky Coulee flow top in RRL-2A. 2. Mr. Weber pointed out that BWIP should optimize the utility of the LHS testing by monitoring shallower units near the RRL and other wells that are more distant from the RRL than currently indicated. 3. The lack of observation wells between RRL-2A and RRL-14 limits the ability of the planned test to characterize responses in three dimensions. 4. The test plan states that interflow will occur if bridge plugs are pulled in boreholes RRL-2A, RRL-6, DC-4, and the McGee well. Such interflow may adversely affect the interpretation of hydraulic testing results. 5. Details concerning the integrity testing noted in the test plan should be presented. 6. The objectives stated in the test plans are

inadequate. The objectives should reflect the concept that the large scale test can be used to assess hydraulic continuity and boundary conditions, as well as a means of calibrating assessments of repository performance. 7. The use of a sucker rod pump (positive displacement) may adversely affect the quality of the early time drawdown data from the pumping and nearby observation wells. The capability to pump at different discharge rates may be limited by the selection of a sucker rod pump for the Rocky Coulee test at the RRL-2 cluster. 8. The possibility that the Cohassett vesicular zone can be pumped should be investigated because the current repository construction plans entail the inclusion of the vesicular zone in the repository. 9. The pulse tests that will be conducted in each zone for the selection of a pumping rate for the pumping test should be described in greater detail, particularly as they might impact the LHS tests. 10. Well development techniques used in RRL-2B should be described. The development techniques can provide useful information toward the selection of a pumping rate. 11. BWIP should make every attempt to maintain a constant pumping rate throughout the test period to minimize potential problems with the interpretation of the test data. 12. The test plan establishes some general criteria for terminating the pumping test; concern exists that the test could be terminated prematurely. 13. The NRC is encouraged to see the integration of tracer testing with the large scale testing. However, concern exists that the injection of tracer and chase water may adversely affect the head responses in observation wells. 14. The criteria that will be used for the interpretation of test data should be presented.

Dr. Steve Baker (Rockwell) presented the correlation of the current test plan with STP 1.1. Mr. Neil Coleman (NRC) stated that the logic chart, presented by Dr. Baker, does not reflect all NRC consultations as established in the May 1985 workshop held in Silver Spring, Maryland. Discussion by Mr. Linehan, Mr. Coleman (NRC), and Dr. Baker (Rockwell) established that changes had been agreed upon in the May meeting which are not reflected in the logic diagram presented by Dr. Baker.

Dr. Baker pointed out that the piezometer cluster completion in RRL-2C is configured to try to use the ratio test for the quantification of vertical hydraulic conductivity. Borehole RRL-14 has been configured with a Westbay installation; the equipment is being evaluated for possible installation in additional boreholes.

Dr. Baker noted that a high degree of concern exists about possible water level interference created by drilling. Rockwell detected water level disturbances in the Grande Ronde from drilling in the Wanapum. There is an apparent response across the Rocky Coulee at DC-20 and RRL-2C. A possible groundwater flow path exists from DC-23 to DC-19. Dr. Baker stated that he

believes that testing will not need to progress to Stage 4 on the logic diagram based on the responses they have seen in the observation wells that were created by the drilling activities. The earliest test date for initiation of the Rocky Coulee LHS test is February 1986. Rockwell has been told by DOE to proceed with the large scale testing as soon as possible.

Mr. Steve Strait (Rockwell) presented several relevant facts pertaining to recent drilling activities at the site. The piezometer sites range in depth from 500 to 3,800 feet. Borehole DC-23W is being developed at this time. Borehole DC-23GR is being drilled; this borehole will be completed in the Grande Ronde Formation about 250 feet from DC-23W. Borehole RRL-17 has been drilled with mud through the Wanapum Formation; this borehole has been cased and cemented but will be deepened. Borehole RRL-17 is located about midway between RRL-2 and DC-20. Many of the RRL boreholes were drilled only to the top of basalt.

Mr. Steve Strait (Rockwell) presented a synopsis of the baseline monitoring program. Mr. Strait presented a hydrograph that illustrates the general downward gradient from the Ringold through the Rattlesnake Ridge to the Mabton interbed. Subsequent hydrographs illustrated a general head increase with depth from the Priest Rapids interflow through the Umtanum flow top.

Mr. Strait stated that there was an apparent perturbation in the Cohassett flow top at DC-19C which was created by the drilling activities in the Wanapum in DC-23W. The bridge plug pulling activities in RRL-14 (for the installation of the Westbay system) created an apparent perturbation in the water levels measured in the Cohassett and Umtanum flow tops in DC-22C. A composite flow top hydrograph for RRL-2C was presented; Mr. Strait stated that the water level data presented for this borehole have not been corrected for atmospheric affects. The sharp drop in heads noted in RRL-2C was due to air lift pumping the piezometers prior to setting the pressure probes. Mr. Strait stated that the water level recoveries for the Rocky Coulee interior and the Grande Ronde #5 interior are indicative of finite transmissivities. Mr. Strait also stated the packers installed in the piezometers completed in the Rocky Coulee flow interior, Cohassett flow top and flow interior, and the Grande Ronde #5 flow interior have not been inflated. The packers have not been inflated so as to allow the measurement of water levels from the surface in conjunction with downhole pressures.

Mr. Strait discussed the drilling fluid loss summary presented in the handouts. Of particular interest is the fluid loss incurred while drilling DC-23W. Fluid losses were 5,288 barrels of mud in the Saddle Mountains and upper Wanapum. Fluid losses in the composite Wanapum were 28,137 barrels of water. These losses and subsequent pumping for well development created the purturbation seen in existing observation wells. The drilling of RRL-2B in

the Rocky Coulee flow top created an approximate 20 psi pressure increase in borehole RRL-2C and a 1 psi pressure increase in RRL-2A. The drilling mud losses in RRL-14 are attributed mainly to the milling operations required to remove the bridge plug in the Umtanum flow interior. The mud losses occurred in the flow tops above the Umtanum flow interior. The bridge plugs in RRL-14 were overlain with 10 feet of sand followed by 10 feet of cement. A water level rise was noted in the Rocky Coulee, Cohassett, and Umtanum flow tops in DC-20C because of the mud losses in RRL-14.

Mr. Strait stated that the Roza and Rosalia flows accounted for the high fluid losses in DC-23W. The hole was cemented to a depth of 1,455 feet but they can still produce water from these former high fluid loss zones.

A detailed hydrograph (handout) for the Priest Rapids in DC-20C illustrates the water level (pressure) rise created by the fluid losses incurred in drilling DC-23W. A pressure increase of about 10 psi occurred. A similar response occurred in the Sentinel Gap in DC-20C. Pressure declines noted in DC-20C (Sentinel Gap) are attributed to developmental pumping in DC-23W. There was no response seen in borehole DB-12 which is located north of the Gable Mountain structure.

Mr. Strait described the Hanford site monitoring network. A figure presented as an overhead projection and in the Rockwell handout illustrates the areal location of the monitoring sites in the network. The network contains both unconfined and confined aquifer monitoring wells. The unconfined aquifer monitoring wells are measured monthly; the remainder of the wells in the network are measured on more frequent schedules. Mr. Strait displayed a figure that illustrates the pressure recovery from resetting a packer in the Rocky Coulee flow top in borehole DC-4. The water level recovery response in this borehole depicts the type of response associated with a tight zone (low hydraulic conductivity). This zone was not cemented in this hole.

Mr. Strait displayed a hydrograph for borehole DB-14 which is open to the Priest Rapids. This hydrograph clearly depicts the water level declines created during the drilling of DC-19, 20, and 22.

A question was raised about how much water level difference exists across the apparent barrier boundary referred to as the Cold Creek Barrier. Mr. Strait stated that the heads in the Wanapum basalts are about 900 feet (msl) at well sites west of the barrier; the heads are about 400 feet (msl) east of the barrier. The heads in the Grande Ronde are about 600 feet (msl) west of the barrier; the heads are about 400 feet (msl) east of the barrier.

Dr. Baker instituted a short break at this time before

introducing Mr. Harvey Dove (Rockwell). Mr. Dove discussed water level projections being conducted by Rockwell and the University of Arizona through Dr. Don Davis. Mr. Dove stated that they have used the water level data obtained from boreholes DC-19, 20, and 22 from June 1, 1984 through May 1, 1985. The data from June 1, 1984, through November 30, 1984, are used for curve fitting using regression techniques and a Theis 'type' curve mathematical technique. The Theis 'type' method in this application does not result in the calculation of aquifer parameters. Mr. Dove stated that they used one data point for each 10 days. Mr. Dove stated that they have a 95% confidence that they can predict the water level trend within 0.2 feet in the cluster wells (DC-19, 20, and 22) through June 1986 for the Rocky Coulee flow top. Dr. Baker provided extra clarification regarding the Theis 'type' curve method described previously by Mr. Dove. Data projections can be made with a linear fitting technique for the flows above the Grande Ronde Basalts. Mr. Davis (Sandia Labs) asked if the information just presented on water level projections is being used for conceptual models. Dr. Baker stated that the water level trend analysis is being used only as a tool for pretest trend evaluation. It is important to note that the University of Arizona projections do not include consideration of the drilling related perturbations that have occurred since May 1985.

Mr. Weber (NRC) asked Dr. Baker to state Rockwell's current position on the status of baseline data. Dr. Baker stated that RHO is confident that they can predict water level trends for LHS testing but they are uncertain about conclusions on how the groundwater system works from water level data. Dr. Baker also stated that they are uncomfortable with an approach that forgets the direction of groundwater flow and just uses bounds on the gradient.

Dr. Williams (W & A) asked Dr. Baker if they have considered revising their test approach based on the apparent vertical interconnection seen in the hydrographs associated with the drilling of DC-23. Dr. Baker responded that Dr. Spane has made some proposals along those lines. Mr. Stone (Rockwell) stated that the information probably will not influence the test design; the information may affect the test data analyses.

Dr. Baker adjourned the meeting for lunch. The NRC group caucused in the meeting room to discuss the events of the morning. The meeting reconvened; Dr. Baker made a brief presentation about the basic geology of the site.

Mr. Weber stated that the NRC had little time to review the latest hydrographs which were received just prior to the meeting. Mr. Weber continued by presenting the NRC comments and questions on the baseline. 1. The water level trends indicate continued recovery for several of the flow tops. These trends also indicate that there may be changes in the gradient and crossovers

(water levels in individual flow tops changing position relative to each other with continued recovery) of water levels for some flow tops. Mr. Weber asked what the significance is of the trends with respect to pre-emplacement groundwater travel time estimations. 2. The NRC believes that the current water level data base justifies conducting the proposed large scale test. The NRC does note that the groundwater level baseline has been perturbed by the recent work conducted on site. 3. The NRC would like to know if the DOE plans to collect regional head data in the future. 4. The information presented to the NRC indicates that a period of time will be required to re-establish water level trends because of the recent perturbations to the groundwater system. Will the schedule accommodate a waiting period to re-establish trends? Mr. Fliegel (NRC) asked what will happen to the long term baseline during the large scale test?

Dr. Baker responded to the previous comments and questions posed by the NRC. Dr. Baker stated that the low transmissivities will minimize the the impact of the large scale test on the baseline. The test, as planned, will not affect adversely the water level trends. Dr. Baker noted that the effects of the test will be controlled as opposed to perturbations created by the drilling of DC-19, 20, and 22. Dr. Baker also stated that the perturbations created at the cluster well sites (DC-19, 20, and 22) would be minimal; Dr. Baker stated they will terminate the test if the perturbation from the test is not minimal. Williams and Associates, Inc. believe that these statements, as a whole, constitute a direct contradiction to what was stated in the test plan. Our comments on the proposed test plan were forwarded to the NRC as Communication #9.

Dr. Spane (Rockwell) interjected a point about the use of the water level data to determine crossover relationships. Dr. Spane stated that density corrections must be considered before using the water level data to determine crossover relationships. The piezometers have been filled with Hanford system water having a uniform total dissolved solids (TDS) content of about 126 mg/liter. Dr. Spane showed overhead transparencies for the DC-19, 20, and 22 clusters that illustrate the apparent differences between observed, fresh water, and environmental heads for June 1984. Dr. Spane stated that not all piezometers contain Hanford system water; Rockwell apparently is collecting water samples from the cluster piezometers to determine the TDS content in the piezometers. Dr. Spane left Williams and Associates, Inc. with the definite impression that Rockwell does not know the water quality in the piezometers. This apparent lack of knowledge raises serious questions about the precision of the existing baseline. Mr. Winter (W & A) learned during the site visit on Wednesday that the impression that Rockwell does not know the water quality in the piezometers is invalid. The information Mr. Winter obtained during the site visit is outlined later in this trip report. Dr. Arnett (Rockwell) stated that they still want

to know what the groundwater flow direction is at the site but that their interest in knowing the flow direction dies as the hydraulic conductivity values drop.

Mr. Weber asked Dr. Baker if Rockwell will terminate the large scale test if they achieve too much drawdown at the cluster sites (DC-19, 20, 22). Dr. Baker responded that they would not terminate the test based on drawdown; they would terminate the test if they believe that recovery from the test would require an inordinate amount of time. Mr. Brown (NWC) stated that he had hoped that the program would be at this point 2 years ago; Dr. Baker agreed.

Dr. Baker returned to addressing the questions raised by Mr. Weber. Dr. Baker stated that the crossovers are not important. Recovery trends (from drilling and well development activities at the clusters DC-19, 20, and 22) can be projected for testing purposes. Rockwell does intend to collect additional head data. Rockwell does not intend to start another test before achieving adequate recovery from the previous testing. Mr. Weber stated that the NRC does not have a clear idea as to what DOE's testing strategy is at this time. Dr. Baker responded that the strategy will become clear during Mr. Rogers' presentation on the testing strategy.

Mr. Rogers presented the test strategy for the BWIP site. Mr. Rogers used a two part flow chart to discuss the large scale test. The flow charts present the test strategy from completing the preparations for the test to deciding when to stop the test. The general criteria for terminating the test are "accomplish all test objectives possible" and "eliminate or minimize perturbation to the baseline data collection effort". As stated, it appears to Williams and Associates, Inc. that the elimination or minimization of a possible perturbation to the baseline will be the controlling factor in the decision making process regarding the termination of the large scale test.

Mr. Thompson (DOE) began a discussion on the problems associated with QA and the BWIP project. Mr. Thompson stated that they are having problems applying the NRC review plan which is designed for engineering and nuclear reactors. The BWIP project is preparing a second draft of their "DOE-RL Readiness Review Plan". Mr. Thompson stated that this 'administrative control' cannot hold up the LHS test.

Dr. Baker continued the discussion of QA and the problems they are having in implementing the NRC guidelines. Dr. Baker stated that the law and STP 1.1 want data collected that <u>may or may not</u> prove the site adequate as a repository. Conversely, the NRC review plan indicates that the investigators should attempt to prove that the site can perform as desired. Rockwell is preparing a "LHS Test Program Control Manual"; this manual will

contain procedures and about 18 policies guiding these procedures.

Mr. Thompson presented the DOE views on the schedule of events planned for the site. Dr. Williams asked what Rockwell will do if some wells respond weakly while other wells respond as anticipated. Dr. Baker responded that they will go through the stages of testing outlined in the flow chart or logic diagram of STP 1.1. Mr. Thompson stated that they do not have a set day-by-day schedule. Additions that have been or will be made to the monitoring system include boreholes DC-24 and 25C and the monitoring of Grande Ronde #5 in RRL-2C and 14. Mr. Thompson presented three proposed schedules for the BWIP site. These schedules specify activities through December 1986. These proposed schedules indicate that several activities could occur at the same time as the large scale test in the Rocky Coulee flow top at the RRL-2 cluster. Williams and Associates, Inc. believe that these concurrent activities may create significant problems with conducting the proposed test and with the evaluation of the data obtained during the test. Mr. Thompson stated that they recognize that a potential problem exists because of the possible fluid losses that may occur during drilling.

Mr. Strait stated that DC-23GR will be drilled with mud into Grande Ronde #2. The hole will be cased to that depth. Mr. Veatch (Rockwell) stated that they will drill with mud to avoid the problem created by drilling DC-23W with water. It was the drilling fluid (water) loss that created the extensive perturbations on the system. Mr. Veatch also stated that the hole will be cased during drilling which will reduce the problems of fluid loss in the Wanapum.

Mr. Davis (Sandia Nat. Labs) asked the U.S.G.S. representative what their position is on the proposed large scale testing. Mr. Myer (U.S.G.S.) stated that their letter to the DOE was based on information available as of August 1985. The U.S.G.S. stated in the letter that they believe that the first large scale test should be run before the exploratory shaft (ES) is started. They have questions regarding the the efforts by Rockwell to project water level trends after the first test. The U.S.G.S. did not believe that drilling DC-23 would perturb the system as it has; their assessment was based on the data obtained from the RRL-2 holes. The U.S.G.S. needs to see the results of drilling and the first test before they can make their assessment regarding the additional planned tests. The U.S.G.S. letter (dated October 21, 1985) is out of date based on the information presented at this meeting.

Mr. Veatch stated that the ES cannot be started until the SCP is released. The SCP is scheduled for release in August 1986. Dr. Baker responded to Mr. Weber's question about the apparent urgency for starting the large scale test at the earliest

possible time. Dr. Baker stated that they want as much information as possible prior to sinking the shaft. There are obvious safety considerations in addition to other reasons for wanting the information from the test.

Mr. Thompson stated that they need synchronous head measurements at a number of locations for the determination of pre-emplacement travel times. Williams and Associates, Inc. noted a continuous reference to "synchronous head measurements" by the Rockwell and DOE staffs. The apparent connotation is that such measurements are required for the determination of pre-emplacement groundwater travel time.

The meeting was adjourned for the day. Dr. Ralston (W & A) and Mr. Winter (W & A) had a dinner meeting with Mr. Brown, Mr. Logsdon, Mr. Marinelli, and Mr. Galloway of Nuclear Waste Consultants (NWC) regarding our comments based on the first day of the meeting. These comments were presented to the group at the 9:00 PM caucus at Mr. Cook's office.

The DOE/NRC meeting reconvened December 10, 1985, at the Holiday Inn. Mr. Cook (NRC) read sections of Criteria 11 and the review plan to the group. The Question of QA was discussed at some length without an obvious resolution of the problems. Mr. Thompson stated that they do not plan to change their approach to the test plan at this time. Dr. Baker, Mr. Stone, Mr. Cook, and Mr. Linehan discussed this topic at some length.

Mr. Rogers presented the test plan for the large scale stress test planned for the RRL-2 wells. Mr. Rogers presented background information about the test site and the relationship of the site to known geologic structures in the area. He also described the Hanford site monitoring network and the location of frequently monitored wells on the reservation. He noted that only the Priest Rapids is being monitored at the DC-16 cluster site in response to Mr. Weber's question. Dr. Williams asked that the frequency of monitoring be defined. Mr. Strait stated that about half of the Hanford site monitoring network is equipped with either Stevens recorders or Sinco pressure monitoring equipment. Mr. Rogers described the RRL-2 site facilities both areally and vertically. Mr. Rogers also described the test objectives.

Mr. Rogers stated that they do not expect to see hydrogeologic boundary conditions during the test of the Rocky Coulee flow top. Mr. Weber asked if the first two tests are considered to be large scale tests. Mr. Rogers answered in the affirmative; Mr. Rogers stated that they are large scale tests because of the significant drawdown that will be created in the pumping well. Mr. Thompson stated that they are planning the largest scale test that the Rocky Coulee will support. Mr. Stone stated that they do not expect to hit any hydrogeologic boundaries until they pump test

the Grande Ronde #5.

Mr. Rogers described how they have used the quasi 3-dimensional finite difference model by Trescott and the axisymmetrical finite element model by Golder to simulate possible responses in the system due to the planned large scale test. Mr. Rogers also described their use of analytical models to simulate the responses to drilling stresses in interflows and dense interiors at the RRL-2 site. Mr. Stone stated that the assumption that the area can be characterized as being homogeneous is the most rational approach based on the current data base; they are looking at the hydrographs to consider alternate interpretations of the system. Mr. Stone noted that the quasi 3-dimensional model is not a full 3-dimensional model because of the use of a transfer coefficient for controlling vertical flow. This approach eliminates considerations of storage in the confining units.

Mr. Rogers outlined the results of their simulations of the planned test. Dr. Ralston (W & A) questioned whether they identified boundary conditions during their simulations; specifically Dr. Ralston asked how long the test would have to be run at 8 gpm in the Rocky Coulee flow top in order to detect boundaries. Mr. Stone stated that the simulations were not run long enough to hit boundaries. Dr. Ralston asked if they can run the test long enough to hit boundaries. Mr. Stone stated that they will not run the test long enough to hit boundaries. Dr. Arnett stated that the test has to be conducted under a restraint that limits drawdown to 1,000 feet in the pumping well. Mr. Marinelli (TT) asked if they will extend the test if they believe that they will hit boundaries. Mr. Stone stated that they would extend the test with the recognition that "synchronous heads" may be jeopardized. Mr. Davis asked if the tracer test would be extended; Mr. Stone stated that the tracer test would be extended with the same constraints. Mr. Thompson interjected at this point that they would use the extra time, if the test is extended, to install the new wells. Williams and Associates, Inc. believe that these statements are contradictory to statements made the preceeding day regarding the length of the planned test. We also believe that the drilling of additional wells during the LHS test in the Rocky Coulee flow top would adversely influence the quality of the data and inhibit the evaluation of the test data especially with respect to the analysis of boundary conditions. Mr. Brown (NWC) stated that the transients from drilling could adversely affect the test results.

Mr. Stone stated that the Rocky Coulee flow top is not a good flow top to be used for boundary detection. Mr. Logsdon asked if their programming constraints are so important as to control the test duration. Mr. Stone responded that they do not consider the RRL-2 testing to be the last answer on the Rocky Coulee. Dr. Robertson (Roy F. Weston, Inc) noted that Rockwell had not used

variable storativity for the confining units during their simulations of test responses. Mr. Rogers stated that they have even less data on storativity than they have on transmissivity (hydraulic conductivity). Mr. Stone stated that they calculated a storativity of 10^{-5} at the DC-7/8 site. Mr. Strait noted that they also have calculated a storativity of 10^{-4} to 10^{-5} in the area of the McGee well. Dr. Ralston asked if there is a target date for the resumption of baseline on the preferred work schedule presented by Mr. Thompson. Both Mr. Thompson and Mr. Stone stated that there is no date as things are too flexible at this time.

Mr. Rogers continued his description of their test planning efforts. He noted that the results of their simulations with the quasi 3-dimensional model cannot be compared directly with the results of simulations prepared by Golder Associates using their axisymmetric model because of different assumptions with respect to aquitard storativity and pumping rate. Also, Golder held the drawdown to 500 feet in their simulations. Mr. Rogers stated that the simulations indicate that the transients from the Rocky Coulee test may propogate into the Cohassett; this propogation may influence future tests.

Mr. Rogers continued his presentation after a short break. Mr. Rogers stated that they intend to wait for quasi-steady state conditions before starting the injection tests. Dr. Gelhar has told them that they do not need to wait for quasi-steady state conditions before starting the test but Rockwell intends to wait. Mr. Weber asked if Rockwell is concerned about the perturbations that will be created by the tracer and chase water injection. Mr. Rogers stated that they are concerned; they do not want to interfere with the possibility of detecting barriers in the hydraulic responses. Mr. Rogers stated that they recognize the need for additional wells but they are not sure how many are needed or where they should be located. Mr. Rogers stated that they will project recovery from the test to see if "synchronous heads" will be delayed. They will use the projected recovery to decide on the termination of the test.

Mr. Coleman asked what their contingency plans are for possible equipment problems. Contingency plans and equipment are addressed by Mr. Stone as noted later in this letter. Mr. Rogers stated that, based on his experience, the pump could be shut down for up to 10% of the test time without adversely affecting the test.

Mr. Rogers stated that they intend to have a constant discharge rate. Heterogeneities may affect their ability to maintain a constant rate. Mr. Stone stated that they plan to use a 3 phrase, 460 volt motor with the sucker rod pump. They will have a 100 kva standby generator with automatic switching; there could be a 3 to 5 minute delay in restarting the pump. They will not

be able to adjust the pumping rate without stopping the pump. Mr. Rogers stated that the criteria for deciding to terminate the test are still being developed.

Mr. Marinelli (TT) pointed out that a potential problem may occur from the injection of tracer. The problem occurs because of the lag time between the injection and the dissipation of a pressure transient in the flow interiors. Mr. Stone noted that they are concerned about possible packer squeeze in these tight zones. A general discussion ensued involving Mr. Marinelli, Mr. Brown, Mr. Strait, and Mr. Stone about this topic. The topic was clarified for Rockwell.

Mr. Weber raised the comments he had presented earlier with respect to the planned test. In response, Mr. Stone stated that they may attempt interference type pulse testing in the Cohassett vesicular zone. Mr. Veatch stated that alternate types of testing of the vesicular zone are being considered. Mr. Stone stated that the pulse tests planned for determining the discharge rates for the pumping tests are standard procedures. The proposed testing of the Cohassett flow top has not been decided; they are keeping their options open for a larger scale test according to Mr. Stone. Data obtained during the development of RRL-2C were used in a qualitative sense to select a pumping rate for the Rocky Coulee test. They ran a temperature log in RRL-2C which indicated that most of the flow created by the well development came from the Grande Ronde #5 flow top. Mr. Weber pointed out that the ES may adversely affect baseline. Mr. Brown (NWC) stated that this is the best time to obtain baseline because the ES may create significant fluid loss problems or mine inflow problems. Mr. Weber stated that it is clear that the DOE is aware of the risks associated with their proposed schedule. Dr. Baker pointed out that they are having to deal with conflicting goals. Dr. Baker also stated that they are aware that the proposed test in the Rocky Coulee probably will not detect major boundaries; they do anticipate finding boundaries, if they exist, on a more local scale.

The meeting reconvened after lunch. Mr. Stone discussed those questions deferred from earlier in the meeting. Mr. Stone stated that they have looked at the problem of the cement in the Rocky Coulee flow top in RRL-2A. An interference pulse test between RRL-2A and RRL-2B indicates that the zone is open and adequate for testing purposes. Mr. Stone stated that they do not have a real answer to the problem of connecting interflows where they will remove straddle packers in boreholes; the packers would be removed to facilitate monitoring deeper flow tops within the boreholes. The report on integrity testing will be released in the near future.

Mr. Stone described the pump selection process for the Rocky Coulee flow top test. Rockwell selected the sucker rod pump

because they can seat the pump near the pumping zone which will minimize casing storage effects. Seating the pump near the test horizon will speed up the tracer recovery. The pump will be set to cycle about 12 times per minute. Mr. Winter (W & A) asked Mr. Stone if they have investigated the magnitude of the pressure fluctuations below the pump (in the test zone). Mr. Stone responded that they have not looked at the pressure fluctuations but he believes that the fluctuations will not be seen beyond RRL-2C. The discharge capacity of the selected pump is 4 to 12 gpm.

Mr. Stone continued the discussion of the comments raised earlier by Mr. Weber. The testing of the vesicular zone was discussed earlier. The effects of cementing the Rocky Coulee flow top in RRL-2A were evaluated by analysis of pulse test data. The original test of the Rocky Coulee and the Grande Ronde #2 in RRL-2A resulted in the calculation of a transmissivity of 10 ft^2/day. The analysis of the recent pulse test (post cementing but excluding the Grande Ronde #2) between RRL-2b and RRL-2A resulted in the calculation of a transmissivity of 6.5 ft^2/day. Mr. Stone stated that the results are essentially the same.

Mr. Stone addressed the contingency plans for the test equipment raised earlier by Mr. Coleman. The test plan calls for redundant flow meters. Rockwell has ordered only one pump but they believe it is adequate because it is heavy duty. The pressure monitoring equipment can be pulled and replaced except in the Cohassett flow top and the flow interior completions. Pulling the transducers will result in the loss of some data. Rockwell will not stop the test if a single transducer fails.

Mr. Weber asked about Rockwell's readiness review. Mr. Stone stated that procedures are outlined for failures. Mr. Veatch stated that the equipment verification is in place. Mr. Stone stated that contingency plans are inherently incorporated in the test plan.

Mr. Stone discussed the tracer test. The objectives of the test are to quantify effective porosity and dispersivity. Dr. Arnett stated that he wants porosity with an estimate of the effective thickness. Mr. Stone stated that they will estimate the contributing thickness to flow by inspecting temperature profiles for the wells. The areal separation of the wells at depth is not much different than the areal separation of the wells at the surface. Tracer volumes were calculated based on detection limits; a major consideration in calculating tracer volumes was the volume of tracer required. Rockwell has attempted to minimize the volume of tracer.

Mr. Thompson interrupted the presentation by Mr. Stone to request comments from visitors at the meeting. An unidentified person requested the manufacturers name for the sucker rod pump. Mr.

Stone identified the manufacturer as LTV Energy Systems.

Dr. Faust (Geotrans-Yakima Indian Nation) presented several comments to the group. The Yakima Indian Nation would like to see these consultation meetings scheduled the same as the workshops. They would like to receive the data (hydrographs) at an earlier date; they would like to receive more advance notice about upcoming meetings. Their water level data only extends through April 1985. The technical data have not been reviewed in detail. They are concerned that the large scale test has been scaled back. More baseline data are needed prior to starting any testing due to the recent perturbations; a few months of data are probably sufficient. The use of water level projections will add uncertainty to the analysis of the test data. Rockwell should anticipate encountering non-ideal conditions for the test which will require test modification. Documentation will be required for such modifications. More large scale tests will be required especially in low transmissivity horizons. Dr. Faust stated that the use of the geometric mean of hydraulic conductivities underestimates the pumping capability; the arithmetic mean is more appropriate for channelized conditions. The values of properties used in the simulations are not consistent with the conceptual model. The tracer tests are important for travel time calculations but a more thorough analysis is required especially considering the 1-dimensional analysis. An adequate baseline for flow directions will require a year or more of additional data and more piezometers. Mr. Thompson requested that Dr. Faust supply written comments.

Mr. Stone continued his presentation on the tracer test. The procedures for the tracer test are hand written at this time (rough draft). Mr. Stone stated that they will place the tracer and chase water in the tubing. A positive displacement pump will be used to blow a plug off the end of the tubing causing the injection of the tracer. After injecting the tracer they will remove the tubing and replace the transducer. A large amount of tracer chase water is required because of the large dead volume (about 50 gal.) in the sand pack outside the piezometer screen. Borehole RRL-2A may be better for the tracer test because of the lower dead volume. Mr. Winter asked Mr. Stone how long the monitoring system will be out of commission between pulling the injection tubing and replacing the transducer. Mr. Stone replied that the system will be out for about 12 hours; Mr. Strait stated that the system probably will be out for a full day. Mr. Logsdon asked why they are not going to use a continuous sampler (HPLC). Mr. Stone replied that there are very definite problems with dissolved gas with the continuous sampler. Mr. Stone stated that the contingency plan calls for two well recirculating tests if this tracer test fails. Mr. Logsdon pointed out that Dr. Leonhart does not believe there is a wide range of effective thicknesses. Mr. Stone stated that he believes there is a 27 foot thickness controlling flow for the the RRL-2 cluster test;

he does not believe that a single fracture controls the flow for this proposed test.

Mr. Winter raised the question as to whether the transducer or the transducer seat is slotted in the boreholes. Dr. Baker responded that the transducer is slotted not the seat so the injection equipment can be seated in the piezometer. Mr. Winter asked if the injection tubing will drain into the piezometer tubing upon the removal of the injection tubing. Mr. Stone responded that the tubing will drain as noted. Dr. Williams asked if Rockwell will use the NTS tracer injection technique to determine the length of the contributing interval. Mr. Stone stated that he wished they used the technique at the BWIP site.

Mr. Marinelli asked if Rockwell has investigated the hydraulic conductivity of the grout. Mr. Stone replied that they have documented this property for grout in their own labs. Mr. Veatch stated that they used a different grout in the flow interiors than in the flow tops.

Dr. Baker introduced Mr. Hall (Rockwell) for a presentation on hydrochemical sampling. Mr. Hall stated that they will look at several aspects relevant to hydrochemical and isotopic interpretations. Mr. Hall stated that there are problems associated using ^{14}C and ^{36}Cl at the BWIP site. The ^{14}C problems occur because of the short half life of ^{14}C and the drilling additives used at the site. The biggest problem with ^{36}Cl is that no one in the U.S. can analyze for it; Rockwell will archive samples. Rockwell expects to obtain good hydrochemical samples but there is a danger of "crossover" of drilling contaminated fluids from other wells migrating to the pumping well. Rockwell will monitor for total organic carbon, tritium, and dissolved oxygen as a means of detecting this "crossover". Mr. Hall stated that if they can detect tritium (which they can measure in parts per billion) or dissolved oxygen, then the well was inadequately developed. Mr. Hall stated that they plan to take a grab sample from the test zone at the cessation of pumping. Mr. Winter asked if they will pull the pump in order to take this sample. Mr. Winter pointed out that pulling the pump will affect the recovery of water levels and pressures because of the interconnection of the monitored zone with the water in the casing (casing storage). Mr. Stone stated that there will be a J slot tool in the hole which will allow pulling the pump without draining the water in storage in the casing but the tool will prohibit sampling. Mr. Rogers stated that it would be best to leave the pump in the well if this procedure is consistent with sampling requirements. Mr. Baker noted that this is a good procedural question.

Mr. Marinelli raised the question about the possible interference from the pressure pulse created by the tracer test with the monitoring of pressures in the flow interiors for the quantification of vertical hydraulic conductivity of the flow

interiors. Mr. Rogers stated that a possible contingency plan could involve injecting the tracer a week or two ahead of the pumping test. The tracer would not migrate very far because of the low hydraulic gradient and low transmissivities found near the RRL-2 wells in the Rocky Coulee flow top. This contingency plan would allow Rockwell to test the injection equipment. Mr. Brown noted that they could inject the tracer and chase water using low heads by changing the schedule as suggested by Mr. Rogers. Mr. Rogers wants to use a high pressure pulse as opposed to the low pressure pulse envisioned by Mr. Brown.

Mr. Winter questioned whether Rockwell would pull the transducer in the second injection well before reinstalling the transducer in the first injection well. In addition, Mr. Winter questioned whether Rockwell would re-establish a pressure trend in the first injection well before pulling the transducer in the second injection well. Mr. Stone initially did not see the relevance of the concern that the possibility exists, with the current scheme, that pressures would not be monitored in the injection flow top (Rocky Coulee) during the injection phases of the testing. Mr. Winter was trying to point out that boundary conditions cannot be detected if the Rocky Coulee flow top is not monitored. Trend data would have to be re-established in each injection well after the injection pulse and prior to pulling the transducer from the second injection well if Rockwell intends to try and detect possible boundary conditions. The interference effects from each pulse injection will create a significant perturbation to the system without the added complication that the principal flow top is not monitored. Mr. Rogers stated that a procedural document will have to be prepared to cover this concern.

The DOE and NRC groups caucused separately before reconvening at 7:33 PM. Mr. Weber stated the NRC concerns based on the previous presentations by DOE. Mr. Weber stated that the proposed test is not consistent with STP 1.1. The baseline is not adequate for determination of pre-emplacement travel times and Rockwell may not be able to re-establish baseline if they proceed with the planned large scale test. The scale of the test is not consistent with the guidelines established in STP 1.1. The scale of the proposed Rocky Coulee LHS test is inadequate because: 1) the test will not test far field continuity nor boundary conditions, 2) the test will not allow performance assessment calibration, and 3) the test will not test a large portion of media (basalts). Mr. Weber stated that the NRC must review any new or revised DOE strategy in order to determine if this strategy will lead to characterization of the site. Mr. Weber also stated that the test planned for the Rocky Coulee flow top, as described in the test plan and in the meeting, will have to be evaluated in light of any new objectives that might be stated in a new or revised DOE strategy. Planned drilling activities, the concurrent tracer test, and the shortness of the test limit the scope of the test with respect to detecting boundary conditions.

Also, the scale of the planned LHS test will test a different population than that tested by the single well tests; the objective of attaining a comparison between single well and LHS values is limited. The testing of flow top continuity also is limited by the scale of the test. Mr. Weber stated that the approach to hydrochemical testing appears reasonable. The transmissivity value (s) obtained from the test will only be valid for the vicinity of the RRL cluster. The quantification of storativity will be limited to the same scale as the transmissivity. The approach to investigating effective thickness and dispersivity appear reasonable. The approach to quantifying vertical hydraulic conductivity appears reasonable but is limited to the vicinity of the RRL cluster.

Mr. Thompson stated that he was very concerned about the 180° turn around from the NRC opening remarks. He does not view the Rocky Coulee test as a large scale test; this test is not meant to provide all the answers. Mr. Baker stated that Rockwell has drilled more wells than are called for in STP 1.1.

Mr. Linehan stated that the NRC comments are based on what was heard in the meeting. Mr. Baker stated that what was said in the meeting is in the test plan. Mr. Linehan pointed out that there are fundamental differences between what was said in the meeting and what is in the test plan. Mr. Linehan asked why there is such a push to run the test. Mr. Thompson replied that the test is required for shaft design and for performance assessment. Mr. Veatch asked if the NRC would be happy if the test was run in the Grande Ronde #5? Mr. Brown stated that he would be happy with such a test if the DOE still considers STP 1.1 valid. Mr. Veatch said, to paraphrase, if STP 1.1 is not being followed then what is the strategy? Mr. Thompson added that they plan to get baseline after testing.

Mr. Cook (NRC) added several comments relevant to QA items. Mr. Cook stated that DOE needs acceptance criteria for the LHS. Performance goals should be stated as objectives for testing. Mr. Cook stated that "administrative control" is not QA; the phrase should be dropped.

Mr. Weber asked for DOE's comments. Mr. Thompson stated that they will rethink their comments. Basically, the comments were as follows. DOE is concerned with the re-establishment of baseline after the perturbation caused by the drilling of DC-23. DOE does not plan to test the Rocky Coulee before re-establishing a baseline sufficient for projection during the LHS test. An appropriate monitoring period will be developed for the monitoring wells. DOE is proceeding with the development of a QA program. Criteria will be developed for conducting the test and for terminating the test. The conflict created by conducting the tracer test concurrently with the large scale test will be evaluated. The meeting adjourned.

Dr. Ralston worked with NRC and DOE personnel on the meeting comments on Wednesday December 11, 1985. Mr. Winter went on the site visit with Mr. Marinelli (TT) and Mr. Galloway (TT); the site visit was led by Mr. Strait. The group visited DC-23W, DC-22, RRL-14, and the ES site. Downhole video from RRL-2C was viewed. Slides were shown and narrated by Mr. Jackson (Rockwell) of the Westbay equipment installation in RRL-14.

Mr. Winter discussed several topics with Mr. Strait and Mr. Jackson during this site visit. All of the piezometers at the cluster sites are filled with Hanford system water except for the Umtanum piezometer in DC-19C. This piezometer has Umtanum flow top water in it because of thermal testing. This piezometer was pumped to induce temperature increases in the other piezometers in the well. All piezometers are tested for water quality once a year when the transducer is pulled for calibration. Mr. Strait showed a transducer probe to the group. The probe has slots cut in the end which rests in the piezometer seat. The slots are about 1/4 inch wide; there are six slots. Mr. Strait stated that the slots provide more open area than is available between the probe and the wall of piezometer tubing (annulus).

The Westbay system installed in RRL-14 is very sophisticated. However, the value of the installation is limited with respect to obtaining data during the LHS tests. Mr. Winter questioned Mr. Jackson about the time required to obtain a pressure profile in the well and the time required to obtain valid pressure data after connecting the traveling probe (transducer) to a pressure port. Mr. Jackson stated that it takes about 8 hours to obtain a complete pressure profile in the well. It takes about 30 minutes for the transducer to reach thermal equilibrium when connected to a pressure port; about 20 minutes are required to reach thermal equilibrium upon disconnection from the port. The probe must be brought to the surface and tripped before returning down hole. The probe cannot be moved up and down between selected ports without traveling to the surface with its current configuration. Westbay is working on the probe system to facilitate taking more rapid measurements. The probe was stuck in the pressure port at the Rocky Coulee flow top on Wednesday, December 11, 1985. The Westbay people were on site working with Rockwell to free the probe. The Westbay system was installed with packers that can be deflated for removal of the system from the borehole. The tubing string is filled with Hanford system water so that the probe only measures a pressure differential. A bar graph prepared by Mr. Jackson indicates that the pressures in the RRL-14 borehole are equilibrating; pressures appear to be below those measured in corresponding flows in DC-22.

Mr. Price (Rockwell) showed Mr. Winter the fire-proof file cabinets that have been installed at the ES site. A fire-proof safe has been installed also. Data must be filed within 24 hours

after being recorded.

Please call if you have any questions regarding this trip report.

Sincerely,

Gerry Winter

Gerry Winter

10/09

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