Final Report Tests on the DuraMelter 1200 HLW Pilot Melter System Using AZ-101 HLW Simulants

VSL-02R0100-2, Rev. 1, 2/17/03

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Office of River Protection

P.O. Box 450
Richland, Washington 99352

**Approved for Public Release,²
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Final Report

Tests on the DuraMelter 1200 HLW Pilot Melter System Using AZ-101 HLW Simulants

prepared by

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Duratek, Inc.

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Bechtel National, Inc.

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W. L. Matlack
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SECTION 1.0 INTRODUCTION

This document provides the final report on data and results obtained from a series of nine tests performed on the one-third scale DuraMelter™ 1200 (DM1200) HLW Pilot Melter system that has been installed at VSL with an integrated prototypical off-gas treatment system. That system has replaced the DM1000 system that was used for HLW throughput testing during Part B1 [1]. Both melters have similar melt surface areas (1.2 m^2) but the DM1200 is prototypical of the present RPP-WTP HLW melter design whereas the DM1000 was not. These tests were performed under a corresponding RPP-WTP Test Specification [2] and associated Test Plans [3, 4]. The nine tests reported here were preceded by an initial series of short-duration tests conducted to support the start-up and commissioning of this system [5]. This report is a follow-up to the previously issued Preliminary Data Summary Reports [6, 7].

The DM1200 system was deployed for testing and confirmation of basic design, operability, flow sheet, and process control assumptions as well as for support of waste form qualification and permitting. These tests include data on processing rates, off-gas treatment system performance, recycle stream compositions, as well as process operability and reliability. Consequently, this system is a key component of the overall HLW vitrification development strategy. The primary objective of the present series of tests was to determine the effects of a variety of parameters on the glass production rate in comparison to the RPP-WTP HLW design basis of $400 \text{ kg/m}^2/\text{d}$. Previous testing on the DM1000 system [1] concluded that achievement of that rate with simulants of projected WTP melter feeds (AZ-101 and C-106/AY-102) was unlikely without the use of bubblers. As part of those tests, the same feed that was used during the cold-commissioning of the West Valley Demonstration Project (WVDP) HLW vitrification system was run on the DM1000 system. The DM1000 tests reproduced the rates that were obtained at the larger WVDP facility, lending confidence to the tests results [1]. Since the inclusion or exclusion of a bubbler has significant design implications, the Project commissioned further tests to address this issue.

In an effort to identify factors that might increase the glass production rate for projected WTP melter feeds, a subsequent series of tests was performed on the DM100 system [9]. Several tests variables led to glass production rate increases to values significantly above the $400 \text{ kg/m}^2/\text{d}$ requirement. However, while small-scale melter tests are useful for screening relative effects, they tend to overestimate absolute glass production rates, particularly for un-bubbled tests. Consequently, when scale-up effects were taken into account, it was not clear that any of the variables investigated would conclusively meet the $400 \text{ kg/m}^2/\text{d}$ requirement without bubbling. The present series of tests was therefore performed on the DM1200 one-third scale HLW pilot melter system to provide the required basis for a final decision on whether bubblers would be

included in the HLW melter. The present tests employed the same AZ-101 waste simulant and glass composition that was used for previous testing [1-3, 8, 9] for consistency and comparability with the results from the earlier tests.

1.1 Test Objectives

The principal objectives of this work were to:

- Determine processing rates without bubbling on the DM1200 system in longer-duration tests than were performed on the DM1000 system [1] and at a larger scale than the tests performed on the DM100 system [9].
- If the design-basis rate of 400 kg/m²/d is achieved without bubbling with a high-solids feed, determine the effect of solids content on processing rates from a similar test but with the nominal solids loading in the melter feed (this corresponds to 20 wt% solids in the Envelope D material from pretreatment).
- Determine the effect of continuous versus pulsed feed from two feed tubes instead of one on feed spreading and processing rates.
- Obtain processing data for a simulated, acidified AZ-101 HLW feed (Test 1 only), as employed at WVDP, using the DM1200 system at the Project nominal melter feed concentration (20 wt% solids from pretreatment, which corresponds to approximately 400 grams of oxides per liter of feed), without bubbling, to determine the effect of nitrated melter feed on feed handling, foaming, cold-cap characteristics, feed spreading, and processing rates.
- Obtain processing data for a simulated AZ-101 HLW feed with frit instead of glass forming chemicals using the DM1200 system, without bubbling, to determine the effect on feed handling, foaming, cold-cap characteristics, and processing rates.
- Determine the amount of reductant (sugar) to be added to the feed to maintain part of the iron (5 to 15%) in the Fe²⁺ state in order to prevent foaming incidents and determine the processing rate with this feed.
- Obtain processing data for a simulated AZ-101 HLW feed using the DM1200 system, without bubbling, at an operating temperature of between 1175 and 1200°C, to determine the effect on feed handling, foaming, cold-cap characteristics, and processing rates.

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- Evaluate off-gas system component performance by sampling exhaust at various points in the off-gas system as well as sump solutions from the various off-gas system components.
- Collect data on mass balance across the melter.
- Identify possible processing problems such as foaming, secondary phase formation, and poor cold cap characteristics, particularly in comparison to previous small-scale and DM1000 melter tests.
- Collect data on product glass composition and product quality.
- Collect operating data with a simulated air-displacement slurry (ADS) pump melter feed system (i.e., intermittent, pulsed flow of feed to the melter), particularly with respect to off-gas transients.
- Determine the effect of bubbling and the positioning of the bubblers (deep or shallow) on processing rates.
- Obtain processing data for a simulated AZ-101 HLW feed with frit instead of glass forming chemicals using the DM1200 system, with bubbling (standard “L” shaped bubbler design), to determine the effect on feed handling, foaming, cold-cap characteristics, and processing rates.

1.2 Test Overview

The DM1200 system and the test matrices are described in the Test Plans [3, 4]. A synthesis of the two Test Plan matrices is compared to the tests conducted in Table 1.1. Three tests were not conducted at the direction of the Project based on the results of earlier tests. A detailed description of the off-gas treatment system has also been provided [10]. In addition, the results of extensive off-line testing of the submerged-bed scrubber (SBS) [11] and the commissioning tests [5] have also been reported. This set of nine tests generated a total of 26,725 kg of glass, as summarized below:

- **Test 1** – High-solids feed (570 g glass/liter), without bubbling (< 4 lpm); 168 hours, 2301 kg glass produced.
- **Test 2** – High-solids feed (570 g glass/liter) + 10 g sugar /liter, without bubbling (< 4 lpm); 216 hours, 2594 kg glass produced.

- **Test 3** – Low-solids feed (400 g glass/liter), with deep bubbling¹ (nominal 60 lpm); 115 hours, 6180 kg glass produced.
- **Test 4** – Low-solids feed (400 g glass/liter), with shallow bubbling¹ (nominal 60 lpm); 122 hours, 3465 kg glass produced.
- **Test 5** – Nitrated feed (420 g glass/liter) with sugar ratio = 0.5, without bubbling (< 4 lpm); 144 hours, 1659 kg glass produced.
- **Test 6** – Frit-based feed (480 g glass/liter), without bubbling (< 4 lpm); 155 hours, 1901 kg glass produced.
- **Test 7** – Frit-based feed (480 g glass/liter), deep bubbling (60 lpm); 120 hours, 5976 kg glass produced.
- **Test 8** – Nitrated feed (420 g glass/liter) with sugar ratio = 0.7, without bubbling (< 4 lpm); 100 hours, 944 kg glass produced.
- **Test 9a** – High-solids feed (570 g glass/liter) + 10 g sugar /liter, without bubbling (< 4 lpm); continuous feeding (as opposed to pulsed feeding) from two feed tubes instead of one, 69 hours, 859 kg glass produced.
- **Test 9b** – High-solids feed (570 g glass/ liter) + 10 g sugar /liter, without bubbling (< 4 lpm); continuous feeding (as opposed to pulse) from two feed tubes instead of one, 1200°C glass temperature, 54 hours, 847 kg glass produced.

All of the tests were performed with the same waste simulant and glass composition, a nominal glass pool temperature of 1150°C (except Test 9b), essentially complete cold cap coverage, and a nominal plenum temperature between 400-600°C. Side-to-bottom electrode firing was used for the unbubbled tests and for Test 4 with shallow bubbling. Side-to-side electrode firing was used (the bottom electrode was not powered) for the rest of the bubbled tests. One of the two installed feed tubes was used in order to more closely reflect the number of feed tubes per unit area planned for the full-scale HLW melter. The exception was Test 9, for which both feed tubes were used. Tables 1.2-1.4 provide a summary of the test conditions and production rate data for each test.

¹ All of the bubbled tests employed two “L”- shaped bubbler lances, one in each of two diagonally opposite corners. The normal immersion of the bubblers was such that their outlets were located 6 inches from the bottom of the melter floor, which is referred to as “deep.” For the “shallow” bubbling test (Test 4), both bubblers were raised so that their outlets were located 13.5 inches from the melter floor.

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1.3 Melter System Description

1.3.1 Feed System

The feed material for these tests was prepared by a chemical supplier, as detailed in Section 2. Each batch of feed slurry was shipped to VSL in lined 55-gallon drums (approximately 16 per shipment) and staged for unloading into the mix tank. Both the mix tank and the feed tank are 750-gallon polyethylene tanks with conical bottoms that are fitted with mechanical agitators; the feed tank also includes baffles to improve mixing, which were installed after Test 5 was completed. Five calibrated load cells directly mounted on the legs of the feed tank were used to measure additions to and removal from the feed tank and were electronically monitored to determine the feed rate to the melter. The requisite amount of feed is pumped to the feed tank from the mix tank; measured amounts of water were combined with the feed at this point for the high-water feed tests. The material in the feed tank is constantly recirculated from the feed tank discharge outlet, at the tank bottom, to the tank inlet at the top, which provides additional mixing.

The way in which the feed is introduced into the melter is designed to mimic the operation of an ADS pump, which is the present RPP-WTP baseline. The recirculation loop extends to the top of the melter where feed is diverted from the recirculation loop into the melter through two parallel Teflon-lined feed lines and water-cooled feed tubes. Three computer-operated pinch valves, one on each of the feed lines and one on the recirculation loop, are activated in a timed sequence to introduce feed into the melter at the desired rate. The feed rate is regulated by adjusting the length of each pulse, the time between each pulse, and the pressure applied to the recirculation loop. A compressed air line is attached to each of the feed lines and can be used to automatically clear the feed lines into the melter after each pulse.

1.3.2 Melter System

The DuraMelter™ 1200 is a Joule-heated melter with Inconel 690 electrodes and thus has an upper operating temperature of about 1200°C. The melter shell is water-cooled and incorporates a jack-bolt thermal expansion system. The footprint of the melter is approximately 8 ft. by 6.5 ft. with a 4 ft. by 2.3 ft. air-lift discharge chamber appended to one end; the melter shell is almost 8 ft. tall. The melter surface area and the melt pool height are approximately 32 percent and 57 percent, respectively, of the corresponding values for the full-scale HLW melter. The discharge riser and trough are full-scale to verify pouring adequacy. Other aspects of the discharge system are also prototypical such as the chamber ventilation scheme. The glass contact refractory is Monofrax™ K-3 while the plenum area walls are constructed of Monofrax™ H refractory. The surface of the glass pool is 34" by 54" with a glass depth of nominally 25". The resultant melt volume is approximately 45,000 cubic inches (735 liters), which represents a glass

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tank capacity of more than 1.7 metric tons of glass; however, at the typical operating glass depth of about 29 inches, the inventory is closer to 2.0 MT. As compared to the two parallel pairs of flat plate electrodes in the former DuraMelter™ 1000 [1], the DuraMelter™ 1200 is fitted with one pair of electrodes placed high on opposite walls of the melter as well as one bottom electrode. The side electrodes are 11" by 34" giving an electrode area for the pair of about 750 sq. in. Depending on the glass level, the plenum space extends about 33" to 36" above the melt surface resulting in a plenum volume ranging from about 43 to 46 ft³. Cross-sectional diagrams of the melter illustrating the discharge chamber and electrode configuration are provided in Figures 1.1 and 1.2.

All of the bubbled tests employed two "L"- shaped bubbler lances, one in each of two diagonally opposite corners. The normal immersion of the bubblers was such that their outlets were located 6 inches from the bottom of the melter floor, which is referred to as "deep." For the "shallow" bubbling test (Test 4), both bubblers were raised so that their outlets were located 13.5 inches from the melter floor.

The single-phase power supply to the melter electrodes (250 kW designed power) is derived from the DuraMelter™ 1000 transformers by wiring them in parallel and using a single large silicon controlled rectifier (SCR). Current can be passed either from the side electrodes to the bottom electrode or between the two side electrodes only, by rearranging jumpers. Programmable process controllers are installed and can be used to control temperature or power. The melt temperature is controlled by configuring the process controller to maintain constant power and the power set-point is adjusted as needed to maintain the desired operating temperature. Alarms can be set to detect out-of-range temperatures or power in the melter. Backup process controllers are installed to be used in case of failure of the main controllers.

The DuraMelter™ 1200 has several other features worth noting. The lid refractory is prototypic and also includes a two-piece construction, which simulates the seam that was part of the full-scale LAW lid, which was to have been fabricated in three pieces; however, that design element of the LAW lid has since been revised. Nozzles are provided for the off-gas film cooler, a standby off-gas port, discharge airlift, along with 11 ports available for top-entering bubblers, start-up heaters and other components as needed. In addition, a bubbler arrangement is installed in the bottom electrode with the objective of developing permanent bubblers for possible use on future melters. Another innovation is a fiber optic distributed temperature monitor that is cast into the Narcon™ 60A castable on the discharge chamber side of the DM1200 that is intended to demonstrate the use of a distributed temperature sensor for refractory corrosion monitoring; however, this was not used for any of the present tests.

1.3.3 Off-Gas System

The DM1200 off-gas system was designed to be prototypic of the off-gas treatment system planned for use with the HLW melter in the RPP-WTP facility. In addition, the system can be reconfigured to represent the LAW off-gas treatment train for testing with LAW feeds. A detailed description of the design and installation of the DM-1200 off-gas system was provided earlier [10]. A schematic process flow diagram showing the components of the system is provided in Figure 1.3.

1.3.3.1 Functional Description

The melter and the entire off-gas treatment system are maintained under slight negative pressure by external induced draft blowers. This negative pressure is necessary to minimize escape of gases from the system into the working spaces surrounding the melter and is prototypical of the full-scale system. The off-gas treatment system, shown schematically in Figure 1.3, consists of a submerged bed scrubber (SBS); a wet electrostatic precipitator (WESP); a high-efficiency mist eliminator (HEME); a high-efficiency particulate arrestor (HEPA); a packed-column caustic scrubber (PBS); a second HEME; a thermal catalytic oxidation unit (TCO); and a second HEPA as the primary treatment units. Differences between the DM1200 off-gas system and the RPP-WTP baseline design include the addition of intermediate blowers and a second High Efficiency Mist Eliminator (HEME) after the caustic scrubber in the pilot system; in addition, the melter pressure control air system was not in place for these tests. The second HEME is present in order to prevent undesirable salt carryover into the TCO unit. Several changes have been made to the RPP-WTP baseline design since the deployment of the DM1200 system, including the replacement of the packed-bed scrubber by a silver mordenite column for iodine removal, which is located after the TCO. The Project is evaluating the addition of a silver mordenite column to the DM1200 system; for the present series of test, however, the packed bed scrubber was not operated.

The system can be functionally subdivided into four subsystems:

Particulate Removal: Components from the submerged bed scrubber (SBS) to HEPA #1 serve to remove essentially all of the particulate from the gas stream with an estimated removal efficiency of greater than 99.9999% for particles greater than 0.3 μm in size. In the RPP-WTP facility, this provision serves to segregate the radioactive from the non-radioactive components in the system for maintenance and handling purposes.

Acid Gas/VOC Control: The caustic scrubber and HEME #2 provide acid gas scrubbing to

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protect the thermal catalytic oxidation (TCO) unit, which is designed to oxidize any hazardous organics that are present in the off-gas stream. However, as noted above, the caustic scrubber was by-passed for these tests. In addition, no catalyst was installed in the TCO for the present tests.

Stack System:

Components from HEPA #2 to the stack outlet, including the emergency/bypass exhaust system, provide final filtration of the gas and serve to exhaust the treated gas stream to the atmosphere.

Liquid Processing:

Components including the water spray lines, liquid sampling and water storage tanks, as well as the effluent evaporator, function to sample and process the system liquids for recycle or discharge.

Initial quenching of the gas stream from the melter takes place in the film cooler. Gas exits the film cooler at a temperature of 250 to 350°C flowing at a rate of 100 - 250 scfm, of which about 5 - 50 scfm is water vapor. The off-gas is then rapidly quenched by direct liquid water contact in the Submerged Bed Scrubber (SBS), which also effects removal of most of the larger particulates. High superficial gas velocity in the piping between the film cooler and SBS minimizes particulate deposition. Gas leaves the SBS at a relatively low temperature (typically between 35 and 50°C). Further mist and particulate removal continues in the WESP, HEPAs, and HEMEs. Water deluge nozzles are installed in WESP and HEMEs to wash down deposits into their respective collection sumps. The system components are fabricated from corrosion resistant materials including AL6XN in the SBS and 316L stainless steel and various plastics in other locations. There are extensive provisions for sampling both the gas and liquid streams throughout the system in order to collect mass balance information and removal efficiency data for each treatment stage.

1.3.3.2 SBS Modifications

Several modifications were made to the SBS as a result of data collected during initial stand-alone testing using a Landa evaporator as an off-gas/steam source simulator [11] and subsequent testing by feeding the DM1200 melter with water; these are briefly summarized here for background. Significant among the issues were:

- Fluctuations in melter pressure (about 2 in. W.C.) attributed to oscillations on the large gas bubble that forms underneath of the SBS diffuser plate at the exit of the down-comer pipe.

- Rapid disintegration of the ceramic saddle packing media that was originally specified by the RPP-WTP Project.
- A need for supplemental cooling to handle the increased steam flow into the SBS at the higher processing rates that are realized when the glass pool is agitated by bubbling.

Several modifications were tested, including extension of the center inlet down-comer below the diffuser plate and alternative packing media. A perforated down-comer extension tube extending 12 inches below the diffuser plate was installed with holes along the tube wall with the intent of breaking up the gas bubble forming below the diffuser plate. This change reduced the amplitude of the pressure pulsations to within about 0.5 in W.C. Several other changes were also investigated, such as plugging weir tubes, plugging the standby gas nozzle, and constraining the inlet source of gas. However, the perforated down-comer extension appeared to have the most effect in mitigating the pressure fluctuations. In the down-comer extension used during the commissioning tests there were 32 half-inch diameter holes distributed along the tube in four rows of eight, 1½ inch apart.

Various packing media, including ½ inch stainless steel saddles, metal balls, and ceramic balls were tested in place of the original ceramic Intalox saddle packing medium. Based on these tests, ceramic balls, approximately an inch in diameter, packed all the way up to the upper retaining screen were used during the commission testing. However, the original Intalox saddles were retained in the spaces between the liquid weirs that protruded through the diffuser plate to prevent jamming of the ceramic balls into crevices. A metal screen was laid on top of the weirs to eliminate intermixing of packing media.

1.3.3.3 Modifications to SBS Cooling System

A schematic diagram of the modified SBS cooling system is given in Figure 1.4. An external heat exchanger and an internal cooling coil were added in order to decrease the operating temperature of the SBS and minimize down-stream moisture condensation; the cooling coil is connected to the heat exchanger. This was in addition to the existing outer cooling jacket on the SBS, which alone proved insufficient for the higher glass production rate tests.

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1.4 Data Acquisition

During these tests, data from most measurement points were logged at two-minute intervals by a computer-based data acquisition system using LabVIEW² software. Redundant manual logging of many of these parameters was also performed by the operations staff. Other parameters were logged only manually. These measurements are discussed in Section 3.

1.5 Quality Assurance

This work was conducted under an NQA-1 based quality assurance program that is in place at VSL. This program is supplemented by a VSL Quality Assurance Project Plan (QAPP) for RPP-WTP work. Per RPP-WTP Project direction, the program was revised during the performance of this work. Accordingly, work performed before 8/1/01 was performed under an NQA-1 (1994) program and corresponding Quality Assurance Project Plan (QAPP) for RPP-WTP work [12], while work performed after that date was performed under an NQA-1 (1989) and NQA-2a (1990) Part 2.7 based quality assurance program and corresponding QAPP [13]. The program is supported by VSL standard operating procedures that were used for this work [14]. This work was not subject to DOE/RW-0333P.

² National Instruments Corporation, Austin Texas.

SECTION 2.0

WASTE SIMULANT AND GLASS FORMULATIONS

2.1 Waste Simulants

The AZ-101 HLW simulant that was used for these tests is based on waste compositions provided in the Tank Waste Remediation System Operation and Utilization Plan (TWRS-OUP) [15]. The TWRS-OUP provides inventory information on 24 major waste components, which is, for the most part identical to that found in the Best Basis Inventory (BBI) database [16]; the exceptions are mercury, which is omitted in the TWRS-OUP, and strontium, for which the higher of the two values was assumed in this work. The TWRS-OUP, in addition to total inventories, provides the information on the partitioning of those inventories into solid and supernatant fractions that is needed to define waste simulants. The chemical wash factors that are provided in the TWRS-OUP were applied to the solid fractions in defining the AZ-101 simulant. For waste components that are not tracked in the TWRS-OUP or the BBI, data from the HLW Feed Staging Plan [17] based on the recommended number of in-tank sludge washings were used. No radionuclides or noble metals were included and all constituents present at less than 0.05 wt% (waste oxide basis) were omitted. In addition, all of the TOC was assumed to be oxalate and the small amounts of boron, lithium, and zinc were omitted since much greater amounts are present in the glass forming additives. While it was recognized that more recent information was available (e.g., in the Tank Farm Contractor Operation and Utilization Plan [18]) the compositional changes for AZ-101 are not great. Furthermore, it was judged more important to keep exactly the same simulant and melter feed composition for these tests as those used previously [1, 5, 8, 9] in order to be able to directly compare the test results.

A total of 32 chemical components are present in the resulting simulant for the washed AZ-101 HLW (Table 2.1). This HLW material must then be blended with the projected products from LAW pretreatment to complete the waste simulant formulation. These pretreatment processes (Cs and Tc removal by ion exchange and Sr/TRU removal by Sr/permanaganate precipitation) lead to increases in the amounts of cesium, technetium, sodium, nitrate, strontium, and manganese in the HLW material. The pretreatment products from technetium removal, which contribute technetium, sodium, and nitrate, were neglected in the simulant since the impact on nitrate is relatively small (75 liters of Tc concentrate vs. 3,811 liters of Cs concentrate [19]) and sodium is used as a glass forming additive. The quantities of pretreatment products to be combined with the AZ-101 HLW material were calculated based on References [19] and [20]. In particular, 7.71% of the total Sr/TRU precipitate from pretreatment of Envelope C waste was assumed to be added to AZ-101 waste, which is equivalent to $(78 \text{ MT} \times 0.0771) = 6.01 \text{ MT}$ of

strontium and $(38 \text{ MT} \times 0.0771) = 2.93 \text{ MT}$ of manganese³. The strontium precipitate will probably consist of a combination of carbonate and hydroxide. We have assumed that the carbonate is predominant and have included 3 g of carbonate per 100 g of oxides in the simulant (no carbonate is present in the washed HLW material as a consequence of the assumed 100% wash factor for carbonate [15]). The composition of the resulting AZ-101 simulant mixed with pretreatment products is summarized in Table 2.1. Subsequent to the Turnover and prior to Test 1, a spike of potassium iodide (at the expense of potassium nitrate) was added to the feed to achieve a target glass composition of 0.1 weight percent iodine if all of the iodine were retained.

2.2 Glass and Melter Feed Formulations

Glass formulations have been developed for the AZ-101 simulant that accommodate the replacement of iron by manganese for Sr/TRU removal and meet the processing and product quality requirements. The glass composition selected for these tests, HLW98-31, is presented in Table 2.1. On an oxide basis, this glass is composed of 27.0 wt% of simulated Envelope D waste and 3.5 wt% of pretreatment products; the resulting content of MnO is 3.03 wt%. Crucible, DM10, DM100, and DM1000 tests have been conducted to determine that this glass meets all processing and performance requirements [1, 8, 9]. The measured viscosity and conductivity at 1150°C are 43 P and 0.41 S/cm, respectively. Heat treatment of HLW98-31 at 950°C for 70 hours resulted in 0.26 vol% of spinel while the glass was completely homogeneous after 66 hours at 1050°C. The glass also shows good TCLP performance: the Cd concentration in the TCLP leachate is 0.067 mg/l, compared to the Universal Treatment Standard (UTS) level of 0.11 mg/l, while all other constituents are below their respective UTS levels by much wider margins.

The additional constituents required to form HLW98-31 glass from the AZ-101 simulant are boron, lithium, sodium, silicon, and zinc. The corresponding chemical additives that are the sources for these elements were selected based upon cost and compatibility with the vitrification process. The theoretical glass yield of the resulting feed is 0.39 kg of glass per kg of feed, which is equivalent to 0.55 kg of glass per liter of feed based on a density of the feed of 1.40 g/ml.

2.3 Preparation of Melter Feed

Early in B1 VSL solicited bids from vendors to collaborate in simulant and feed development and to supply material for the large-scale melter tests, which resulted in the selection of NOAH Technologies Corporation. NOAH Technologies' Quality Assurance program has been reviewed and approved by VSL. NOAH Technologies has produced the

³ Note that the WTP feed scheduling assumptions have since been revised so that, at present, no Sr/TRU precipitates will be available for blending with AZ-101 HLW material.

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simulant and feed samples used in development and screening tests conducted to date at VSL as well as larger-scale tests on the DM100, DM1000 and DM1200 melter systems.

Table 2.2 lists the starting materials and amounts required to generate the target AZ-101 simulant and feed; the data are based on a total of about 26 MT of feed, which would result in 10 MT of glass. NOAH Technologies prepared the feed in batches based on their production capacity of about 4,000 kg per batch. The formulation was specified by VSL based on chemical assays of the raw materials provided by NOAH, or as necessary, assay samples of those materials performed by VSL. NOAH Technologies also prepared the nitrated feed by adding concentrated nitric acid to the feed. Addition was considered complete once the pH was between 3 and 4, thereby mimicking the procedures used to produce the West Valley melter feed. The starting simulant and feed was prepared with sufficient oxide concentration so that after addition of nitric acid, the glass yield of the nitrated feed was about 400 grams per liter.

For the frit tests, the melter feed was prepared at NOAH Technologies by blending waste simulant produced by NOAH Technologies and frit produced by Ferro Corporation. The composition of the frit is provided in Table 2.3. The particle size of the frit was -200 mesh. The waste stimulant and frit were mixed such that the target glass composition defined in the last column of Table 2.1 was achieved. Tests using a feed prepared with -200 mesh glass frit showed that it had acceptable rheological properties at a concentration of about 570 grams of oxides per liter of feed. A feed prepared using HLW AZ-101 simulant and glass frit (instead of glass forming chemicals) did not show any adverse effects after aging for up to one week.

2.4 Analysis of Feed Samples

General Properties

Feed samples were analyzed from each distinct feed tank charging or at least once per day of operation to confirm chemical composition and physical properties. Sample names, sampling dates, sampling location, tank mass during sampling and measured properties are provided in Table 2.4. All samples were taken from the feed line immediately upstream of the entrance point to the melter. The measured feed sample properties for all four types of feed are summarized in Table 2.5. The target glass yields of 570 g/l for Tests 1, 2, 9 (Nominal), 400 g/l for Tests 3-4 (High Water), 420 g/l for Tests 5 and 8 (Nitrated Nominal), and 480 g/l for Tests 6 and 7 (Frit Nominal) were approximated in all samples analyzed. The averages of glass yields for each type were close to their target values. The target values for glass yields in terms of kg glass/kg feed were used in calculating production rates. Other measured parameters such as water percent and density fall into narrow ranges for similar feed types. The vast majority of measured feed pH values were between 9 and 10, as expected, with the exception of samples from Tests 5 and 8, in which the feed was acidified with nitric acid. The average measured pH

was about 5, which was slightly above the target pH range of 3-4 when the feed was prepared, which we attribute to aging effects: Laboratory tests conducted to determine the amount of acid required to reach the desired pH range, indicated that as the acidified feed ages, the pH gradually increases due to neutralization reactions with feed components.

Rheology

Samples of the melter feeds that were used for these tests were also subjected to rheological characterization. The results from rheological characterization of a variety of other melter feeds and waste simulants, as well as the effects of a range of test variables, are described in detail in a separate report [21]. Melter feeds were characterized using a Haake RS75 rheometer, which was equipped with either a Z40DIN or a FL22-SZ40 sensor. A typical set of measurements consists of identifying the flow characteristics of the slurry by measuring the shear stress on the slurry at controlled shear rates and temperatures. In these measurements, the shear rate values are preset and are increased stepwise from 0.01 s^{-1} to 200 s^{-1} (70 s^{-1} for FL22-SZ40) with a sufficient delay (typically 15 to 30 seconds) between steps to ensure that shear stress is allowed to fully relax and therefore measured at equilibrium. It should be noted that this approach is somewhat different than the "flow curve" approach that is often used in which the shear rate is ramped up to some maximum value and then ramped back down to produce a hysteresis curve that is dependent on the arbitrarily selected ramp rate. In contrast, the present measurements are equilibrium values of the shear stress at each measured shear rate. The viscosity of the sample as a function of the shear rate is then calculated as the ratio of the shear stress to the shear rate. All of the measurements in this work were made at 25°C ; previous work [21], which examined a range of temperatures, showed a relatively weak effect of temperature.

Rheograms for the melter feeds, which show the feed viscosity versus shear rate, are presented in Figure 2.1; measured values for viscosity at selected shear rates are compared in Table 2.4. The samples group into three distinct populations; the most viscous being the nominal feed, the least viscous being the nitrated feed, with both the high-water and the frit-based feeds falling in between. The observed and expected reduction in viscosity with increased water contents or decreased oxide loading has been observed in previous analysis of simulated HLW melter feeds [9, 21]. Nominal feed has the highest oxide loading and lowest water content and thus the highest viscosity. The nitrated feed has the lowest viscosity even though the water content is comparable to the nominal feed. The lower pH promotes the dissolution of suspended particles thus decreasing viscosity. The high-water and frit-based feeds have similar viscosities even though the frit-based feed has a lower water content (61% vs. 64%). The similarity in viscosities may be due to less agglomeration of glass frit than hydroxide particles in high water feeds.

2.4.3 Chemical Composition

A large number of feed samples was subjected to chemical analysis using x-ray fluorescence (XRF) and direct-current plasma atomic emission spectroscopy (DCP). The chemical compositions of the feed samples from the nine tests were determined by first making a glass from the feed samples via crucible melt. The glass was subsequently crushed and either dissolved in an HF/HNO₃ acid mixture with the aid of a microwave oven to produce a solution for DCP analysis or analyzed directly by XRF. Target values for boron and lithium oxides were used for normalizing the XRF data since those two elements were not determined by XRF. Data from both methods are compared to the target composition and are listed in Tables 2.6 and 2.7 respectively. Average feed sample compositions obtained by DCP and XRF are compared to the average discharged glass analysis and target values in Table 2.8.

The compositional analysis can be put into perspective by dividing the 31 elements into three categories; major elements with measured oxide concentrations greater than 3%, intermediate elements with measured oxide concentrations between 0.5 and 3%, with the remainder being minor elements. The major elements constitute the bulk of the glass and, therefore, largely determine its properties. Both XRF and DCP results for the major elements (Al, B, Fe, Li, Na, Si, Zr) are consistent and show good agreement with the target composition. One exception is lithium which is discussed further below. Elements in the intermediate concentration range (Mg, Mn, Ni, Sr, Zn) vary in their similarity to target composition. Strontium values were consistently more than 15% below target whereas manganese, nickel, and zinc concentrations were much closer to target. Magnesium oxide concentrations were about 20 times higher than the 0.06 wt% target due to contamination during feed batching at NOAH. This error was reported to the WTP Project prior to proceeding; however, it was determined that it would have an inconsequential effect on the processing properties of the feed or glass. The large number of minor elements (As, Ba, Ca, Cd, Ce, Cl, Cr, Cs, Cu, F, K, La, P, Pb, Sb, Se, S, Te, Ti) are all inherited from the simulated waste. Deviations were not calculated for these oxides due to the high volatility of many of the constituents and the uncertainty associated with deviation calculations on very low concentrations. As expected, highly volatile elements such as selenium, sulfur, and chlorine are under-represented in the glasses. Conversely, common elements, which are typical impurities in bulk chemicals, such as calcium, phosphorus, and potassium are over-represented when the constituent is a minor element.

Lithium was the only major element to deviate from the target value and, therefore, an alternative analytical method was employed to determine if the discrepancy was actual or analytical in nature. Consequently, Atomic Absorption (AA) was used to supplement the results obtained by DCP. Several digested glass samples that had been analyzed by DCP were reanalyzed by AA, the results of which are provided in Table 2.9. All measured lithium concentrations determined by both methods were below target, in some cases by over 25%. The

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two methods provided comparable results with the DCP analysis being, on average, slightly higher and, therefore, closer to target. Based on this comparison we conclude that either the feed is actually slightly deficient in lithium or that there is a problem with the glass dissolution that only affects lithium; given the fact that a standard reference glass is included in each glass dissolution set and that no issues were observed with those lithium values, we consider the latter possibility unlikely.

SECTION 3.0 MELTER OPERATIONS

Nine melter tests were conducted on the DM1200 with the AZ-101 simulant between 6/25/01 and 11/10/01, producing over 26,700 kg of glass. Feed type and system operating parameters, including glass bubbling rate, were varied, as shown in the test summary in Tables 1.2-1.4. Prior to beginning the tests, over 10,000 kg of glass was produced during the turnover of the melt pool composition and the commissioning tests that preceded the present tests [2].

The measured glass production rates are depicted in Figures 3.1 - 3.9 as cumulative and two-hour moving averages. Typically, by the end of each test, the cumulative production rate approximates the two-hour average rate, indicating that steady-state rates have been approached. The principal factor affecting glass production rates was the rate and mode of glass pool bubbling. The production rate with deep bubbling was about four times higher (Test 3: 980 kg/m²/day vs. Test 1: 255 kg/m²/day) than without bubbling. However, the actual effect of bubbling is even greater than this as a result of the difference in the feed solids content for these two tests: the feed for the bubbled test (Test 3) has a solids content corresponding to 400 g glass per liter, whereas the feed for the test without bubbling (Test 1) yielded 570 g glass per liter. Bubbling at a shallower depth resulted in an approximate two-fold increase in production rate over the test without bubbling (Test 4: 540 kg/m²/day vs. Test 1: 255 kg/m²/day), indicating that bubbler depth has a significant impact on glass production rate. It should be noted, however, that the average bubbling rate was slightly lower for Test 4 than for Test 3; the higher rate could not be sustained when the bubblers were raised to the shallow location due to pile-up of the feed. A four to five-fold increase in production rate attributable to bubbling was observed for frit-based feed (Test 7: 1100 kg/m²/day vs. Test 6: 210 kg/m²/day). The addition of sugar to these low-nitrate feeds had a negative impact on glass production, as can be seen by comparing Test 1 (steady-state rate of 255 kg/m²/day) and Test 2 (steady-state rate of 205 kg/m²/day). Varying feed composition (nitration in combination with different amounts of sugar and the replacement of glass forming additives by glass frit) had no measurable effects on glass production rates. The general processing behavior varied little from tests to test; the appearance of the cold cap also showed little variation, with the exception of the test with nitrated feed, for which the cold cap appeared somewhat more fluid. The change to continuous feeding with two feed tubes using a peristaltic pump as opposed to pulsed feeding from a single feed tube using a simulated ADS pump also did not result in an increase in production rates, which is evident when comparing the results to comparable tests discussed above (Test 9a: 230 kg/m²/day vs. 205-255 kg/m²/day). As expected, increasing the glass pool temperature did result in an increase in the production rate (by about one third).

A variety of operational measurements were recorded during these melter tests including temperatures throughout the melter system, as given in Tables 3.1-3. The target glass temperature of 1150°C was successfully maintained for most of the glass pool during each of the tests, as illustrated in Figures 3.10 - 3.18. An exception is the intended increase to 1200°C in the latter portion of Test 9 (Figure 3.18). The coldest regions were between 27" and 30" from the floor as a result of those thermocouples being in or near the cold cap. In tests with bubbling, the 1150°C target temperature was averaged at more locations throughout the melt pool resulting in more uniform temperature profiles. This is most readily observed by comparing the thermocouple 1" from the melter floor in tests with and without bubbling. Tests without bubbling have bottom glass pool temperatures about 50°C lower than the bulk glass temperature, whereas tests with bubbling have bottom glass temperatures similar to the remainder of the glass pool. Plenum temperatures between 300 - 500°C were obtained for the steady-state portions of the tests. Tests without bubbling typically resulted in plenum temperatures of 300 - 400°C, whereas plenum temperatures for tests with bubbling were about 50 - 100°C higher due to additional heat transfer from the openings in the cold cap caused by bubbling. Despite the somewhat higher plenum temperatures for the bubbled test, visual observations of the cold cap indicated that the feed rates obtained were still close to the maximum that could be sustained for the given test conditions. The plenum temperature is a function of the extent to which the surface of the melt pool is covered by feed and examples of this relationship are shown in Figures 3.19 - 3.27 as the plenum temperatures decreasing over the course of each test as the cold cap develops; similarly, the rise in plenum temperatures at about 90 hrs into Test 3 (Figure 3.21) is a result of the drop in feed rate at that time (Figure 3.3).

Electrode temperatures were below 1100°C except for the East electrode in the bubbling tests and in the latter half of Test 9. Electrode temperatures for the first half of Test 9 are typical of other tests; the bottom electrode being 40°C colder than the East electrode with the West electrode temperature being in-between (Figure 3.28). In the second half of Test 9, power was increased to raise the glass temperature to 1200°C, which also raised the electrode temperatures about 50°C. The discharge chamber and riser temperatures were maintained above 950°C throughout the tests. Gas temperatures after film cooler dilution typically averaged between 250 and 400°C, depending on the plenum temperature, the amount of added film cooler air, and the temperature of the added film cooler air. As was expected from the plenum temperatures, tests with bubbling had film cooler outlet temperatures near the top of the range, whereas tests without bubbling had temperatures near the bottom of the range.

The amount of power supplied to the electrodes depended on the feed rate and the water content of the feed. Tests with higher feed rates (e.g., bubbled tests) required more power; however, when normalized to glass production, they had the lowest power utilization per unit glass produced (Tables 1.2-1.4). Typically, power utilization per unit mass of glass was inversely

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proportional to the glass production rate due to the constant amount of power required to maintain melter temperatures. An interesting illustration is provided in Test 9 as a result of the test being conducted at two temperatures resulting in two production rates using the same feed. Notice in Figure 3.28 and Table 1.4 that despite the increase in glass temperature and therefore power demand, the increased glass production rate more than compensates for the additional power usage. In tests without bubbling, power demand per unit glass production increased with increased feed water content as expected.

SECTION 4.0 OFF-GAS SYSTEM PERFORMANCE

The off-gas treatment system, shown schematically in Figure 1.3, consists of a submerged bed scrubber (SBS), a wet electrostatic precipitator (WESP), a high efficiency mist eliminator (HEME), a high efficiency particulate arrestor (HEPA), a packed bed caustic scrubber (PBS), a second HEME, a thermal catalytic oxidation unit (TCO), and a second HEPA as the primary treatment units. The data on the off-gas system performance collected during the nine tests are presented and discussed in this section. Further details on post-test inspection results and characterization data for solids accumulations in various part of the system that were sampled are provided in Appendix A. Further details on SBS fluids (viscosity and particle size distribution) are provided in Appendix B.

4.1 Off-Gas System Test Results

Data for each of the off-gas system components, logged by LabVIEW, were imported into MS Excel files for data manipulation and plotting. Time "0" on the x-axis of each data plot corresponds to the start of water feed into the melter at the beginning of each test run. Where indicated, some data were smoothed by time averaging instantaneous measurements logged at two-minute intervals over ten-minute periods to reduce data scatter and the number of data points for the plots. The average, minimum, and maximum values of the measured off-gas system parameters are given in Table 4.1 for all nine tests.

The measured gas flow rates from the melter are presented in Section 6 (see Table 6.1), which includes the non-condensable flow rate and the water content. Of the non-condensable flow (variable, but typically about 160 dscfm), 70 scfm is from the film cooler air and the majority of the remainder is from melter in-leakage (the bubblers and non-condensable feed decomposition gases are much smaller contributions). The film cooler air flow rate was held constant at 70 scfm and the air temperature (about 75°F) and supply pressure (about 2.2 psi) also varied little.

4.1.1 Melter Pressure

The computer logged melter pressure values for Test 1 at two-minute intervals are shown in Figure 4.1. As can be seen in the figure, the data show considerable scatter, most likely depending on when during the feed cycle the pressure was recorded. These data, smoothed by

averaging over five consecutive measurements, are shown in Figure 4.2. The ten-minute time averaged melter pressure data for Tests 1 through 9 are shown in Figures 4.2 through 4.10. During most of the tests the melter pressure was in the range of -2 in. W.C. to -8 in W.C. The instantaneous melter pressure occasionally went positive. This occurred occasionally during initial feed introduction into the melter and during installation and removal of off-gas sampling equipment. Accumulation of feed on the cold-cap surface and subsequent break-up of the cold-cap resulting in feed suddenly coming into contact with the hot glass surface can also cause melter pressure to increase.

During Test 1, the melter pressure was controlled to within the negative pressure range for the duration of the test except for instantaneous positive pressure values during set-up and removal of the off-gas sampling equipment. Since the SBS immediately follows the melter in the off-gas train and because of the large pressure drop across the SBS, blow-down of the SBS (i.e., periodic removal of some of the accumulated fluids) also influences the melter pressure. Typically, after a blow-down the melter pressure goes from a slight negative value to a more negative value until the blower is adjusted to compensate for the effect. After the HLW tests reported here, a control-air system was installed in the DM1200 to better control the melter pressure and to minimize pressure variations.

During Test 2, the melter pressure was controlled within the negative pressure range for the duration of the test. Occasionally, instantaneous melter pressure values went positive during set-up and removal of the off-gas sampling equipment, during inspection of the film cooler, and possibly due to feed build up on the West side of the melter and subsequent sudden contact of feed with the hot glass surface.

The melter pressure as a function of time during Test 3 is shown in Figure 4.4. The instantaneous melter pressure occasionally went positive during set-up and removal of off-gas sampling equipment, during replacement of glass discharge can, and due to suspended portions of the cold-cap suddenly falling into the glass melt. The back-up off-gas system vent was activated several times during these pressure surges. During the tests, the SBS was blown-down to increase the melter vacuum.

The melter pressure during Test 4 is shown in Figure 4.5. Instantaneous positive pressure values were attributed to set-up and removal of off-gas sampling equipment.

The melter pressure during Test 5 is shown in Figure 4.6. Feeding was stopped from 24.0 hours to 24.7 hours from the start of the test due to a leak in the feed pump. The melter pressure was controlled to within acceptable limits during this test.

Melter pressure data for Test 6 are shown in Figure 4.7. The melter pressure was controlled to within the negative pressure range except for occasional instantaneous positive pressure changes. The positive pressure changes occurred during camera maintenance, cleaning of view ports, dip sampling of the melt pool, and due to cold-cap breakage.

During Test 7, feeding was interrupted briefly (from 38.5 to 42.7 hours) due to interruption of cooling water supply to the SBS. The off-gas was diverted to the back-up system during this time. This can be seen in Figure 4.8. Other than this interruption, the melter pressure was stable except for positive readings during set-up and removal of off-gas sampling equipment.

The melter pressure during Test 8 is shown in Figure 4.9. Instantaneous positive pressure values were attributed to set-up and removal of off-gas sampling equipment.

The melter pressure during Test 9 is given in Figure 4.10. The melter pressure was stable during the test. Instantaneous positive pressure values were attributed to set-up and removal of off-gas sampling equipment.

4.1.2 SBS Performance

Data on the performance of the SBS during the nine tests are presented in this section. Inlet and outlet gas temperatures, pressures and flow rates, pressure drop across the SBS, sump water temperature, heat exchanger inlet and outlet water temperatures, and flow rates were recorded during the tests. The amounts of heat removed by the SBS jacket cooling water and the cooling coil, which is connected to the plate heat exchanger, were calculated from these data. Post-test inspections of the SBS were also conducted, the results of which are summarized in this section with further details provided in Appendix A.

The performance of the SBS fluid handling system was uniformly good in that liquids and suspended solids were easily and reliably removed during routine blow-downs and, as discussed below, the amount of solids remaining in the SBS at the end of the tests was always very small. This suggests that the natural flows in the SBS sump in combination with the sparger lances serve to maintain good suspension of the collected solids.

After four tests, the SBS down-comer was redesigned and a new down-comer was installed at the request of the Project. The modification was done in response to solids deposition on the inside of the down-comer at the point at which it passes through the diffuser plate. A potential reason for solids accumulation at this location was assumed to be the slightly raised metal lugs used to position the down-comer when it was appended to the original SBS design.

However, the new design, which provided a smooth, flush inside surface for the down-comer did not eliminate the solids deposition at that point. Since the pipe above that point is insulated, it is possible that the deposition is a result of condensation that begins at that point.

Data on the performance of the SBS with respect to solids removal are presented and discussed in Section 6.0. Results of the analysis of SBS sump fluids are presented and discussed in Section 4.2. The remainder of this section provides a discussion of the SBS operating parameters for each of the tests. At the end of each test, the SBS was blown down completely, the lower bowl removed, and the SBS bowl and down-comer inspected for deposits and photographed. The SBS sump was then refilled with city water before the start of each test. Specific observations and representative photographs are presented in the test-by-test discussion below.

Test 1 SBS Data

The SBS inlet and outlet gas temperatures for Test 1 are plotted in Figure 4.11. The inlet gas temperature peaked at 498°C and the outlet gas temperature peaked at 52.6 °C. The average inlet gas temperature was 228°C. The average outlet gas temperature was -23.6°C. The inlet, outlet, and differential pressures are shown in Figure 4.12. The inlet pressure averaged -8.2 in. W.C. and the outlet pressure averaged -48.0 in. W.C. The apparent change in the measured value of the differential pressure after 100 hours into the test, seen in Figure 4.12, is an artifact that is due to clogging of the differential pressure sensor. This occurred several times during the present series of tests. In subsequent tests, this problem was alleviated by increasing the purge gas flow rate to the sensor.

Water temperatures in the SBS, the SBS chilled cooling water supply temperature, the water cooling jacket outlet temperature, and the water outlet temperature from the plate heat exchanger recorded during Test 1 are shown in Figure 4.13. These data are time-averaged over 10 minutes (5 measurements). There was very little difference in water temperatures measured at four depths (48, 60, 72 and 78 inches) within the SBS. During Test 1, the liquid in the SBS was heated to a maximum temperature of $\approx 56^{\circ}\text{C}$ during the initial period of water feeding and the average SBS water temperature was $\approx 24^{\circ}\text{C}$. The average slurry feed rate to the melter was about 35.7 kg/hr. The nominal glass yield of this feed was 570 g/liter of feed (0.38 kg glass/kg feed).

The amount of heat removed by the SBS jacket cooling water and the plate heat exchanger are shown in Figure 4.14. The heat-load data are calculated based on 10 minute time-averaged cooling water temperature increases (outlet temperature minus supply temperature) across the cooling jacket and plate heat exchanger multiplied by the flow rate through each. The average flow through the jacket was 41.8 gpm and the average cooling water flow through the

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plate heat exchanger was 50.6 gpm. For this test, heat removal averaged 52.7 kW by the plate heat exchanger and 14.7 kW by the cooling jacket. Consequently, during Test 1, about 78 % of the heat load to the SBS was removed by the plate heat exchanger and about 22 % by the jacket.

When the volume of liquid in the SBS overflow tank exceeded 65 gallons, it was difficult to maintain a steady vacuum in the melter. Therefore, the liquid volume in the overflow tank was maintained below 60 gallons. About 141 hours into the test, the diaphragm pump used for blow-down in the SBS failed and was replaced. After about 100 hours of operation the differential pressure sensor for the SBS clogged and had to be cleaned.

Test 2 SBS Data

The SBS inlet and outlet gas temperatures for Test 2 are plotted in Figure 4.15. The inlet gas temperature peaked at 462°C and the outlet gas temperature peaked at 47.3°C. The average inlet gas temperature was 228°C. The average outlet gas temperature was 22.1°C. The inlet, outlet, and differential pressures are shown in Figure 4.16. The inlet pressure averaged -7.9 in. W.C. and the outlet pressure averaged -48.4 in. W.C.

Water temperatures in the SBS, the SBS chilled cooling water supply temperature, the water cooling jacket outlet temperature, and the water outlet temperature from the plate heat exchanger recorded during Test 2 are shown in Figure 4.17. These data are time averaged over 10 minutes (5 measurements). There was very little difference in water temperatures measured at four depths (48, 60, 72 and 78 inches) within the SBS. During Test 2, the liquid in the SBS was heated to a maximum temperature of $\approx 51^{\circ}\text{C}$ during the initial period of water feeding and the average SBS water temperature was $\approx 22^{\circ}\text{C}$. The average slurry feed rate to the melter was about 31.8 kg/hr. The nominal glass yield of this feed was 570 g/liter of feed (0.38 kg glass/kg feed).

The amount of heat removed by the SBS jacket cooling water and the plate heat exchanger are shown in Figure 4.18. The heat load data are calculated based on 10 minute time-averaged cooling water temperature increases (outlet temperature minus supply temperature) across cooling jacket and plate heat exchanger multiplied by the flow rate through each. The average flow through the jacket was 45.5 gpm and the average cooling water flow through the plate heat exchanger was 48.0 gpm. For this test, heat removal averaged 42.4 kW by the plate heat exchanger and 12.2 kW by the cooling jacket. Consequently, during Test #2, about 78 % of the heat load to the SBS was removed by the plate heat exchanger and about 22 % by the jacket.

Test 3 SBS Data

The SBS inlet and outlet gas temperatures for Test 3 are plotted in Figure 4.19. Inlet gas temperature peaked at 528°C and the outlet gas temperature peaked at 64.2°C. The average inlet gas temperature was 312°C. The average outlet gas temperature was 40.7°C. The inlet, outlet, and differential pressures are shown in Figure 4.16. The inlet pressure averaged -7.6 in. W.C. and the outlet pressure averaged -58.2 in. W.C. The discontinuity in the differential pressure reading between 10 and 22 hours into the test is a result of clogging of the differential pressure sensor.

Water temperatures in the SBS, the SBS chilled cooling water supply temperature, the water cooling jacket outlet temperature, and the water outlet temperature from the plate heat exchanger recorded during Test 3 are shown in Figure 4.21. These data are time averaged over 10 minutes (5 measurements). There was very little difference in water temperatures measured at four depths (48, 60, 72 and 78 inches) within the SBS. During Test 3 the liquid in the SBS was heated to a maximum temperature of $\approx 55^{\circ}\text{C}$ during the initial period of water feeding and the average SBS water temperature was $\approx 41^{\circ}\text{C}$. The average slurry feed rate to the melter was about 168.3 kg/hr. The nominal glass yield of this feed was 400 g/liter of feed (0.29 kg glass/kg feed).

As expected, the high feed rate resulted in correspondingly high heat load on the SBS. The amount of heat removed by the SBS jacket cooling water and the plate heat exchanger are shown in Figure 4.22. The heat load data are calculated based on 10 minute time-averaged cooling water temperature increases (outlet temperature minus supply temperature) across cooling jacket and plate heat exchanger multiplied by the flow rate through each. The average flow through the jacket was 42.6 gpm and the average cooling water flow through the plate heat exchanger was 48.7 gpm. For this test, heat removal averaged 153.6 kW by the plate heat exchanger and 47.7 kW by the cooling jacket. Consequently, during Test 3 about 76% of the heat load to the SBS was removed by the plate heat exchanger and about 24% by the jacket.

Test 4 SBS Data

The SBS inlet and outlet gas temperatures for Test 4 are plotted in Figure 4.23. The inlet gas temperature peaked at 487°C and the outlet gas temperature peaked at 57.3°C. The average inlet gas temperature was 266°C. The average outlet gas temperature was 34.3°C. The inlet, outlet, and differential pressures are shown in Figure 4.24. The inlet pressure averaged -7.4 in. W.C. and the outlet pressure averaged -52.5 in. W.C.

Water temperatures in the SBS, the SBS chilled cooling water supply temperature, the water cooling jacket outlet temperature, and the water outlet temperature from the plate heat

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exchanger recorded during Test 4 are shown in Figure 4.25. These data are time-averaged over 10 minutes (5 measurements). There was very little difference in water temperatures measured at four depths (48, 60, 72 and 78 inches) within the SBS. During Test 4, the liquid in the SBS was heated to a maximum temperature of $\approx 62.7^{\circ}\text{C}$ during the initial period of water feeding and the average SBS water temperature was $\approx 35^{\circ}\text{C}$. The average slurry feed rate to the melter was about 96.7 kg/hr. The nominal glass yield of this feed was 400 g/liter of feed (0.29 kg glass/kg feed).

The amount of heat removed by the SBS jacket cooling water and the plate heat exchanger are shown in Figure 4.26. The heat load data are calculated based on 10 minute time-averaged cooling water temperature increases (outlet temperature minus supply temperature) across cooling jacket and plate heat exchanger multiplied by the flow rate through each. The average flow through the jacket was 41.8 gpm and the average cooling water flow through the plate heat exchanger was 51.2 gpm. For this test, heat removal averaged 104.6 kW by the plate heat exchanger and 29.7 kW by the cooling jacket. Consequently, during Test 4 about 78 % of the heat load to the SBS was removed by the plate heat exchanger and about 22 % by the jacket.

Photographs of the solids deposits in the SBS bowl are shown in Figure 4.27. Photographs of the solids deposits inside the down-comer are shown in Figure 4.28. In order to alleviate the solids deposition and to provide better distribution of the gas bubbles, the down-comer was modified and re-installed in the SBS. The new down-comer, before and after installation, is shown in Figure 4.29. Additional views of the installed down-comer are given in Figure 4.30. The flat-bottom down-comer was used for Test 1-4, while the serrated-bottom down-comer was used for Test 5-9.

Test 5 SBS Data

The SBS inlet and outlet gas temperatures for Test 5 are plotted in Figure 4.31. The inlet gas temperature peaked at 408°C and the outlet gas temperature peaked at 42.9°C . The average inlet gas temperature was 219°C . The average outlet gas temperature was 25.0°C . The inlet, outlet, and differential pressures are shown in Figure 4.32. The inlet pressure averaged -8.8 in. W.C. and the outlet pressure averaged -48.3 in. W.C.

Water temperatures in the SBS, the SBS chilled cooling water supply temperature, the water cooling jacket outlet temperature, and the water outlet temperature from the plate heat exchanger recorded during Test 5 are shown in Figure 4.33. These data are time-averaged over 10 minutes (5 measurements). There was very little difference in water temperatures measured at four depths (48, 60, 72 and 78 inches) within the SBS. During Test 5, the liquid in the SBS was heated to a maximum temperature of $\approx 48.5^{\circ}\text{C}$ during the initial period of water feeding and the average SBS water temperature was $\approx 25^{\circ}\text{C}$. The average slurry feed rate to the melter was about

34.6 kg/hr. The nominal glass yield of this feed was 420 g/liter of feed (0.31 kg glass/kg feed).

The amount of heat removed by the SBS jacket cooling water and the plate heat exchanger are shown in Figure 4.34. The heat load data are calculated based on 10 minute time-averaged cooling water temperature increases (outlet temperature minus supply temperature) across cooling jacket and plate heat exchanger multiplied by the flow rate through each. The average flow through the jacket was 38.7 gpm and the average cooling water flow through the plate heat exchanger was 47.7 gpm. For this test, heat removal averaged 50.7 kW by the plate heat exchanger and 11.3 kW by the cooling jacket. Consequently, during Test 5 about 82% of the heat load to the SBS was removed by the plate heat exchanger and about 18% by the jacket.

Photographs of the solids deposits in the SBS bowl are shown in Figure 4.35. Photographs of the solids deposits inside the down-comer and a general view of the weir tubes are shown in Figure 4.36. A photograph of solids from the down-comer is shown in Figure 4.37.

Test 6 SBS Data

The SBS inlet and outlet gas temperatures for Test 6 are plotted in Figure 4.38. The inlet gas temperature peaked at 395°C and the outlet gas temperature peaked at 46.0°C. The average inlet gas temperature was 182°C. The average outlet gas temperature was 23.2°C. The inlet, outlet, and differential pressures are shown in Figure 4.39. The inlet pressure averaged -8.4 in. W.C. and the outlet pressure averaged -49.3 in. W.C.

Water temperatures in the SBS, the SBS chilled cooling water supply temperature, the water cooling jacket outlet temperature, and the water outlet temperature from the plate heat exchanger recorded during Test 6 are shown in Figure 4.40. These data are time-averaged over 10 minutes (5 measurements). There was very little difference in water temperatures measured at four depths (48, 60, 72 and 78 inches) within the SBS. During Test 6, the liquid in the SBS was heated to a maximum temperature of $\approx 52.2^{\circ}\text{C}$ during the initial period of water feeding and the average SBS water temperature was $\approx 23.5^{\circ}\text{C}$. The average slurry feed rate to the melter was about 35.5 kg/hr. The nominal glass yield of this feed was 480 g/liter of feed (0.35 kg glass/kg feed).

The amount of heat removed by the SBS jacket cooling water and the plate heat exchanger are shown in Figure 4.41. The heat load data are calculated based on 10 minute time-averaged cooling water temperature increases (outlet temperature minus supply temperature) across cooling jacket and plate heat exchanger multiplied by the flow rate through each. The average flow through the jacket was 39.4 gpm and the average cooling water flow through the plate heat exchanger was 49.7 gpm. For this test, heat removal averaged 52.6 kW by the plate

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heat exchanger and 13.8 kW by the cooling jacket. Consequently, during Test 6 about 79% of the heat load to the SBS was removed by the plate heat exchanger and about 21% by the jacket.

Photographs of the solids deposits in the SBS bowl and a view of the down-comer are shown in Figure 4.42.

Test 7 SBS Data

The SBS inlet and outlet gas temperatures for Test 7 are plotted in Figure 4.43. The inlet gas temperature peaked at 424°C and the outlet gas temperature peaked at 49.4°C. The average inlet gas temperature was 278°C. The average outlet gas temperature was 37.6°C. The inlet, outlet, and differential pressures are shown in Figure 4.44. The inlet pressure averaged -8.0 in. W.C. and the outlet pressure averaged -50.6 in. W.C. About 38 hours into the test, the cooling water to the SBS was interrupted and feed to the melter was stopped for about 5 hours. During this time the off-gas was diverted to the backup system. Feeding was restarted after the cooling water supply was restored.

Water temperatures in the SBS, the SBS chilled cooling water supply temperature, the water cooling jacket outlet temperature, and the water outlet temperature from the plate heat exchanger recorded during Test 7 are shown in Figure 4.45. These data are time-averaged over 10 minutes (5 measurements). There was very little difference in water temperatures measured at four depths (48, 60, 72 and 78 inches) within the SBS. During Test 7, the liquid in the SBS was heated to a maximum temperature of $\approx 51.0^{\circ}\text{C}$ during the initial period of water feeding and the average SBS water temperature was $\approx 39.5^{\circ}\text{C}$. The average slurry feed rate to the melter was about 137.0 kg/hr. The nominal glass yield of this feed was 480 g/liter of feed (0.35 kg glass/kg feed).

The amount of heat removed by the SBS jacket cooling water and the plate heat exchanger are shown in Figure 4.46. The heat load data are calculated based on 10 minute time-averaged cooling water temperature increases (outlet temperature minus supply temperature) across cooling jacket and plate heat exchanger multiplied by the flow rate through each. The average flow through the jacket was 40.0 gpm and the average cooling water flow through the plate heat exchanger was 52.1 gpm. For this test, heat removal averaged 130.9 kW by the plate heat exchanger and 37.1 kW by the cooling jacket. Consequently, during Test 7 about 78% of the heat load to the SBS was removed by the plate heat exchanger and about 22% by the jacket.

Photographs of the solids deposits in the SBS bowl and a view of the down-comer are given in Figure 4.47. A close-up view of the SBS down-comer with the deposits is shown in Figure 4.48.

Test 8 SBS Data

The SBS inlet and outlet gas temperatures for Test 8 are plotted in Figure 4.49. The inlet gas temperature peaked at 368°C and the outlet gas temperature peaked at 41.1°C. The average inlet gas temperature was 183°C. The average outlet gas temperature was 23.3°C. The inlet, outlet, and differential pressures are shown in Figure 4.50. The inlet pressure averaged -6.7 in. W.C. and the outlet pressure averaged -43.5 in. W.C.

Water temperatures in the SBS, the SBS chilled cooling water supply temperature, the water cooling jacket outlet temperature, and the water outlet temperature from the plate heat exchanger recorded during Test 8 are shown in Figure 4.51. These data are time-averaged over 10 minutes (5 measurements). Between 23 and 28 hours into the test the data indicate that the cooling water supply to the plate heat exchanger was interrupted. There was very little difference in water temperatures measured at four depths (48, 60, 72 and 78 inches) within the SBS. During Test 8, the liquid in the SBS was heated to a maximum temperature of $\approx 46.7^{\circ}\text{C}$ during the initial period of water feeding and the average SBS water temperature was $\approx 23.7^{\circ}\text{C}$. The average slurry feed rate to the melter was about 34.6 kg/hr. The nominal glass yield of this feed was 420 g/liter of feed (0.31 kg glass/kg feed).

The amount of heat removed by the SBS jacket cooling water and the plate heat exchanger are shown in Figure 4.52. The heat load data are calculated based on 10 minute time-averaged cooling water temperature increases (outlet temperature minus supply temperature) across cooling jacket and plate heat exchanger multiplied by the flow rate through each. The average flow through the jacket was 40.8 gpm and the average cooling water flow through the plate heat exchanger was 50.7 gpm. For this test, heat removal averaged 41.5 kW by the plate heat exchanger and 11.7 kW by the cooling jacket. Consequently, during Test 8 about 78% of the heat load to the SBS was removed by the plate heat exchanger and about 22% by the jacket.

Test 9a and 9b SBS Data

Test 9 was about 120 hours in duration. The first 66.7 hours of this test is referred to as Test 9a and the latter part as Test 9b. During Test 9a and 9b, a peristaltic pump was used to introduce feed into the melter through both feed tubes. During Test # 9b the nominal glass-melt temperature was increased to 1200°C.

The SBS inlet and outlet gas temperatures for Test 9 are plotted in Figure 4.53. During Test 9a, the inlet gas temperature peaked at 348°C and the outlet gas temperature peaked at 33.5°C. The average inlet gas temperature was 198°C. The average outlet gas temperature was 21.1°C. The inlet, outlet, and differential pressures are shown in Figure 4.54. The inlet pressure

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averaged -6.3 in. W.C. and the outlet pressure averaged -45.2 in. W.C. during Test 9a.

During Test 9b, the inlet gas temperature peaked at 201°C and the outlet gas temperature peaked at 22.7°C. The average inlet gas temperature was 178°C. The average outlet gas temperature was 21.4°C. The inlet, outlet, and differential pressures are shown in Figure 4.54. The inlet pressure averaged -5.9 in. W.C. and the outlet pressure averaged -45.2 in. W.C. during Test 9b. The differential pressure sensor was clogged for the first 17.5 hours of the test and again from hours 106 to 109.

Water temperatures in the SBS, the SBS chilled cooling water supply temperature, the water cooling jacket outlet temperature, and the water outlet temperature from the plate heat exchanger recorded during Test 9 are shown in Figure 4.55. These data are time-averaged over 10 minutes (5 measurements). There was very little difference in water temperatures measured at four depths (48, 60, 72 and 78 inches) within the SBS. During Test 9a, the liquid in the SBS was heated to a maximum temperature of $\approx 39.1^\circ\text{C}$ during the initial period of water feeding and the average SBS water temperature was $\approx 21.6^\circ\text{C}$. The average slurry feed rate to the melter was about 30.0 kg/hr. The nominal glass yield of this feed was 570 g/liter of feed (0.38 kg glass/kg feed). During Test 9b, the liquid in the SBS was heated to a maximum temperature of $\approx 25.8^\circ\text{C}$ and the average SBS water temperature was $\approx 21.9^\circ\text{C}$. The average slurry feed rate to the melter was about 39.4 kg/hr. The nominal glass yield of this feed was 570 g/liter of feed (0.38 kg glass/kg feed).

The amount of heat removed by the SBS jacket cooling water and the plate heat exchanger are shown in Figure 4.56. The heat load data are calculated based on 10 minute time-averaged cooling water temperature increases (outlet temperature minus supply temperature) across cooling jacket and plate heat exchanger multiplied by the flow rate through each. For Test 9a, the average flow through the jacket was 41.4 gpm and the average cooling water flow through the plate heat exchanger was 49.1 gpm. For Test 9a, heat removal averaged 38.8 kW by the plate heat exchanger and 10.9 kW by the cooling jacket. Consequently, during Test 9a about 78% of the heat load to the SBS was removed by the plate heat exchanger and about 22% by the jacket. For Test 9b, the average flow through the jacket was 41.5 gpm and the average cooling water flow through the plate heat exchanger was 49.0 gpm. For Test 9b, heat removal averaged 39.9 kW by the plate heat exchanger and 11.1 kW by the cooling jacket. Consequently, during Test 9b about 78% of the heat load to the SBS was removed by the plate heat exchanger and about 22% by the jacket.

Post-test inspection of the SBS showed deposits in the bottom bowl and the down-comer. A photograph of the SBS bottom bowl is shown in Figure 4.57. A photograph of the down-comer with the deposits is shown in Figure 4.58.

4.1.3 WESP Performance

The inlet and outlet gas temperatures and the differential pressure across the WESP were collected and recorded by the computerized data acquisition system. WESP current and voltage were recorded manually.

Data on the performance of the WESP with respect to solids removal are presented and discussed in Section 6.0. Results of the analysis of solids deposits in the WESP are presented and discussed in Section 4.2 and Appendix A.

Test 1

The WESP inlet and outlet gas temperatures and the differential pressure across the WESP during Test 1 are plotted in Figure 4.59. During this test, at a steady-state feed rate of 35.7 kg/hr, the WESP inlet gas temperature averaged 29.4°C and the outlet gas temperature averaged 36.0°C, indicating a 6.6°C temperature increase across the WESP. The average WESP inlet temperature exceeded the average SBS outlet gas temperature by 5.8°C during this time; the increase is probably due to the higher ambient temperature in the vicinity of that elevated pipe run. The pressure differentials measured at 2-minute intervals across the WESP during this period averaged 1.5 in. W.C. with a standard deviation of 0.2 in. W.C. During Test 1, the WESP inlet water spray was off. There were no WESP blow downs during the test. At the end of the test, the amount of liquid removed from the WESP sump was 217 kg which is essentially the same amount that was present at the beginning of the test; therefore, there was no water loss or gain during Test 1.

Test 2

The WESP inlet and outlet gas temperatures and the differential pressure across the WESP during Test 2 are plotted in Figure 4.60. During this test, at a steady-state feed rate of 31.8 kg/hr, the WESP inlet gas temperature averaged 26.9°C and the outlet gas temperature averaged 31.2°C, indicating a 4.3°C temperature increase across the WESP. The average WESP inlet temperature exceeded the average SBS outlet gas temperature by 4.8°C during this time. The pressure differentials measured at 2-minute intervals across the WESP during this period averaged 1.7 in. W.C. with a standard deviation of 0.3 in. W.C. During Test 2, the WESP inlet water spray was on at a rate of about 7-8 lpm. During the test, water was added at a rate of about 1.1 lph to compensate for water loss from the WESP. At the end of the test, 124 kg of liquid was removed from the WESP.

Test 3

The WESP inlet and outlet gas temperatures and the differential pressure across the WESP during Test 3 are plotted in Figure 4.61. During this test, at a steady-state feed rate of 168.3 kg/hr, the WESP inlet gas temperature averaged 41.6°C and the outlet gas temperature averaged 45.0°C, indicating a 3.4°C temperature increase across the WESP. The average WESP inlet temperature exceeded the average SBS outlet gas temperature by only 0.9°C during this time. The pressure differentials measured at 2-minute intervals across the WESP during this period averaged 2.1 in. W.C. with a standard deviation of 0.3 in. W.C. During Test 3, the WESP inlet water spray was on at a rate of about 8 lpm. During the test, water was added at a rate of about 0.7 lph to compensate for water loss from the WESP. At the end of the test, 121 kg of liquid was removed from the WESP.

Test 4

The WESP inlet and outlet gas temperatures and the differential pressure across the WESP during Test 4 are shown in Figure 4.62. During this test, at a steady-state feed rate of 96.7 kg/hr, the WESP inlet gas temperature averaged 36.2°C and the outlet gas temperature averaged 39.9°C, indicating a 3.7°C temperature increase across the WESP. The average WESP inlet temperature exceeded the average SBS outlet gas temperature by 1.9°C during this time. The pressure differentials measured at 2-minute intervals across the WESP during this period averaged 1.9 in. W.C. with a standard deviation of 0.4 in. W.C. During Test 4, the WESP inlet water spray was on at a rate of about 7-8 lpm. During the test, water was added at a rate of about 0.8 lph to compensate for water loss from the WESP. At the end of the test, 126 kg of liquid was removed from the WESP.

At the end of the test, the WESP was inspected for deposits. Photographs of the rods and collector plates before and after wash-down are shown in Figures 4.63 and 4.64, respectively.

Test 5

The WESP inlet and outlet gas temperatures and the differential pressure across the WESP during Test 5 are shown in Figure 4.65. During this test, at a steady-state feed rate of 34.6 kg/hr, the WESP inlet gas temperature averaged 27.3°C and the outlet gas temperature averaged 31.1°C, indicating a 3.8°C temperature increase across the WESP. The average WESP inlet temperature exceeded the average SBS outlet gas temperature by 2.3°C during this time. The pressure differentials measured at 2-minute intervals across the WESP during this period averaged 2.4 in. W.C. with a standard deviation of 0.4 in. W.C. During Test 5, the WESP inlet

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water spray was on at a rate of about 7-8 lpm. During the test, water was added at a rate of about 0.95 lph to compensate for water loss from the WESP. At the end of the test, 126 kg of liquid was removed from the WESP.

Test 6

The WESP inlet and outlet gas temperatures and the differential pressure across the WESP during Test 6 are shown in Figure 4.66. During this test, at a steady-state feed rate of 35.5 kg/hr, the WESP inlet gas temperature averaged 25.3°C and the outlet gas temperature averaged 29.7°C, indicating a 4.4°C temperature increase across the WESP. The average WESP inlet temperature exceeded the average SBS outlet gas temperature by 2.1°C during this time. The pressure differentials measured at 2-minute intervals across the WESP during this period averaged 2.5 in. W.C. with a standard deviation of 0.5 in. W.C. During Test 6, the WESP inlet water spray was on at a rate of about 8 lpm. During the test, water was added at a rate of about 0.9 lph to compensate for water loss from the WESP. At the end of the test, 121 kg of liquid was removed from the WESP.

At the end of the test, the WESP was inspected for deposits. Photographs of the rods and collector plates before and after wash-down are shown in Figures 4.67 and 4.68, respectively.

Test 7

The WESP inlet and outlet gas temperatures and the differential pressure across the WESP during Test 7 are shown in Figure 4.69. During this test, at a steady-state feed rate of 137.0 kg/hr, the WESP inlet gas temperature averaged 37.5°C and the outlet gas temperature averaged 40.5°C, indicating a 3.0°C temperature increase across the WESP. The average WESP inlet temperature was less than the average SBS outlet gas temperature by 0.1 °C during this time. The pressure differentials measured at 2-minute intervals across the WESP during this period averaged 2.3 in. W.C. with a standard deviation of 0.5 in. W.C. About 38 hours into the test, the cooling water to the SBS was interrupted and feed to the melter was stopped for about 5 hours. During this time, the off-gas was diverted to the backup system. Feeding was restarted after the cooling water supply was restored. During Test 7, the WESP inlet water spray was off as a result of electrical instabilities in the WESP when the spray was on. During the test about 18.9 liters of water was removed at 87.4 hours and another 46.5 liters at 110.4 hours into the test. At the end of the test, 156 kg of liquid was removed from the WESP.

At the end of the test, the WESP was inspected for deposits. Photographs of the rods and collector plates before and after wash-down are shown in Figures 4.70 and 4.71, respectively.

Test 8

The WESP inlet and outlet gas temperatures and the differential pressure across the WESP during Test 8 are shown in Figure 4.72. During this test, at a steady-state feed rate of 34.6 kg/hr, the WESP inlet gas temperature averaged 25.3°C and the outlet gas temperature averaged 32.2°C, indicating a 6.9°C temperature increase across the WESP. The average WESP inlet temperature exceeded the average SBS outlet gas temperature by 2.0°C during this time. The pressure differentials measured at 2-minute intervals across the WESP during this period averaged 1.8 in. W.C. with a standard deviation of 0.3 in. W.C. During Test 8, the WESP inlet water spray was off. There were no WESP blow-downs during the test. At the end of the test, 151 kg of liquid was removed from the WESP. The liquid level in the WESP remained almost constant, between 12.1" and 12.5", during the test.

At the end of the test the WESP was inspected for deposits. Photographs of the rods and collector plates before and after wash-down are given in Figures 4.73 and 4.74, respectively.

Test 9

Test 9 was about 120 hours in duration. The first 66.7 hours of this test are referred to as Test 9a and the latter part as Test 9b. During Test 9, a peristaltic pump was used to introduce feed into the melter through two feed tubes. During Test 9b, the nominal glass-melt temperature was increased to 1200°C.

The WESP inlet and outlet gas temperatures and the differential pressure across the WESP during Test 9 are shown in Figure 4.75. During Test 9a at a steady-state feed rate of 30.0 kg/hr, the WESP inlet gas temperature averaged 24.6°C and the outlet gas temperature averaged 29.9°C, indicating a 5.3°C temperature increase across the WESP. The average WESP inlet temperature exceeded the average SBS outlet gas temperature by 3.5°C during this time. The average differential pressure and the standard deviation were not calculated for this part of the test because the differential pressure sensor clogged 30 hours into the test.

During Test 9b, at a steady-state feed rate of 39.4 kg/hr, the WESP inlet gas temperature averaged 23.6°C and the outlet gas temperature averaged 29.7°C, indicating a 6.1°C temperature increase across the WESP. The average WESP inlet temperature exceeded the average SBS outlet gas temperature by 2.2°C during this time. The pressure differentials measured at 2-minute intervals across the WESP during this period averaged 1.5 in. W.C. with a standard deviation of 0.2 in. W.C.

During Test 9, the WESP inlet water spray was off. There were no WESP blow-downs

during the test. At the end of the test, 124 kg of liquid was removed from the WESP. The liquid level in the WESP changed very little, from 11.9" to 11.0", during the test.

At the end of the test, the WESP was inspected for deposits. Photographs of the rods and collector plates before and after wash-down are shown in Figures 4.76 and 4.77, respectively.

4.1.3.1 WESP Electrical Data

The average WESP current and voltage during the tests is shown graphically in Figure 4.78. The average WESP current and voltage before and after the wash-down are tabulated in Table 4.2. The data do not show any apparent trend. Additional data on WESP operating conditions are tabulated in Table 4.3.

4.1.4 HEME and HEPA Filters

The WESP is followed in the off-gas system by a Paxton blower (Blower #1), a high efficiency mist eliminator (HEME #1), a heater, and the first HEPA filter (HEPA #1). The purpose of the HEME is to trap any entrained mist from the gas exiting the WESP. The purpose of the heater is to ensure that the water-saturated gas exiting the HEME is heated above its dew point before passing through the HEPA filter to prevent moisture condensation in the HEPA filter. The outlet temperature and the pressure differential across HEPA #1 are the only two parameters that were monitored by the off-gas data acquisition system. The HEPA #1 outlet temperature and pressure differential across HEPA #1 are shown in Figures 4.79 – 4.87 for the nine tests. The outlet temperatures ranged from 109 to 125°C. The differential pressure across HEPA #1 was in the range of 0.2 in. to 0.3 in. W.C. indicating that no significant particulate loading or moisture blinding of HEPA #1 occurred during these tests.

4.1.5 Packed Bed Scrubber (PBS)

Following HEPA #1 are a second blower and control damper, which are followed by a packed bed caustic scrubber. The PBS was not operated during any of these tests. Consequently, the only data collected was for gas inlet temperature. The inlet gas temperature was in the range of 74 to 88°C during these tests.

4.1.6 Effluent Liquid Treatment System

Effluent liquids from the SBS, WESP, HEME #1, the caustic scrubber, and HEME #2 (following the caustic scrubber) are all transferred to a series of sampling tanks that discharge into three 500-gallon storage tanks for neutralization, mixing, and storage. The largest effluent volume is the overflow (blow-down) from the SBS, which is pumped to one of two "SBS sampling" tanks. Caustic solution (25-30% NaOH) from the same caustic tank that supplies the PBS can also be added to the 500-gallon storage tank that receives acidic effluents from SBS sampling tanks. Therefore, this storage tank is referred to as the "neutralization tank". Effluents collected in the storage tanks can be periodically pumped to the "Landa Evaporator" for concentration and either recycle or disposal. Salt residues from evaporation of the effluent liquids are periodically removed from the Landa Evaporator.

The various effluent liquid sampling and storage tanks are visually monitored during periodic rounds and effluent liquid transfers are made as needed. The only parameters of the effluent liquid treatment system monitored by the computerized data acquisition system during the post commissioning tests was the pH of the neutralization tank

4.1.7 Thermal Catalytic Oxidation Unit

A second HEME and a thermal catalytic Oxidation (TCO) unit follow the caustic scrubber in the off-gas treatment system. The HEME removes any water droplets that may be contained in the gas exiting the caustic scrubber. The TCO unit is equipped with a 80 kW heater at the front end to condition the incoming gas, as needed. The TCO was not active during these tests. However, the TCO heater was used to prevent moisture condensation within the building stack. The temperature of the gas at the outlet of the TCO was about 80°C for the first four tests and about 120°C for the last five tests.

4.1.8 Off-Gas Temperatures

A typical plot of the sequence of gas temperatures through the DM1200 off-gas system is given in Figure 4.88.

4.2 SBS and WESP Fluids

SBS Fluids

One-liter samples were collected from the SBS and WESP sumps each time liquids were blown down and at the end of each test. Samples were subjected to total dissolved solids (TDS) and total suspended solids (TSS) determinations by gravimetric analysis of filtered material and the evaporated filtrate. Additional sample was filtered to generate solids and filtrate for complete chemical analysis, which included pH determination, direct current plasma emission spectroscopy (DCP) analysis for metals, atomic absorption (AA) for cesium, and ion chromatography for anions; the dried filtered solids underwent microwave-assisted acid dissolution prior to chemical analysis. The only anions determined in the filtered solids were sulfate and iodide due to interference from the acids required to dissolve the filtered solids. Due to the sheer volume of samples collected, not all samples were subject to each analysis. The results from additional characterization of selected samples with respect to viscosity and particle size distribution are presented in Appendix B.

All of the SBS and WESP sump samples that were taken throughout the DM1200 tests are listed in Tables 4.4 and 4.5; the middle letter in the sample name is "S" for the SBS samples and "W" for the WESP samples. The tables provide the TSS, TDS, and pH values for each sample, as well as the amount of glass that had been produced at the time the sample was taken. Also shown in Table 4.4 is the blow-down volume from which each SBS sample was taken and the cumulative SBS blow-down volume; as discussed earlier, the WESP was only blown down during Test 7. Detailed information on WESP water additions during testing are provided in Table 4.3. The volume of the SBS sump is about 500 gallons.

The TSS, TDS, and pH values for the SBS liquids are plotted in Figures 4.89 and 4.90. The SBS TDS typically exceeded the TSS values and ranged from 60 mg/l to 6700 mg/l. The higher values for both the TDS and TSS were from bubbling tests that featured higher production rates. One of the factors influencing the TDS was the solution pH since collected material was more likely to dissolve in the more acidic SBS solutions. The SBS solution pH was dependent on NO_x melter emission rates, which were in turn a function of feed nitrate content, processing rate, and feed sugar content (see Section 6.3). The lowest measured pH values were about pH 1, which occurred for Test 5 using nitrated feed. Tests 1 and 2 were identical except Test 2 was conducted with small amounts of sugar added to the feed resulting in substantially less nitrogen oxides being emitted. The decrease in emissions resulted in a SBS pH of about 8.5 instead of 3.7. During each test, the SBS solutions appeared to reach a steady-state pH with respect to melter emissions and the periodic blow-downs.

Figures 4.91-4.99 compare the amount of water fed to the total volumetric accumulations in the SBS over the course of each test. There is close agreement between these quantities for the

tests without bubbling, indicating that nearly all of the feed water is condensed in the SBS as a result of its low operating temperature for those tests. In tests with bubbling (Tests 3, 4, and 7), the SBS sump temperatures rose to between 34 and 40°C, resulting in a higher percentage of feed water being emitted. While this comparison illustrates these points, it could be further refined by taking into account the water feeding used to cool the melter plenum at the start of each test and by employing the instantaneous feed rate as opposed to the test average feed rate. Water was fed to the melter at the beginning of each test to create a cold cap and thereby minimize subsequent off-gas surges due to pulsed feeding onto bare glass (this is the same feed start-up protocol used at West Valley.) Consequently, the accumulation in the SBS is slightly greater than the amount of water that was introduced as part of the slurry feed.

Chemical analysis results for the SBS samples are provided in Table 4.6. Figures 4.100-4.104 compare the SBS dissolved and suspended fractions from Tests 3 (sample 12J-S-142B) and Test 5 (sample 12L-S-62A) with the composition of the feed. As might be expected, the dissolved solids consist mainly of species such as alkali metals, halogens, boron, and sulfur, as well as significant amount of selenium. These constituents are also relatively volatile. The dissolved solids from Test 5 contain a larger proportion of metals that typically have limited solubility at higher pH values, such as alkaline earth metals and transition metals, as a result of the low solution pH of 1.37. The suspended solids consist primarily of iron and silicon with significant amounts of selenium, tellurium, nickel, lead, chromium, and zirconium. Other metals such as aluminum, calcium, magnesium, cadmium, manganese, and zinc are present in both the suspended and dissolved fractions of the SBS samples⁴. Comparison of suspended solids from Tests 3 and 5 show that less of the alkaline earths, tellurium, selenium, and aluminum are observed in the suspended fraction of Test 5 due to the low pH. Iodide was present only in the dissolved fraction.

The accumulations of elements in the SBS solutions (including blow-downs) over the course of Tests 1 and 2 are depicted in Figures 4.105-108. The total accumulations by constituent from these two tests are compared to their corresponding amounts in the target glass in Table 4.7. Over one kilogram each of selenium, iodine, and sulfate accumulated over the course of the tests, as well as tens of grams of metals such as cadmium, cesium, nickel, and tellurium. Also, more than 200 grams of both chlorine and fluorine were recovered in these fluids. However, the SBS liquids constitute a significant proportion of the elemental mass balance for only the halogens, sulfur, and selenium (Table 4.7), with up to 41 percent of these feed constituents reporting to the SBS fluids. It should be noted that the percentage of feed magnesium recovered in the SBS fluids is inflated as a result of the actual feed concentrations greatly exceeding the very low target value (see Section 2.4) that was used for these calculations. Several differences between the data for

⁴ It should be noted that the filter pore size mandated by the standard methods that were used is 1.5 micron and therefore any particles less than this size could have contributed to the "dissolved" fraction instead of the suspended fraction.

Test 1 and Test 2 are apparent, which is interesting given the fact that the only difference between these tests was the addition of 10 g of sugar per liter of feed for Test 2. Despite this seemingly small change, as discussed above, the increased amount of reductant has a significant impact on NO_x emissions. The change in NO_x emissions is then reflected in the SBS pH, which, in turn, affects the scrubbing efficiency for various species. The pH also has a significant affect on the split between dissolved and suspended fractions for many elements. The greater rate of accumulation of iodine and sulfate in Test 2 (Figure 4.106) is probably due to increased scrubbing efficiency at higher solution pH (3.5 vs. 8.5). The increased rate of accumulation for cadmium (Figure 4.108) is mirrored by the significantly increased cadmium emission rates (based on off-gas sampling results; see Section 6.0, Tables 6.3 and 6.6) in Test 2. The instantaneous increase in accumulations of elements such as nickel, zirconium, calcium, manganese, and lithium at the end of Test 1 are probably related to the emptying and refilling of the SBS in between the tests. The wetting and drying cycle associated with dropping the SBS bowl and performing inspections may result in the spalling of deposits, while the addition of fresh water favors increased dissolution of material deposited within the SBS.

WESP Fluids

Results from the analysis of sump samples from the WESP are provided in Table 4.8. These results indicate that the majority of the coarser, less-soluble species were removed by the SBS leaving predominantly highly soluble species for accumulation in the WESP. Notice that the concentrations of dissolved species in the WESP typically exceed the corresponding values in the SBS by greater than an order of magnitude. Conversely, the suspended solid concentration is substantially lower than that in the SBS. The WESP solutions are high in selenium, tellurium, alkali metals, boron, and sulfate, as depicted in Figures 4.109 and 4.110 for Tests 3 (sample 12K-W-6A) and 5 (sample 12L-W-107A), respectively. These observations are generally consistent with the enhanced capture by the WESP of smaller particulates formed by the more volatile species, as is intended in the off-gas system design. The principal difference between the dissolved compositions in Tests 3 and 5 is the much larger proportion of tellurium in the Test 5 WESP solution. Between 120 and 220 kg of solution was removed from the WESP at the end of each test as compared to over 2000 kg removed from the SBS at the end of each test. This coupled with the lack of WESP blow downs during testing (only 18.9 liters was removed from the WESP during the nine tests) results in the WESP not being a significant factor with respect to elemental mass balances with the possible exception of selenium and tellurium.

SECTION 5.0 GLASS PRODUCT

Over 26,700 kg of glass product was discharged from the melter using an airlift system into 55-gallon drums. The discharged product glass was sampled at the end of each test by removing sufficient glass from the top of the drums for total inorganic analysis and X-ray diffraction analysis (XRD). Product glass masses, discharge date, and the analyses performed for discharges during Tests 1 through 9 are listed in Table 5.1.

5.1 Compositional Analysis

Glass samples were crushed and either dissolved in HF/HNO₃ acid mixtures with the aid of a microwave oven to produce a solution for DCP analysis or analyzed directly by XRF. Target values for boron and lithium oxide concentrations were used for normalizing the XRF data since those elements were not determined by XRF. Digested glass samples were also analyzed for cesium using AA and ion chromatography for sulfate and iodide. XRF-analyzed compositions for discharged glass samples are provided in Table 5.2 for XRF data and in Table 5.3 for DCP data. Results of both DCP and XRF analysis are summarized for discharged glasses and compared to those for feed samples in Table 2.8. Generally, there was very good agreement with the target composition for the majority of oxides, in particular for the major oxides, as described for feed samples in Section 2.4. As was observed in the feed sample analysis, lithium and strontium are both about 15% below target, presumably as a result of actual deficiencies in the delivered feed. Lanthanum was consistently low in the product glass, as was the case for the feed samples (Section 2.4). The magnesium contamination (1.1-1.2 wt% MgO vs. the 0.06 wt% target) present in the feed samples was also present in the discharged glasses. The loss of volatile elements such as sulfur, selenium, and tellurium, although still significant, was less pronounced in the discharged glasses due to the presence of a cold cap maintained in the melter but absent during crucible melting of feed samples. No iodine was detected in any of the samples by either method. The iodine detection limit is estimated at about 0.001 wt% for XRF but suitable glass standards are not available to confirm this. Data from the DCP and XRF analytical methods give comparable results for most constituents with XRF yielding results closer to target for some constituents (e.g., silica and iron) and DCP yielding results closer to target for others (e.g., zirconium).

5.2 Compositional Trends

Compositional trends over the course of the nine tests are plotted for selected elements in Figures 5.1-5.3 (XRF data) and 5.4-5.5 (DCP data). The figures illustrate many of the points

apparent in the tabular summaries of the data; generally good agreement with target for most major oxides, deficiencies in lithium and strontium, significantly above-target concentrations of magnesium, and the loss of volatile elements. They also illustrate the compositional consistency for the majority of constituents over the course of testing. Exceptions occur during Test 6 and especially Test 7, both of which employed glass frit in place of chemicals for the glass formers. Notice the changes in aluminum, magnesium, calcium, and sulfur between 18000 kg and 24000 kg of production. Review of the feed data from individual tests (Table 2.6) shows many of the feed samples from these tests exhibit the same trends. All three elements are components in the simulant as opposed to the frit (see Tables 2.2 and 2.3); however, the trend cannot be attributed to a simple blending error in the ratio of simulant and frit because many other elements do not change in concentration over this period and aluminum concentrations increase while magnesium decreases. The most likely explanation appears to be contaminants in the glass frit but no impact on the glass production rates is anticipated from these variations. Fewer samples were analyzed using the DCP method and therefore trends are less obvious; however, two distinct boron populations can be discerned in Figure 5.4. Note that the glass poured during the first 12,000 kg of production had B_2O_3 concentrations averaging about 11 wt% (about 10% above target) whereas glasses produced in later tests have B_2O_3 concentrations close or slightly below the target value.

Volatile elements are of particular interest due to their often hazardous or radioactive nature and the implications for recycling off-gas system effluents. Iodine was the most volatile feed constituent given that none of the 0.1 wt% glass equivalent was measured in the product glass. As expected, selenium was also very volatile with less than a third of the feed selenium being incorporated into the product glass. Conversely, cesium, which is known to be volatile, was retained at concentrations at or near target levels. Another noteworthy observation is the increase in concentrations over feeding periods followed by dramatic decreases during idling periods for certain elements, most notably sulfur and selenium.

5.3 Iron Redox State

The iron oxidation state for glass samples from all nine tests was measured using colorimetric methods. Sample information including name, test, and the amount of glass produced are given in Table 5.4. The method detection limit of 0.4% divalent iron for these samples is a function of the lowest standard, the amount of glass dissolved, and the iron content of the glass.

One objective provided by the WTP Project for these melter tests was to add reductants (sugar) to yield a product glass with measurable amounts of divalent iron but not to exceed 20% of the total iron. This objective was intended to improve production rates by managing potential

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foaming. This objective was met in all tests except for Test 5. This test featured feed acidified with nitric acid and sugar at a ratio of 0.5 (1 mole sucrose: 16 moles nitrate or 3 moles of carbon: 4 moles nitrate). Test 8 was a repeat of Test 5 with an increase in sugar ratio to 0.7 and resulted in between 1 and 2 percent measured Fe^{2+} content. Initial tests with extra sugar were monitored closely to ensure that the divalent iron did not exceed the stated upper limit. The results from three of the longer tests are depicted in Figure 5.6. Notice that the rate of increase with glass production is approximately the same for Tests 2 and 9. The drop in divalent iron concentration for the last sample for both tests is due to a lag in time between the end of feeding and final glass discharge. The similar results for the two tests with same feed composition, sugar level, and approximate feed rate were expected. The latter half of Test 9 was conducted at a melting temperature of 1200°C instead of 1150°C, which may explain the higher divalent iron values reached in the latter portion of the test. The consistency of Test 7 divalent iron concentrations suggests a steady-state process with respect to iron reduction throughout the majority of the test. The lower divalent iron value is probably due to the increase in production rate (about 4 times higher than Test 2) and/or the air being bubbled through the melt pool. It is worth noting that all of the bubbled tests (Test 3, 4, and 7) as well as all of the tests without sugar additions (Tests 1, 3, and 4) exhibited small but measurable amounts of divalent iron in the glass products.

SECTION 6.0 MONITORED OFF-GAS EMISSIONS

6.1 Particulate and Gaseous Emissions

Sixty-five exhaust samples were taken from the melter and various off-gas system components using 40-CFR-60 Methods 3, 5, and 29 to examine particulate and certain gaseous fluxes. The majority of the off-gas analyte concentrations were derived from laboratory data on solutions extracted from air samples (filters and various solutions) together with measurements of the volume of air sampled. The volume of air sampled and the rate at which it can be sampled are defined in 40-CFR-60 and SW-846. Isokinetic sampling, which entails removing gas from the exhaust at the same velocity that the air is flowing in the duct (40-CFR-60, Methods 1-5), was used. Typically, a sample size of 30 dscf is taken at a rate of between 0.5 and 0.75 dscfm. Total particulate loading was determined by gravimetric analysis of the standard particle filter and of probe-rinse solutions. Downstream of the particulate filter in the sampling train are iced impingers with acidic (5% concentrated nitric acid plus 10% hydrogen peroxide) and basic (0.2 N sodium hydroxide) solutions. The analysis of these solutions permits the determination of total gaseous emissions of several elements, notably halides and sulfur. A list of all isokinetic sampling taken is provided in Table 6.1 including sampling date, sampling location, air sample volume, air flow rates, particulate emission rates, and air moisture content. The particle loading on the WESP filters from Test 1 was so low that the three six-hour samples were combined into one 36-hour sample in the subsequent eight tests.

Average melter, SBS, and WESP particulate emission rates and associated decontamination factors (DFs, i.e., ratio of species inlet flux to species outlet flux) are summarized in Table 6.2 for all nine tests. Elemental emission rates and DFs are provided in Tables 6.3-6.29. Solids carry-over from the melter was minimal during these tests, never exceeding 0.5 % of feed solids. As expected, the particulate emissions, both as flux and percent of feed, are far lower in tests without bubbling (Tests 1, 2, 6 and 9) than tests with bubbling (Tests 3, 4, and 7). DFs across the melter for total solids were around 200-400 with bubbling and around 500-2000 without bubbling. Exceptions were the two tests with nitrated feed without bubbling (Tests 5 and 8), which had the lowest DF values across the melter despite the low achieved production rates. Tests with frit additives as compared to comparable tests with chemicals as the source of glass formers, resulted in lower particle carryover for bubbled tests (Test 3 vs. Test 7) and higher particle carryover in tests without bubbling (Test 2 vs. Test 6). The average value given for Test 9 averages two samples taken while glass was produced at 1200°C and one while glass was produced at 1150°C (Table 6.27). As expected, the sample corresponding to 1150°C gave a higher melter DF (almost 800), whereas the samples corresponding to 1200°C gave a significantly lower DF (450). DFs across the SBS for total

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particulate ranged from about 3 to 26 and were higher for the bubbled tests, for which the particulate flux from the melter was higher. Across the WESP, DF values ranged from about 50 to 300 with no clear trend relating to feed type or melter operating conditions. Cumulative DF values are calculated from feed fluxes into the melter and emissions from the WESP. Values exceeding one million were not obtained for any test however three tests had cumulative DFs greater than 800,000.

The composition of the particles is similar to that observed in previous studies [1, 9]: high in volatile species such as boron, selenium, sulfur, and alkali, with lower concentrations of all other feed constituents. SBS particle emissions are even higher in selenium, sulfur, and alkali metals and even lower in other major feed constituents, such as silica, aluminum, and iron. Impinger solutions were analyzed for all of the elements in the feed but only the halides, sulfur, selenium, and boron were detected. The presence of these elements in the gas fraction is consistent with observations from previous studies [1, 2, 9]. The average composition of feed, melter emissions, and SBS emissions (excluding oxygen, nitrate, nitrite) are displayed in Figures 6.1-6.3, respectively. Notice that the relative percentage of volatiles such as selenium, sulfur, and alkali increase down-stream as the major constituents decrease. These results are consistent with previously observed trends: melter emissions are the result of both volatile constituents and feed entrainment and the SBS removes all but some of the more volatile feed constituents, which form the majority of the finer particulate matter. The composition of WESP particle emissions are difficult to determine due to the very low particle loading. Gaseous WESP are similar to SBS emissions with smaller halogen fluxes.

Iodine was detected in significant quantities in samples taken at all three off-gas locations. Iodine was only detected in the impinger solution downstream of the particle filter, indicating that it was exclusively gaseous. Furthermore, greater than 90% of all the iodine detected was measured in the basic impinger (0.2 N NaOH) downstream of the two acidic impingers (5% nitric acid and 10% hydrogen peroxide). This suggests that the iodine emitted is molecular (I_2) as opposed to HI; however, the division between molecular and acid gas halogens based on impinger pH has only been verified for chlorine and fluorine. Iodine melter emissions were highly variable ranging from 5 to 68 % of feed iodine with no clear trend with respect to melter operating conditions or feed type. This variability coupled with the lack of iodine detected in the glass product result in variable mass balance closure with respect to feed iodine. Significant iodine was measured in SBS emissions in only two tests (Tests 1 and 4) and in WESP emissions in Test 4. Iodine results from these nine tests are similar to the previous three Commissioning Tests [2] in that the majority of the iodine detected was in the basic impinger catch and melter emissions were variable; they are different in that little iodine was detected downstream of the WESP.

6.2 Particle Size Distribution

Samples were also taken using a University of Washington cascade impactor, which separates particles into particle size ranges enabling the determination of particle size distributions; the limit of each size range is referred to as the "cut-point." The melter and SBS exhaust streams were sampled during each test. Data for the particle size distributions are provided in Tables 6.30 – 6.38 for melter emissions and Tables 6.39-6.40 for SBS emissions. The chemical compositions of each particle size fraction emitted from the melter from the first five tests are provided in Tables 6.41 - 6.45; typically, greater than about 65 wt% of the particulate is larger than about 14 microns. Enough material was collected on filters from the melter and SBS exhaust to determine size distributions; however, sufficient material for chemical analysis was only collected on melter exhaust samples. The particulate concentration in the WESP exhaust was insufficient for accurately determining particle size distributions and therefore no sampling was attempted. Particle emissions from the SBS were mainly sub-micron in size, whereas melter emissions were concentrated in the coarser size fractions. This is consistent with the design intent of the SBS, which is primarily to remove the larger particulate, leaving removal of the finer particulate to the WESP, which is much better suited to that function. The composition of the particles emitted from the melter varied with size as shown in Tables 6.41 - 6.45. In the previous study [2], increases in mass percent for Cd, Cs, K, S, and Te were observed with decreasing particle size, whereas elemental mass percentages of Al, B, Mn, Si, Sr, Zn and Zr decreased with decreasing particle size. Also, sodium and selenium were common in all size fractions and show some tendency towards the smaller fractions. This trend is roughly adhered to in all the samples analyzed except those from Test 2 (Table 6.42). Chemical analysis by particle size is complicated by the small accumulated masses on each individual filter.

6.3 FTIR Analysis

Off-gas analysis by Fourier Transform Infra-Red (FTIR) spectroscopy was performed using an On-Line Technologies Inc. Model 2010 Multi-Gas™ Analyzer. Data were recorded at 71 s intervals, corresponding to an average of 128 scans at 0.5 cm⁻¹ spectral resolution. The melter off-gas supplied to the FTIR spectrometer was extracted using a heated sampling and transfer loop, which removed a gas sample stream from the off-gas system at 5 liters per minute. The sampling and transfer loop was maintained at 150 C throughout in order to prevent analyte loss due to condensation.

Off-gas emissions were monitored by FTIR spectroscopy during each test for a set of selected species over discrete time intervals at specified off-gas system locations. Table 6.46 displays a summary of the average analyte concentrations measured over the course of each test.

Real-time nitrogen oxide concentrations are presented in Figures 6.4-6.13 over the nine tests. As expected, NO and NO₂ were observed at the highest concentrations among the nitrogen-bearing analytes. As expected, concentrations of these nitrogen species as well as carbon monoxide were orders of magnitude higher in Tests 5 and 8 due to the use of nitrated feed. The nitrogen dioxide concentration was below the nitrogen oxide concentration in these tests and neither constituent was removed by either the SBS or WESP. The increase in sugar from a ratio of 0.5 (Test 5) to 0.7 (Test 8) did not result in a reduction in nitrogen oxide concentrations but did result in significant increases in both carbon monoxide and carbon dioxide. In the other seven tests, nitrogen oxide concentrations were affected by feed rate and sugar additions to the feed. The only difference between Tests 1 and 2 is the addition of 10 grams of sugar per liter, which led to a reduction in nitrogen emissions by a factor of about 8 and an increase in carbon monoxide emissions by a factor of about 9. Tests with bubbling (Tests 3, 4, and 7) had higher production rates and were conducted without sugar, resulting in higher relative nitrogen oxide emissions. Another aspect of the NO_x emissions is the high degree of variability during each test as can be observed in Figures 6.4 - 6.13. Notice that even over short periods of time NO emissions vary over factors of 10. Other nitrogen species such as ammonia, hydrogen cyanide, and N₂O were observed in small quantities in many of the tests. HF, HCl, and SO₂ were detected at rather low concentrations, typically less than 1 ppm. Moisture percentages at the melter outlet were a function of feed rates and were greatly reduced downstream by condensation in the SBS unit. Nitrogen mass balances over tests are shown in Table 6.47 for the predominant NO_x species (NO and NO₂) compared to feed nitrogen. In tests without sugar (Tests 1, 3, 4, 7), all of the feed nitrate was emitted as nitrogen oxides. In the nitrated tests, about half the feed nitrates were emitted as nitrogen oxides in keeping with previous tests conducted with high nitrate feeds at sugar ratios of around 0.5. Although the amount of added sugar was small in Tests 2, 6 and 9 the sugar ratio was well above 1.0 resulting in most of the feed nitrates being reduced to molecular nitrogen.

SECTION 7.0

SUMMARY AND CONCLUSIONS

A series of nine tests was performed on the DM1200 HLW pilot melter system to collect data on glass production rates and system performance for a range of feed types and system operating parameters. The tests used the same AZ-101 HLW simulant and glass composition, which was selected to meet all product quality, waste loading, and processability requirements. Consequently, variation of the waste stimulant or the glass formulation was not within the scope of these tests. Within these constraints, factors that were varied included feed solids content; reductant additions; feed nitration; replacement of glass forming chemical by a glass frit; increased operating temperature; increased number of feed tubes; continuous instead of pulsed feed introduction; and inclusion of melt pool agitation by bubbling.

Bubbling gave by far the most significant impact on glass production rates, as summarized in Figure 7.1. This conclusion is consistent with the results of the previous tests with the same stimulant and glass composition that were conducted on the DM1000 [1] and DM100 melter systems [9]. Furthermore, the conclusion that the glass production rates with baseline AZ-101 feed fall well short of the 400 kg/m²/d WTP HLW melter design basis is also consistent with the previous tests performed at the same scale [1]. Previous smaller-scale tests performed on the DM100 system [9] also indicated generally rather modest increases in glass production rates for most of the variables investigated, although several tests gave rates significantly above the 400 kg/m²/d design basis. However, while small-scale melter tests are useful for screening relative effects, they tend to overestimate absolute glass production rates, particularly for un-bubbled tests. This effect is illustrated in Figure 7.2. Consequently, when scale-up effects were taken into account, it was not clear that any of the variables investigated in the DM100 tests would conclusively meet the 400 kg/m²/d full-scale requirement without bubbling. The present series of test was therefore performed on the DM1200 one-third scale HLW pilot melter system to resolve this question. Notable differences between the results of the present tests and the screening tests conducted on the DM100 system [9] are that, as expected due to scale-up effects, the absolute rates are lower for the larger system, but also the effects of some of the seemingly more influential variables were significantly lower. For example, glass production rates increased from 430 to 650 kg/m²/d in the DM100 tests when chemical glass formers were replaced by glass frit [9], whereas the same change in the DM1200 tests resulted in little, if any, improvement in the rate (210 kg/m²/d). It should be noted, however, that comparison of the results from these tests is complicated by the fact that the solids contents were not the same in the two sets of tests (higher for the DM100 tests).

In summary, while the glass production rate results from the present tests have extended the range of variables explored, they are consistent with our earlier analysis and recommendation to the RPP-WTP Project [22]. While it is possible that some combination of variables, which would represent significant departures from the baseline flow-sheet, design, and operating

parameters, might meet the design basis rate, the data that are presently available suggest that such a solution would be unlikely to be robust with respect to variations in waste composition. Over and above the increase in absolute rates, this robustness is perhaps the strongest argument for the inclusion of bubblers into the HLW design, given the uncertainty and variability in the RPP-WTP HLW feed compositions.

In parallel with the glass production rate determinations, extensive data were collected on the performance of the DM1200 off-gas system over a wide range of feed types and operating conditions. The general performance of the system was good with minimal accumulations of solids in the film cooler and off-gas jumper, effective removal of larger solids by the SBS, and effective removal of smaller particulate by the WESP, which is consistent with the off-gas system design intent. The solids that were collected in the SBS were easily suspended and effectively removed in the liquid blow-downs, which resulted in minimal accumulation. In addition, the residual accumulation was soft and easily re-suspended. An important observation from these tests was the accumulation of deposits in the SBS down-comer at the point at which it passes through the diffuser plate; in one test, this led to significant increases in the pressure drop across the SBS. Consequently, future testing should address this issue. The performance of the WESP used for these tests was generally good but, as a result of these tests, several design problems were identified that led to periods of electrical instability; these have since been rectified and the unit has been stable in subsequent tests.

Extensive data were collected from off-gas samples taken throughout the system during these tests. These data were reduced to DF values for total particulate across the melter, the SBS, and the WESP. In addition, across the melter and the SBS, where particle loads were sufficiently high, DFs by element, particle size distributions, and elemental compositions by particle size were determined. Cumulative DFs across the melter, SBS, and WESP were between about 170,000 and 980,000, with several tests giving values towards the higher end of that range. Extensive data were also collected on the compositions of samples of sump fluids from the SBS and WESP that were collected throughout the tests, which are important for flow-sheet input and recycle closure. These data included pH, dissolved and suspended solids fractions, and chemical composition. The SBS sump fluid TDS values typically exceeded the TSS values and ranged from 60 mg/l to 6700 mg/l. The pH values ranged from 1.06 to 8.60 and were influenced by the melter emissions, particularly NO_x, through the feed type, with the lowest pH values being for the nitrated feeds. The dissolved solids consisted mainly of species such as alkali metals, halogens, boron, and sulfur, as well as significant amount of selenium. The suspended solids consisted primarily of iron and silicon with significant amounts of selenium, tellurium, nickel, lead, chromium, and zirconium. Other metals such as aluminum, calcium, magnesium, cadmium, manganese, and zinc were present in both the suspended and dissolved fractions of the SBS samples. Iodide was present only in the dissolved fraction.

Results from the analysis of sump samples from the WESP indicate that the majority of the coarser, less-soluble species were removed by the SBS leaving predominantly highly soluble species for accumulation in the WESP. The concentrations of dissolved species in the WESP typically exceeded the corresponding values in the SBS by greater than an order of

magnitude; however, the liquid accumulation rates in the WESP were also very much lower than for the SBS. Conversely, the suspended solid concentrations were substantially lower than those in the SBS. The WESP solutions were high in selenium, tellurium, alkali metals, boron, and sulfate. These observations are generally consistent with the enhanced capture by the WESP of smaller particulates formed by the more volatile species, as is intended in the off-gas system design.

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Table 1.1. Test Matrix.

TP	TP Test #	Actual Test #	Feed Type	Bubbling	Sugar	Bulk Glass Temperature, °C	Type of feeding
VSL-01T01 00-2	1	1	High Solids	No	No	1150	Pulsed Simulated ADS
	1a	2	High Solids + 10 g sugar/ liter feed	No	Yes	1150	Pulsed Simulated ADS
	1b	9a	High Solids + 10 g sugar/ liter feed	No	Yes	1150	Continuous Peristaltic
	2	4	Nominal	Yes; Shallow, L-shaped	Yes	1150	Pulsed Simulated ADS
	3	3	Nominal	Yes; Deep, L-shaped	Yes	1150	Pulsed Simulated ADS
	4	Not Conducted	Nominal	No	Yes	1150	Pulsed Simulated ADS
VSL-01T01 00-3	1	5	Nitrated Sugar Ratio = 0.5	No	Yes	1150	Pulsed Simulated ADS
		8	Nitrated Sugar Ratio = 0.7				
	2	6	Frit + 7.5 g sugar/ liter	No	Yes	1150	Pulsed Simulated ADS
	3	7	Frit + 7.5 g sugar/ liter feed	Yes; deep, L-shaped	No	1150	Pulsed Simulated ADS
	4	9b	Nominal + 10 g sugar/ liter feed	No	Yes	1175 to 1200	Continuous Peristaltic
	5	Not Conducted	Nominal	Yes; deep, simplified straight-pipe	No	1150	Pulsed Simulated ADS
	6	Not Conducted	Nominal	Yes; shallow, simplified straight-pipe	No	1150	Pulsed Simulated ADS

Notes:

- TP = Test Plan
- All tests are with AZ-101.
- "Nominal" solids content corresponds to Envelope D feed from pretreatment of 20 wt% solids, which for the AZ101 formulation, gives a melter feed oxide content of about 400 g/l, based on the estimated density.
- Oxide content of "High solids" feed was about 570 g/l.
- Electrode firing patterns were side-to-bottom for the un-bubbled and shallow bubbler tests and side-to-side for the remaining bubbled tests.
- Tests 5 and 8 were conducted with an acidified (nitrated) feed. All other tests used alkaline feeds.
- Test 9 employed two feed tubes; all others employed one.
- Test 9b was originally intended to be conducted with the pulsed, simulated ADS feed system.

Table 1.2. Summary of Test Conditions and Results for Tests 1-4.

Test #		1	2	3	4
Time	Feed Start	6/25/01 10:45	7/23/01 17:47	8/6/01 16:59	8/20/01 13:08
	Feed End	7/2/01 10:50	8/1/01 11:47	8/11/01 11:47	8/25/01 1444
	Interval	168.1 hr	216 hr	114.8 hr	121.6 hr
Water Feeding for Cold Cap		2.25 hr	1.6 hr	0.8 hr	1.9 hr
Slurry Feeding		165.8 hr	214.4 hr	114.0 hr	119.7 hr
Cold cap burn		5.0 hr	10.0 hr	3.3 hr	3.3 hr
Total		173.1 hr	226.0 hr	118.1 hr	124.9 hr
Bubbling Rate		<4 lpm	< 4 lpm	Deep: 62 lpm	Shallow: 50 lpm
Electrode Firing		Side to Bottom	Side to Bottom	Side to Side	Side to Bottom
Feed	Characteristics	High Solids	High Solids + 10 g sugar/l	High Water	High Water
	Used	5927 kg	6816 kg	19184 kg	11573 kg
	Glass yield (target)	570 g/l	570 g/l	400 g/l	400 g/l
		0.38 kg/kg	0.38 kg/kg	0.29 kg/kg	0.29 kg/kg
	Average Rate	35.7 kg/hr	31.8 kg/hr	168.3 kg/hr	96.7 kg/hr
Glass Produced	Poured	2301 kg	2594 kg	6180 kg	3465 kg
	Average Rate ^{\$}	278 kg/m ² /day	242 kg/m ² /day	1084 kg/m ² /day	579 kg/m ² /day
	Average Rate [*]	272 kg/m ² /day	242 kg/m ² /day	976 kg/m ² /day	561 kg/m ² /day
	Steady State Rate [*]	255 kg/m ² /day	205 kg/m ² /day	980 kg/m ² /day	540 kg/m ² /day
	Average Power Use	6.1 kW.hr/ Kg glass	5.7 kW.hr/ kg glass	3.9 kW.hr/ kg glass	4.7 kW.hr/ kg glass

\$ - Rates calculates from glass poured.

*- Rates calculated from feed data.

Note: Rates do not take into account the time for water feeding and cold cap burn-off.

Table 1.3. Summary of Test Conditions and Results.

Test #		5	6	7	8
Time	Feed Start	9/25/01 13:17	10/11/01 08:21	10/22/01 14:12	10/29/01 13:45
	Feed End	10/1/01 13:37	10/17/01 19:24	10/27/01 14:12	11/2/01 17:45
	Interval	144.5 hr	155.0 hr	120.0 hr	100.0 hr
Water Feeding for Cold Cap		2.0 hr	2.2 hr	1.5 hr	1.1 hr
Slurry Feeding		142.5 hr	152.8 hr	118.5 hr	98.9 hr
Cold cap burn		6.4 hr	14.5 hr	4.3 hr	10.3 hr
Total		150.9 hr	169.5 hr	124.3 hr	110.3 hr
Bubbling Rate		< 4 lpm	<4 lpm	60 lpm deep	< 4 lpm
Electrode Firing		Side to Bottom	Side to Bottom	Side to Side	Side to Bottom
Feed	Characteristics	Nitrated + sugar (sugar ratio=0.5)	Frit + 7.5 g sugar/l	Frit + 7.5 g sugar/l	Nitrated + sugar (sugar ratio=0.7)
	Used	4932 kg	5417 kg	16240 kg	3426 kg
	Glass yield (target)	420 g/l feed	480 g/l feed	480 g/l feed	420 g/l feed
		0.31 kg/kg feed	0.35 kg/kg feed	0.35 kg/kg feed	0.31 kg/kg feed
	Average Rate	34.6 kg/hr	35.5 kg/hr	137.0 kg/hr	34.6 kg/hr
Glass Produced	Poured	1659 kg	1901 kg	5976 kg	944 kg
	Average Rate ^{\$}	233 kg/m ² /day	249 kg/m ² /day	1009 kg/m ² /day	191 kg/m ² /day
	Average Rate [*]	215 kg/m ² /day	248 kg/m ² /day	959 kg/m ² /day	215 kg/m ² /day
	Steady State Rate [*]	220 kg/m ² /day	210 kg/m ² /day	1100 kg/m ² /day	200 kg/m ² /day
	Average Power Use	6.5 kW.hr/kg glass	6.0 kW.hr/kg glass	3.3 kW.hr/kg glass	6.3 kW.hr/kg glass

^{\$} - Rates calculated from glass poured.

^{*}- Rates calculated from feed data.

Note: Rates do not take into account the time for water feeding and cold cap burn-off.

**Table 1.4. Summary of Test Conditions and Results for Test 9 (Both Feed Tubes;
Continuous Instead of Pulsed Feed).**

Test #		9a	9b
Time	Feed Start	11/5/1 14:20	11/8/1 11:00
	Feed End	11/8/1 11:00	11/10/1 17:00
	Interval	68.6 hr	54.0 hr
Water Feeding for Cold Cap		1.1 hr	NA
Slurry Feeding		67.5 hr	54.0 hr
Cold cap burn		NA	6.9 hr
Total		68.6 hr	60.9 hr
Glass Temperature		1150°C	1200°C
Bubbling Rate		< 4 lpm	
Electrode Firing		Side to Side	
Feed	Characteristics	Nominal + 10 g sugar / l	
	Glass yield (target)	570 g/l	
		0.38 kg/kg	
	Used	2028 kg	2125 kg
Glass Produced	Average Rate	30.0 kg/hr	39.4 kg/hr
	Poured	859 kg	847 kg
	Average Rate [§]	255 kg/m ² /day	313 kg/m ² /day
	Average Rate [*]	228 kg/m ² /day	299 kg/m ² /day
	Steady State Rate [*]	230 kg/m ² /day	310 kg/m ² /day
Average Power Use		6.3 kW.hr/kg glass	5.4 kW.hr/kg glass

§ - Rates calculated from glass poured.

*- Rates calculated from feed data.

Note: Rates do not take into account the time for water feeding and cold cap burn.

Table 2.1. Composition Summary of AZ-101 Waste, LAW Pretreatment Products, AZ-101 Simulant Plus Pretreatment Products, Glass Additives, and HLW98-31 Glass.

	AZ-101 Envelope D Waste	Pretreatment Products(as wt% of total AZ-101 oxides)	AZ-101 Simulant (Envelope D + Pretreatment Products)	Additives (as wt% of glass)	HLW98-31 Glass Composition
Al ₂ O ₃	27.41%		24.27%		7.40%
As ₂ O ₃	0.15%		0.13%		0.04%
B ₂ O ₃				10.00%	10.00%
BaO	0.16%		0.14%		0.04%
CaO	0.91%		0.81%		0.25%
CdO	1.38%		1.22%		0.37%
CeO ₂	0.31%		0.27%		0.08%
Cl	0.03%		0.02%		0.01%
Cr ₂ O ₃	0.16%		0.14%		0.04%
Cs ₂ O	0.01%	0.3%	0.27%		0.08%
CuO	0.10%		0.09%		0.03%
F	0.14%		0.12%		0.04%
Fe ₂ O ₃	38.49%		34.08%		10.39%
K ₂ O	0.63%		0.55%		0.17%
La ₂ O ₃	1.20%		1.06%		0.32%
Li ₂ O				6.00%	6.00%
MgO	0.24%		0.21%		0.06%
MnO	7.76%	3.5%	9.94%		3.03%
Na ₂ O	1.46%	0.8%	1.96%	6.00%	6.59%
NiO	1.99%		1.76%		0.54%
P ₂ O ₅	0.47%		0.42%		0.13%
PbO	0.56%		0.50%		0.15%
SO ₃	0.93%		0.82%		0.25%
Sb ₂ O ₅	0.78%		0.69%		0.21%
SeO ₂	0.55%		0.49%		0.15%
SiO ₂	0.08%		0.07%	45.51%	45.53%
SrO	0.16%	8.6%	7.60%		2.32%
TeO ₂	0.53%		0.47%		0.14%
TiO ₂	0.23%		0.21%		0.06%
ZnO				2.00%	2.00%
ZrO ₂	13.19%		11.68%		3.56%
TOTAL	100%	13.16%	100%	69.51%	100%
Total Oxides (kg)	82,997	10,920	93,917	214,108	308,025
Volatiles,g/100 g oxides					
CO ₃	0.00	4.96*	3.00		
NO ₂	1.08		0.95		
NO ₃	0.61	1.63	1.97		
TOC	1.50		1.32		

 * If all Sr in pretreatment is precipitated as SrCO₃

Table 2.2. Chemical Compositions of the AZ-101 Simulant (Plus Pretreatment Products) and the Corresponding Melter Feed to Produce 10 MT of HLW98-31 Glass.

AZ-101+ Pretreatment Products		Glass-Forming Additives	
Starting Materials	Target Weight, kg	Starting Materials	Target Weight, kg
Al(OH) ₃	1131.6		
Na ₂ HAsO ₄	7.5		
Ba(OH) ₂ *8H ₂ O	8.7		
CaCO ₃	44.1		
CdO	37.2		
Ce(OH) ₄	10.1		
Cr ₂ O ₃ *1.5H ₂ O	5.2		
CsOH (50% Solution)	17.5		
CuSO ₄ *5H ₂ O	8.8		
NaF	8.4		
Fe(OH) ₃ Slurry	10553.5		
KNO ₃	28.3		
La(OH) ₃ *3H ₂ O	48.5		
Li ₂ CO ₃		Li ₂ CO ₃	1484.1
(MgCO ₃) ₄ (Mg(OH) ₂ *5H ₂ O)	15.1		
MnO ₂	371.5		
NaOH (50% Solution)	12.8		
		Na ₂ B ₄ O ₇ *10H ₂ O	2738.7
Ni(NO ₃) ₂ *6H ₂ O			
Ni(OH) ₂	66.7		
FePO ₄ (80%)	33.8		
PbCO ₃ *Pb(OH) ₂	17.3		
Na ₂ SO ₄	39.4		
Sb ₂ O ₃	21.1		
SeO ₂	14.9		
SiO ₂	2.2	SiO ₂	4551.8
Sr(NO ₃) ₂	57.3		
Sr(OH) ₂ *8H ₂ O	522.2		
TeO ₂	14.2		
TiO ₂	6.3		
ZnO		ZnO	200.0
ZrOOH(CO ₃)0.5 (50%)	570.9		
Zr(OH) ₄ (50%)	330.8		
KCl	1.5		
KI	13.1		
Na ₂ CO ₃		Na ₂ CO ₃	264.3
NaNO ₂	63.6		
NaNO ₃			
C ₂ H ₂ O ₄ *2H ₂ O	208.1		
H ₂ O	1897.6		
TOTAL	16,189.9	TOTAL	9238.9
		FEED TOTAL	25,428.8

Table 2.3. Composition and Properties of the Glass Frit Used in Tests 6 and 7.

Composition	
Oxide	Weight %
B ₂ O ₃	14.39
Li ₂ O	8.63
Na ₂ O	8.63
SiO ₂	65.47
ZnO	2.88
Viscosity	
Temperature (°C)	Viscosity (poise)
950	231
1000	128
1050	77
1100	50
1150	34
1200	24
Glass Transition Temperature = 448 ± 5°C	

Table 2.4. Measured Feed Sample Properties.

Test#	Sampling Date	Sample Name	Wt% Water	Density (g/ml)	Glass Yield (kg/kg)	Glass Yield (g/l)	pH	Yield Stress (Pa)	Viscosity (P)	
									@1/s	@10/s
1	6/25/01	12F-F-81A	51.5	1.44	0.393	566	9.77	0.8	NA	NA
	6/26/01	12F-F-97A	51.5	1.44	0.398	573	9.79	2.0	23.1	2.8
	6/28/01	12F-F-146A	51.3	1.47	0.404	594	9.77	<2.0	43.7	5.9
	6/29/01	12G-F-6A	52.5	1.42	0.385	547	9.76	0.7	30.1	2.9
	6/30/01	12G-F-33A	50.9	1.46	0.404	590	9.78	0.3	30.8	3.6
	7/1/01	12G-F-53A	51.0	1.45	0.398	577	9.76	2.5	33.8	3.4
	7/2/01	12G-F-71A	50.9	1.46	0.400	584	9.78	0.6	27.2	3.1
	Average		51.4	1.45	0.397	576	9.77	1.4	31.5	3.6
	Standard Deviation		0.5	0.02	0.006	15	0.01	NA	NA	NA
2	7/24/01	12G-F-130A	52.1	1.42	0.384	545	9.73	7.7	42.9	6.1
	7/25/01	12G-F-149A	52.7	1.42	0.383	544	9.73	NA	NA	NA
	7/26/01	12H-F-32A	52.0	1.47	0.394	579	9.76	NA	NA	NA
	7/27/01	12H-F-43A	52.2	1.46	0.393	574	9.74	NA	NA	NA
	7/28/01	12I-F-22A	51.8	1.47	0.359	528	9.78	NA	NA	NA
	7/29/01	12I-F-40A	52.3	1.44	0.390	562	9.78	NA	NA	NA
	7/30/01	12I-F-57A	53.1	1.45	0.381	552	9.79	NA	NA	NA
	7/31/01	12I-F-66A	51.7	1.47	0.395	581	9.77	NA	NA	NA
	8/01/01	12I-F-82A	51.6	1.46	0.389	568	9.77	8.3	31.7	5.9
	Average		52.5	1.45	0.385	559	9.76	NA	NA	NA
	Standard Deviation		0.5	0.02	0.010	17	0.02	NA	NA	NA
3	8/07/01	12J-F-53A	63.6	1.33	0.287	382	9.73	1.8	8.0	0.99
	8/07/01	12J-F-62A	63.0	1.34	0.311	417	9.72	NA	NA	NA
	8/08/01	12J-F-81A	61.6	1.31	0.311	407	9.76	NA	NA	NA
	8/09/01	12J-F-99A	64.8	1.29	0.290	374	9.71	NA	NA	NA
	8/09/01	12J-F-112A	63.9	1.30	0.297	386	9.71	NA	NA	NA
	8/10/01	12J-F-131A	63.1	1.32	0.309	408	9.78	NA	NA	NA
	8/11/01	12J-F-149A	64.0	1.33	0.303	403	9.76	1.8	7.9	0.87
	Average		63.4	1.32	0.301	397	9.74	NA	NA	NA
	Standard Deviation		0.9	0.02	0.009	15	0.03	NA	NA	NA
4	8/21/01	12K-F-54A	67.1	1.28	0.267	342	9.76	0.9	4.5	0.55
	8/22/01	12K-F-83A	66.6	1.32	0.296	391	9.77	NA	NA	NA
	8/23/01	12K-F-104A	63.7	1.30	0.297	386	9.73	NA	NA	NA
	8/24/01	12K-F-125A	63.7	1.32	0.294	388	9.73	1.8	7.0	0.80
	Average		65.3	1.31	0.289	377	9.75	NA	NA	NA
	Standard Deviation		1.6	0.02	0.012	20	0.02	NA	NA	NA

Table 2.4. Measured Feed Sample Properties (continued).

Test #	Sampling Date	Sample Name	Wt% Water	Density (g/ml)	Glass Yield (kg/kg)	Glass Yield (g/l)	pH	Yield Stress (Pa)	Viscosity (P)	
									@ 1/s	@ 10/s
5	9/24/01	12K-F-144A	50.4	1.44	0.334	481	7.33	1.2	9.0	0.96
	09/24/01	12K-F-144A	50.4	1.44	0.334	481	7.33	NA	NA	NA
	09/26/01	12L-F-30A	45.6	1.44	0.323	465	5.48	NA	NA	NA
	09/27/01	12L-F-49A	51.2	1.45	0.322	467	5.38	NA	NA	NA
	09/28/01	12L-F-70A	50.8	1.43	0.320	457	5.32	NA	NA	NA
	09/29/01	12L-F-80A	54.1	1.40	0.291	407	5.32	NA	NA	NA
	09/30/01	12L-F-107A	52.4	1.43	0.313	448	5.14	NA	NA	NA
	10/01/01	12L-F-119A	52.5	1.44	0.314	452	5.15	NA	NA	NA
	Average		51.6	1.43	0.317	454	5.59	NA	NA	NA
	Standard Deviation		1.3	0.02	0.012	22	0.72	NA	NA	NA
6	10/11/01	12L-F-147A	62.3	1.29	0.331	427	10.01	1.0	5.3	0.70
	10/11/01	12L-F-148A	60.6	1.31	0.345	451	9.91	NA	NA	NA
	10/11/01	12L-F-155A	62.0	1.31	0.352	461	9.90	NA	NA	NA
	10/12/01	12M-F-6A	63.5	1.31	0.349	457	9.91	NA	NA	NA
	10/12/01	12M-F-9A	60.0	1.31	0.337	442	9.91	NA	NA	NA
	10/12/01	12M-F-11A	60.3	1.31	0.347	454	9.81	NA	NA	NA
	10/12/01	12M-F-19A	60.6	1.30	0.347	452	9.89	NA	NA	NA
	10/12/01	12M-F-21A	60.3	1.30	0.347	451	9.94	NA	NA	NA
	10/12/01	12M-F-22A	61.0	1.29	0.348	448	9.94	NA	NA	NA
	10/12/01	12M-F-24A	60.0	1.30	0.314	408	9.92	NA	NA	NA
	10/13/01	12M-F-30A	60.2	1.33	0.352	466	9.95	NA	NA	NA
	10/13/01	12M-F-32A	61.1	1.29	0.340	439	9.96	NA	NA	NA
	10/13/01	12M-F-33A	62.0	1.29	0.328	424	9.97	NA	NA	NA
	10/13/01	12M-F-39A	61.0	1.30	0.339	440	9.94	NA	NA	NA
	10/13/01	12M-F-40A	60.7	1.32	0.346	456	9.95	NA	NA	NA
	10/13/01	12M-F-43A	60.5	1.30	0.344	447	9.92	NA	NA	NA
	10/14/01	12M-F-49A	60.2	1.32	0.354	466	9.92	NA	NA	NA
	10/14/01	12M-F-50A	62.1	1.30	0.332	431	9.92	NA	NA	NA
	10/14/01	12M-F-54A	60.8	1.32	0.350	462	9.89	NA	NA	NA
	10/15/01	12M-F-71A	60.7	1.29	0.340	440	9.85	NA	NA	NA
	10/16/01	12M-F-87A	60.9	1.32	0.346	457	8.85	NA	NA	NA
	10/17/01	12M-F-100A	60.8	1.33	0.351	467	8.66	NA	NA	NA
	Average		61.0	1.31	0.343	448	9.84	NA	NA	NA
	Standard Deviation		0.9	0.01	0.009	15	0.26	NA	NA	NA

Table 2.4. Measured Feed Sample Properties (continued).

Test #	Sampling Date	Sample Name	Wt% Water	Density (g/ml)	Glass Yield (kg/kg)	Glass Yield (g/l)	pH	Yield Stress (Pa)	Viscosity (P)	
									@ 1/s	@ 10/s
7	10/22/01	12M-F-143A	54.0	1.32	0.363	479	9.39	0.7	4.1	0.49
	10/23/01	12N-F-6A	59.9	1.35	0.358	483	9.38	NA	NA	NA
	10/24/01	12N-F-38A	60.4	1.34	0.344	461	9.51	NA	NA	NA
	10/25/01	12N-F-64A	60.0	1.34	0.356	477	9.00	NA	NA	NA
	10/26/01	12N-F-99A	60.2	1.33	0.353	470	9.00	NA	NA	NA
	10/27/01	12N-F-127A	61.6	1.32	0.350	462	8.58	0.7	4.0	0.53
	Average		60.2	1.33	0.354	472	9.14	NA	NA	NA
	Standard Deviation		0.8	0.01	0.006	9	0.32	NA	NA	NA
8	10/30/01	12O-F-16A	51.7	1.42	0.309	439	4.94	ND	0.18	0.07
	10/31/01	12O-F-31A	52.2	1.42	0.298	423	5.00	NA	NA	NA
	11/01/01	12O-F-49A	54.2	1.40	0.288	403	4.95	NA	NA	NA
	11/02/01	12O-F-68A	48.0	1.40	0.309	432	4.83	ND	0.11	0.05
	Average		51.5	1.41	0.301	424	4.93	NA	NA	NA
	Standard Deviation		2.3	0.01	0.009	14	0.06	NA	NA	NA
9	11/06/01	12O-F-106A	50.7	1.47	0.404	593	9.74	6.3	28.6	4.3
	11/07/01	12O-F-125A	50.6	1.46	0.390	569	9.78	NA	NA	NA
	11/08/01	12O-F-144A	50.5	1.49	0.401	598	9.77	NA	NA	NA
	11/09/01	12P-F-13A	50.6	1.48	0.395	584	9.81	NA	NA	NA
	11/10/01	12P-F-41A	52.1	1.45	0.395	573	9.83	9.7	45.7	4.5
	Average		50.9	1.47	0.397	584	9.79	NA	NA	NA
	Standard Deviation		0.6	0.01	0.005	11	0.03	NA	NA	NA

ND: Not Detected. NA: Not Analyzed.

Table 2.5. Averages for Measured Feed Sample Properties.

Feed Type	Test #	Wt% Water	Density (g/ml)	pH	Glass Yield		Glass Yield Target, kg/kg
					g/l	kg/kg	
Nominal	1, 2, 9	51.6	1.45	9.77	571	0.39	0.38
High Water	3, 4	64.1	1.31	9.74	389	0.30	0.29
Frit Nominal	6, 7	60.6	1.31	9.67	453	0.35	0.35
Nitrated Nominal	5, 8	51.1	1.43	5.51	446	0.31	0.31

Table 2.6. XRF Analyzed Composition of Crucible-Melted Feed Samples (wt%).

Test #		1								2			
Sample I.D.	Target	12F-F-81A	12F-F-97A	12F-F-146A	12G-F-6A	12G-F-33A	12G-F-53A	12G-F-71A	Avg.	12G-F-130A	12G-F-149A	12H-F-32A	12H-F-43A
Al ₂ O ₃	7.40	7.54	7.23	7.31	7.74	7.32	7.27	7.45	7.41	7.22	7.78	7.41	7.89
As ₂ O ₃	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.04
B ₂ O ₃ *	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10	10.00	10.00	10.00	10.00
BaO	0.04	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
CaO	0.25	0.29	0.29	0.30	0.28	0.29	0.29	0.29	0.29	0.30	0.29	0.30	0.28
CdO	0.37	0.40	0.35	0.40	0.34	0.35	0.35	0.32	0.36	0.33	0.31	0.32	0.33
CeO ₂	0.08	0.07	0.06	0.06	0.07	0.06	0.07	0.07	0.07	0.07	0.06	0.07	0.09
Cl	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Cr ₂ O ₃	0.04	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.05	0.04	0.05	0.05
Cs ₂ O	0.08	0.09	0.08	0.08	0.08	0.07	0.07	0.07	0.08	0.06	0.07	0.07	0.07
CuO	0.03	0.03	0.04	0.03	0.03	0.03	0.04	0.04	0.03	0.03	0.02	0.03	0.03
F	0.04	NA	NA	NA	NA	NA	NA	NA	NC	NA	NA	NA	NA
Fe ₂ O ₃	10.39	10.28	10.76	10.54	9.69	10.35	10.38	10.35	10.34	10.29	9.80	10.35	10.57
K ₂ O	0.17	0.26	0.24	0.25	0.26	0.24	0.25	0.25	0.25	0.23	0.28	0.24	0.24
La ₂ O ₃	0.32	0.12	0.06	0.13	0.14	0.15	0.11	0.11	0.12	0.11	0.12	0.12	0.11
Li ₂ O*	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
MgO	0.06	1.13	1.13	1.13	1.17	1.25	1.16	1.20	1.17	1.17	1.17	1.16	1.40
MnO	3.03	3.10	3.16	3.14	2.89	3.07	3.09	3.05	3.07	3.11	2.93	3.02	3.12
Na ₂ O	6.59	6.59	6.47	6.46	6.93	6.60	6.51	6.24	6.54	6.83	6.76	6.96	7.15
NiO	0.54	0.48	0.52	0.50	0.45	0.49	0.49	0.48	0.49	0.47	0.44	0.49	0.50
P ₂ O ₅	0.13	0.34	0.34	0.33	0.35	0.33	0.34	0.34	0.34	0.42	0.32	0.32	0.36
PbO	0.15	0.13	0.14	0.14	0.11	0.13	0.13	0.12	0.13	0.13	0.12	0.12	0.13
Sb ₂ O ₃	0.21	0.18	0.17	0.18	0.18	0.18	0.19	0.18	0.18	0.15	0.16	0.17	0.16
SeO ₂	0.15	0.04	0.04	0.04	0.03	0.03	0.04	0.02	0.03	0.03	0.03	0.04	0.05
SiO ₂	45.54	44.86	44.50	44.33	45.60	44.77	44.88	45.25	44.88	44.88	45.70	44.69	47.71
SO ₃	0.25	0.21	0.25	0.20	0.22	0.24	0.20	0.17	0.21	0.17	0.17	0.17	0.20
SrO	2.32	1.94	2.02	2.15	1.88	2.04	2.06	2.03	2.01	2.04	1.89	1.99	1.42
TeO ₂	0.14	0.11	0.11	0.10	0.11	0.12	0.10	0.09	0.11	0.08	0.09	0.08	0.10
TiO ₂	0.06	0.09	0.08	0.08	0.08	0.08	0.07	0.07	0.08	0.07	0.07	0.08	0.07
ZnO	2.00	1.80	1.89	1.90	1.69	1.82	1.84	1.82	1.82	1.85	1.72	1.86	1.97
ZrO ₂	3.56	3.87	4.02	4.16	3.64	3.94	4.03	3.95	3.95	3.90	3.67	3.90	0.00
Sum	99.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

* Target values. NA: Not Analyzed. NC: Not Calculated.

Table 2.6. XRF Analyzed Composition of Crucible-Melted Feed Samples (wt%).

Test #		2						3				
Sample I.D.	Target	12I-F-22A	12I-F-40A	12I-F-57A	12I-F-66A	12I-F-82A	Avg.	12J-F-53A	12J-F-62A	12J-F-81A	12J-F-99A	12J-F-112A
Al ₂ O ₃	7.40	7.55	7.48	7.41	7.41	7.41	7.50	7.53	7.46	7.23	7.71	7.32
As ₂ O ₃	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.04
B ₂ O ₃ *	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
BaO	0.04	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
CaO	0.25	0.29	0.29	0.29	0.29	0.30	0.29	0.30	0.34	0.30	0.28	0.30
CdO	0.37	0.34	0.32	0.33	0.36	0.31	0.33	0.36	0.37	0.37	0.31	0.35
CeO ₂	0.08	0.07	0.06	0.07	0.06	0.06	0.07	0.08	0.07	0.07	0.06	0.07
Cl	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cr ₂ O ₃	0.04	0.05	0.04	0.05	0.04	0.04	0.05	0.05	0.04	0.05	0.04	0.05
Cs ₂ O	0.08	0.08	0.08	0.09	0.08	0.07	0.07	0.07	0.07	0.07	0.06	0.06
CuO	0.03	0.03	0.02	0.02	0.02	0.03	0.03	0.04	0.03	0.03	0.03	0.04
F	0.04	NA	NA	NA	NA	NA	NC	NA	NA	NA	NA	NA
Fe ₂ O ₃	10.39	9.91	10.33	10.17	10.29	10.33	10.23	10.81	10.65	10.71	9.77	10.49
K ₂ O	0.17	0.29	0.24	0.24	0.24	0.25	0.25	0.26	0.29	0.23	0.27	0.24
La ₂ O ₃	0.32	0.12	0.11	0.11	0.12	0.12	0.12	0.14	0.17	0.14	0.13	0.13
Li ₂ O*	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
MgO	0.06	1.18	1.23	1.18	1.20	1.16	1.20	1.19	1.17	1.16	1.24	1.15
MnO	3.03	2.89	2.99	2.95	3.02	2.99	3.00	3.06	3.12	3.16	2.79	3.05
Na ₂ O	6.59	7.49	6.77	6.95	6.76	6.73	6.93	6.17	6.39	6.03	6.75	6.49
NiO	0.54	0.48	0.45	0.46	0.47	0.47	0.47	0.53	0.54	0.51	0.46	0.50
P ₂ O ₅	0.13	0.32	0.34	0.33	0.32	0.33	0.34	0.32	0.33	0.34	0.35	0.34
PbO	0.15	0.12	0.13	0.12	0.12	0.13	0.12	0.13	0.11	0.13	0.11	0.12
Sb ₂ O ₃	0.21	0.18	0.17	0.18	0.19	0.16	0.17	0.17	0.17	0.18	0.15	0.16
SeO ₂	0.15	0.04	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.01	0.02	0.01
SiO ₂	45.54	44.75	44.93	44.97	44.77	44.64	45.23	44.47	44.50	44.93	46.11	45.11
SO ₃	0.25	0.19	0.13	0.21	0.19	0.18	0.18	0.22	0.20	0.13	0.21	0.15
SrO	2.32	1.92	1.98	1.98	2.03	2.11	1.93	2.10	1.91	2.10	1.83	2.00
TeO ₂	0.14	0.10	0.09	0.10	0.11	0.08	0.09	0.09	0.09	0.07	0.08	0.06
TiO ₂	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.09	0.07	0.07	0.08
ZnO	2.00	1.76	1.81	1.78	1.84	1.89	1.83	1.92	2.04	1.93	1.71	1.88
ZrO ₂	3.56	3.78	3.90	3.91	3.96	4.10	3.46	3.88	3.82	4.04	3.47	3.84
Sum	99.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

* Target values. NA: Not Analyzed. NC: Not Calculated.

Table 2.6. XRF Analyzed Composition of Crucible-Melted Feed Samples (wt%).

Test #		3			4				5			
Sample I.D.	Target	12J-F-131A	12J-F-149A	Avg.	12K-F-83A	12K-F-104A	12K-F-125A	Avg.	12K-F-144A	12L-F-30A	12L-F-49A	12L-F-70A
Al ₂ O ₃	7.40	7.29	7.60	7.45	7.36	7.77	7.51	7.54	7.66	7.23	7.36	7.48
As ₂ O ₃	0.04	0.04	0.04	0.04	0.03	0.04	0.04	0.04	0.03	0.04	0.03	0.04
B ₂ O ₃ *	10.00	10.00	10.00	10.00	10.0	10.00	10.00	10.00	10.00	10.00	10.00	10.00
BaO	0.04	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
CaO	0.25	0.29	0.30	0.30	0.30	0.29	0.29	0.29	0.32	0.32	0.31	0.30
CdO	0.37	0.39	0.34	0.36	0.33	0.36	0.34	0.34	0.35	0.42	0.33	0.33
CeO ₂	0.08	0.07	0.05	0.07	0.07	0.06	0.06	0.06	0.07	0.08	0.09	0.08
Cl	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
Cr ₂ O ₃	0.04	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Cs ₂ O	0.08	0.08	0.07	0.07	0.05	0.08	0.08	0.07	0.06	0.07	0.06	0.05
CuO	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.03	0.03
F	0.04	NA	NA	NC	NA	NA	NA	NC	NA	NA	NA	NA
Fe ₂ O ₃	10.39	10.56	10.11	10.44	10.45	10.24	10.40	10.37	10.13	10.07	10.09	10.35
K ₂ O	0.17	0.24	0.27	0.26	0.22	0.25	0.24	0.24	0.26	0.27	0.27	0.27
La ₂ O ₃	0.32	0.12	0.11	0.13	0.13	0.13	0.15	0.14	0.11	0.13	0.13	0.13
Li ₂ O*	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
MgO	0.06	1.17	1.21	1.18	1.29	1.33	1.28	1.30	1.24	1.16	1.19	1.22
MnO	3.03	3.05	2.83	3.01	3.01	2.83	2.98	2.94	2.88	2.97	2.90	2.86
Na ₂ O	6.59	6.56	6.64	6.43	6.78	6.48	6.21	6.49	7.25	6.63	6.54	6.68
NiO	0.54	0.51	0.48	0.50	0.49	0.48	0.49	0.49	0.48	0.49	0.50	0.52
P ₂ O ₅	0.13	0.32	0.35	0.34	0.33	0.32	0.33	0.33	0.34	0.31	0.31	0.31
PbO	0.15	0.13	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.12
Sb ₂ O ₃	0.21	0.18	0.17	0.17	0.15	0.17	0.18	0.17	0.17	0.18	0.14	0.13
SeO ₂	0.15	0.03	0.02	0.02	0.03	0.02	0.02	0.02	0.01	0.03	0.03	0.02
SiO ₂	45.54	44.68	45.53	45.05	45.06	45.34	45.30	45.23	44.68	45.11	45.90	45.95
SO ₃	0.25	0.19	0.22	0.19	0.21	0.24	0.22	0.22	0.08	0.25	0.20	0.18
SrO	2.32	2.06	1.89	1.98	1.85	1.80	1.90	1.85	1.96	1.99	1.85	1.91
TeO ₂	0.14	0.10	0.09	0.08	0.09	0.10	0.10	0.10	0.05	0.12	0.08	0.07
TiO ₂	0.06	0.08	0.07	0.08	0.08	0.09	0.10	0.09	0.09	0.11	0.10	0.11
ZnO	2.00	1.88	1.78	1.87	1.81	1.76	1.81	1.79	1.83	1.87	1.86	1.93
ZrO ₂	3.56	3.92	3.68	3.81	3.73	3.67	3.82	3.74	3.80	3.97	3.59	2.93
Sum	99.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

* Target values. NA: Not Analyzed.

Table 2.6. XRF Analyzed Composition of Crucible-Melted Feed Samples (wt%).

Test #		5				6							
Sample I.D.	Target	12L-F-80A	12L-F-107A	12L-F-119A	Avg.	12L-F-147A	12L-F-148A	12L-F-155A	12M-F-6A	12M-F-9A	12M-F-11A	12M-F-19A	12M-F-21A
Al ₂ O ₃	7.40	8.04	7.14	7.12	7.43	7.47	7.43	7.14	7.65	7.52	7.68	7.60	7.67
As ₂ O ₃	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.04	0.04	0.04	0.04	0.04
B ₂ O ₃ *	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
BaO	0.04	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
CaO	0.25	0.33	0.27	0.32	0.31	0.70	0.71	0.68	0.70	0.68	0.69	0.69	0.67
CdO	0.37	0.37	0.33	0.31	0.35	0.34	0.39	0.38	0.35	0.35	0.34	0.36	0.34
CeO ₂	0.08	0.07	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.08	0.07	0.08	0.07
Cl	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Cr ₂ O ₃	0.04	0.05	0.04	0.04	0.04	0.05	0.04	0.04	0.05	0.04	0.05	0.04	0.04
Cs ₂ O	0.08	0.08	0.06	0.05	0.06	0.07	0.09	0.08	0.07	0.07	0.08	0.08	0.08
CuO	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.03	0.03	0.03	0.03	0.03
F	0.04	NA	NA	NA	NC	NA	NA	NA	NA	NA	NA	NA	NA
Fe ₂ O ₃	10.39	10.43	9.41	9.45	9.99	11.26	11.14	10.32	10.40	9.96	10.62	10.57	10.39
K ₂ O	0.17	0.29	0.26	0.26	0.27	0.25	0.24	0.23	0.26	0.26	0.26	0.25	0.26
La ₂ O ₃	0.32	0.14	0.12	0.11	0.12	0.11	0.12	0.11	0.11	0.11	0.11	0.12	0.11
Li ₂ O*	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
MgO	0.06	1.36	1.16	1.06	1.20	1.22	1.23	1.21	1.28	1.19	1.28	1.21	1.28
MnO	3.03	1.37	2.90	2.90	2.68	2.12	2.48	2.81	2.34	2.76	2.09	2.57	2.36
Na ₂ O	6.59	8.01	6.43	6.53	6.87	6.51	6.58	6.70	6.91	6.73	6.52	6.16	6.89
NiO	0.54	0.55	0.45	0.44	0.49	0.54	0.53	0.48	0.49	0.46	0.50	0.50	0.50
P ₂ O ₅	0.13	0.35	0.30	0.29	0.32	0.32	0.31	0.32	0.32	0.33	0.32	0.31	0.32
PbO	0.15	0.07	0.12	0.12	0.11	0.12	0.13	0.12	0.12	0.12	0.11	0.13	0.11
Sb ₂ O ₃	0.21	0.11	0.13	0.13	0.14	0.16	0.18	0.19	0.16	0.16	0.15	0.17	0.16
SeO ₂	0.15	0.02	0.03	0.03	0.02	0.05	0.04	0.05	0.03	0.03	0.04	0.05	0.04
SiO ₂	45.54	44.07	47.47	47.55	45.82	44.15	43.40	44.33	44.67	44.99	45.04	44.29	44.75
SO ₃	0.25	0.14	0.22	0.21	0.18	0.17	0.17	0.19	0.16	0.17	0.16	0.18	0.18
SrO	2.32	2.08	1.71	1.65	1.88	1.95	2.04	1.97	1.85	1.91	1.82	2.01	1.82
TeO ₂	0.14	0.07	0.07	0.08	0.08	0.09	0.11	0.12	0.09	0.09	0.09	0.11	0.10
TiO ₂	0.06	0.10	0.10	0.12	0.10	0.21	0.22	0.21	0.21	0.20	0.20	0.23	0.19
ZnO	2.00	1.99	1.73	1.75	1.85	2.08	2.11	2.08	1.95	1.95	1.96	2.08	1.94
ZrO ₂	3.56	3.88	3.43	3.36	3.57	3.94	4.21	4.14	3.73	3.81	3.80	4.19	3.71
Sum	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

* Target values. NA: Not Analyzed. NC: Not Calculated.

Table 2.6. XRF Analyzed Composition of Crucible-Melted Feed Samples (wt%).

Test #		6											
Sample I.D.	Target	12M-F-22A	12M-F-24A	12M-F-30A	12M-F-32A	12M-F-33A	12M-F-39A	12M-F-40A	12M-F-43A	12M-F-49A	12M-F-50A	12M-F-54A	12M-F-71A
Al ₂ O ₃	7.40	7.36	7.61	7.30	7.68	7.81	7.58	7.79	7.77	7.72	7.74	7.67	7.85
As ₂ O ₃	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
B ₂ O ₃ *	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
BaO	0.04	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
CaO	0.25	0.69	0.69	0.68	0.70	0.69	0.68	0.66	0.67	0.69	0.68	0.67	0.64
CdO	0.37	0.34	0.28	0.31	0.29	0.28	0.29	0.32	0.33	0.31	0.33	0.35	0.32
CeO ₂	0.08	0.08	0.07	0.08	0.07	0.07	0.07	0.08	0.08	0.08	0.06	0.07	0.08
Cl	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00
Cr ₂ O ₃	0.04	0.05	0.05	0.04	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Cs ₂ O	0.08	0.07	0.06	0.06	0.06	0.06	0.06	0.07	0.08	0.07	0.08	0.08	0.06
CuO	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
F	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fe ₂ O ₃	10.39	10.71	10.66	10.59	11.40	11.07	10.19	10.16	10.30	9.96	10.42	10.07	10.31
K ₂ O	0.17	0.24	0.24	0.24	0.25	0.25	0.27	0.26	0.26	0.26	0.26	0.26	0.26
La ₂ O ₃	0.32	0.11	0.12	0.12	0.13	0.11	0.12	0.10	0.11	0.11	0.10	0.11	0.12
Li ₂ O*	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
MgO	0.06	1.24	1.33	1.30	1.31	1.34	1.28	1.34	1.28	1.29	1.27	1.27	0.77
MnO	3.03	2.52	2.50	2.53	1.84	1.63	1.84	2.03	2.35	2.28	1.28	1.94	2.83
Na ₂ O	6.59	6.76	6.81	6.67	6.83	7.00	7.04	7.06	6.58	6.57	6.61	6.71	6.50
NiO	0.54	0.50	0.50	0.50	0.54	0.53	0.47	0.45	0.48	0.46	0.48	0.47	0.47
P ₂ O ₅	0.13	0.32	0.32	0.33	0.32	0.33	0.32	0.34	0.33	0.33	0.33	0.32	0.25
PbO	0.15	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.12
Sb ₂ O ₃	0.21	0.16	0.12	0.15	0.12	0.12	0.11	0.15	0.15	0.16	0.13	0.16	0.17
SeO ₂	0.15	0.03	0.05	0.04	0.04	0.04	0.04	0.05	0.04	0.02	0.05	0.04	0.04
SiO ₂	45.54	44.21	44.25	44.43	43.91	45.11	45.32	45.20	45.04	45.81	45.85	45.50	44.60
SO ₃	0.25	0.15	0.16	0.14	0.13	0.14	0.16	0.18	0.14	0.09	0.20	0.19	0.14
SrO	2.32	1.95	1.89	1.96	1.94	1.91	1.84	1.79	1.86	1.81	1.85	1.90	1.96
TeO ₂	0.14	0.10	0.08	0.09	0.08	0.07	0.09	0.10	0.09	0.06	0.10	0.10	0.10
TiO ₂	0.06	0.21	0.21	0.21	0.21	0.21	0.20	0.19	0.20	0.20	0.20	0.20	0.22
ZnO	2.00	2.02	2.04	2.06	2.06	2.06	1.99	1.88	1.92	1.89	1.97	1.94	2.06
ZrO ₂	3.56	4.03	3.81	4.02	3.90	2.98	3.87	3.62	3.76	3.67	3.85	3.81	4.07
Sum	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

* Target values. NA: Not Analyzed. NC: Not Calculated.

Table 2.6. XRF Analyzed Composition of Crucible-Melted Feed Samples (wt%).

Test #	6				7						
Sample I.D.	Target	12M-F-87A	12M-F-100A	Avg.	12M-F-143A	12N-F-6A	12N-F-38A	12N-F-64A	12N-F-99A	12N-F-127A	Avg.
Al ₂ O ₃	7.40	7.83	7.76	7.62	8.49	8.41	8.54	7.70	8.04	8.50	8.28
As ₂ O ₃	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.04	0.04	0.04	0.04
B ₂ O ₃ *	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
BaO	0.04	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
CaO	0.25	0.65	0.65	0.68	0.60	0.62	0.59	0.57	0.59	0.66	0.60
CdO	0.37	0.36	0.38	0.33	0.30	0.33	0.30	0.38	0.40	0.39	0.35
CeO ₂	0.08	0.08	0.09	0.08	0.08	0.08	0.07	0.09	0.07	0.08	0.08
Cl	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Cr ₂ O ₃	0.04	0.05	0.05	0.04	0.04	0.04	0.04	0.05	0.05	0.04	0.04
Cs ₂ O	0.08	0.08	0.08	0.07	0.07	0.08	0.07	0.06	0.08	0.07	0.07
CuO	0.03	0.03	0.04	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03
F ⁻	0.04	NA	NA	NC	NA	NA	NA	NA	NA	NA	NC
Fe ₂ O ₃	10.39	10.59	10.99	10.55	10.10	10.90	10.62	10.62	10.54	10.73	10.59
K ₂ O	0.17	0.25	0.26	0.25	0.28	0.28	0.27	0.24	0.24	0.28	0.26
La ₂ O ₃	0.32	0.12	0.13	0.11	0.13	0.13	0.13	0.13	0.12	0.12	0.13
Li ₂ O*	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
MgO	0.06	0.78	0.70	1.20	0.37	0.41	0.47	1.09	1.00	0.24	0.60
MnO	3.03	2.78	2.44	2.28	2.78	2.71	2.56	3.02	2.59	2.11	2.63
Na ₂ O	6.59	6.63	5.99	6.67	6.38	6.10	6.84	6.57	6.81	6.54	6.54
NiO	0.54	0.51	0.54	0.49	0.48	0.52	0.51	0.52	0.51	0.51	0.51
P ₂ O ₅	0.13	0.26	0.25	0.31	0.21	0.19	0.21	0.31	0.28	0.18	0.23
PbO	0.15	0.13	0.13	0.12	0.12	0.13	0.13	0.13	0.13	0.12	0.13
Sb ₂ O ₃	0.21	0.19	0.19	0.15	0.16	0.18	0.15	0.16	0.16	0.15	0.16
SeO ₂	0.15	0.03	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.05	0.04
SiO ₂	45.54	44.05	44.25	44.69	45.34	43.98	44.08	43.67	43.78	44.43	44.22
SO ₃	0.25	0.12	0.17	0.16	0.19	0.16	0.16	0.18	0.13	0.17	0.16
SrO	2.32	2.03	2.12	1.91	1.84	2.05	1.95	2.07	2.09	2.11	2.02
TeO ₂	0.14	0.08	0.11	0.09	0.10	0.09	0.09	0.10	0.09	0.09	0.09
TiO ₂	0.06	0.23	0.23	0.21	0.24	0.25	0.23	0.20	0.19	0.23	0.22
ZnO	2.00	2.06	2.15	2.01	1.94	2.10	2.01	2.02	1.98	2.12	2.03
ZrO ₂	3.56	4.09	4.27	3.88	3.68	4.18	3.90	4.07	4.08	4.04	4.00
Sum	99.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

* Target values.

NA: Not Analyzed.

NC: Not Calculated.

Table 2.6. XRF Analyzed Composition of Crucible-Melted Feed Samples (wt%) (Continued).

Test #		8					9						All
Sample I.D.	Target	12O-F-16A	12O-F-31A	12O-F-49A	12O-F-68A	Avg.	12O-F-106A	12O-F-125A	12O-F-144A	12P-F-13A	12P-F-41A	Avg.	Tests Avg.
Al ₂ O ₃	7.40	7.31	7.82	7.83	7.11	7.52	7.20	7.65	7.29	7.25	7.57	7.20	7.58
As ₂ O ₃	0.04	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
B ₂ O ₃ *	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
BaO	0.04	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
CaO	0.25	0.30	0.31	0.31	0.30	0.30	0.29	0.29	0.29	0.28	0.29	0.29	0.44
CdO	0.37	0.42	0.39	0.36	0.47	0.41	0.45	0.44	0.33	0.30	0.31	0.45	0.35
CeO ₂	0.08	0.08	0.08	0.07	0.09	0.08	0.07	0.06	0.06	0.06	0.06	0.07	0.07
Cl	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.02	0.02	0.01	0.00
Cr ₂ O ₃	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.04	0.04	0.04	0.04
Cs ₂ O	0.08	0.07	0.06	0.06	0.08	0.07	0.08	0.07	0.06	0.06	0.07	0.08	0.07
CuO	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
F	0.04	NA	NA	NA	NA	NC	NA	NA	NA	NA	NA	NC	NC
Fe ₂ O ₃	10.39	9.66	9.67	9.90	10.13	9.84	10.43	9.93	10.44	10.19	10.18	10.43	10.35
K ₂ O	0.17	0.25	0.27	0.27	0.25	0.26	0.24	0.25	0.25	0.24	0.24	0.24	0.25
La ₂ O ₃	0.32	0.12	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.13	0.13	0.12	0.12
Li ₂ O*	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
MgO	0.06	1.16	1.21	1.35	1.21	1.23	1.22	1.21	1.20	1.27	1.24	1.22	1.15
MnO	3.03	2.85	2.51	1.65	3.38	2.59	3.27	3.19	3.38	3.18	2.98	3.27	2.71
Na ₂ O	6.59	6.42	6.68	7.35	6.29	6.68	6.58	6.69	6.52	7.16	6.69	6.58	6.67
NiO	0.54	0.47	0.48	0.49	0.48	0.48	0.49	0.46	0.50	0.46	0.48	0.49	0.49
P ₂ O ₅	0.13	0.30	0.33	0.33	0.31	0.32	0.32	0.31	0.32	0.31	0.33	0.32	0.32
PbO	0.15	0.11	0.10	0.08	0.13	0.10	0.13	0.12	0.13	0.13	0.12	0.13	0.12
Sb ₂ O ₃	0.21	0.18	0.15	0.11	0.21	0.16	0.19	0.18	0.16	0.15	0.16	0.19	0.16
SeO ₂	0.15	0.04	0.03	0.03	0.04	0.03	0.06	0.04	0.05	0.03	0.04	0.06	0.03
SiO ₂	45.54	46.29	45.95	45.81	45.09	45.78	44.37	45.10	44.61	44.76	45.03	44.37	44.98
SO ₃	0.25	0.20	0.18	0.16	0.18	0.18	0.23	0.19	0.23	0.22	0.23	0.23	0.18
SrO	2.32	1.85	1.85	1.92	1.95	1.89	2.05	1.89	2.00	1.94	1.94	2.05	1.94
TeO ₂	0.14	0.11	0.08	0.07	0.11	0.09	0.13	0.10	0.09	0.07	0.09	0.13	0.09
TiO ₂	0.06	0.12	0.12	0.11	0.11	0.11	0.09	0.09	0.09	0.08	0.10	0.09	0.14
ZnO	2.00	1.79	1.81	1.83	1.87	1.82	1.85	1.76	1.87	1.82	1.78	1.85	1.90
ZrO ₂	3.56	3.84	3.73	3.71	4.01	3.83	4.06	3.77	3.90	3.81	3.84	4.06	3.80
Sum	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

* Target values.

NA: Not Analyzed.

NC: Not Calculated.

Table 2.7. DCP Analyzed Compositions of Crucible-Melted Feed Samples (wt%).

Test#	Target	1						2		
Oxide		12F-F-146A1	12F-F-146A2	12G-F-6A	12G-F-33A	12G-F-53A	12G-F-71A	12G-F-130A	12G-F-149A	12I-F-22A
Al ₂ O ₃	7.40	7.71	7.41	7.54	7.62	7.71	7.71	7.56	7.12	7.22
As ₂ O ₃	0.04	NA	NA	NA	NA	NA	NA	NA	0.00	0.00
B ₂ O ₃	10.00	10.91	10.72	10.65	10.36	10.87	10.32	10.55	10.11	10.42
BaO	0.04	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05
CaO	0.25	0.31	0.31	0.27	0.27	0.27	0.29	0.27	0.29	0.29
CdO	0.37	NA	NA	NA	NA	NA	NA	NA	0.28	0.28
CeO ₂	0.08	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cl	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cr ₂ O ₃	0.04	0.05	0.04	0.04	0.04	0.04	0.05	0.05	0.04	0.04
Cs ₂ O*	0.08	0.09	0.05A	0.08	0.08	0.09	0.08	0.08	0.08	0.08
CuO	0.03	NA	NA	NA	NA	NA	NA	NA	0.02	0.03
F	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fe ₂ O ₃	10.39	9.57	9.79	9.43	9.51	9.48	9.62	9.59	9.15	9.30
K ₂ O	0.17	0.21	0.20	0.19	0.18	0.17	0.19	0.17	0.23	0.25
La ₂ O ₃	0.32	NA	NA	NA	NA	NA	NA	NA	NA	NA
Li ₂ O	6.00	5.26	5.04	5.15	5.15	5.18	4.92	5.38	4.94	4.74
MgO	0.06	1.34	1.28	1.20	1.21	1.21	1.30	1.23	1.28	1.31
MnO	3.03	2.84	2.77	2.79	2.79	2.82	2.83	2.66	2.45	2.41
Na ₂ O	6.59	6.66	6.42	6.46	6.41	6.55	6.49	6.53	6.10	6.68
NiO	0.54	0.50	0.52	0.44	0.46	0.46	0.48	0.45	0.45	0.47
P ₂ O ₅	0.13	0.22	0.26	0.10	0.26	0.23	0.29	0.45	0.37	0.32
PbO	0.15	NA	NA	NA	NA	NA	NA	NA	0.18	0.18
Sb ₂ O ₃	0.21	NA	NA	NA	NA	NA	NA	NA	0.15	0.19
SeO ₂	0.15	NA	NA	NA	NA	NA	NA	NA	0.01	0.03
SiO ₂	45.54	44.71	43.66	44.27	44.83	44.50	44.79	43.13	41.57	42.53
SO ₃	0.25	NA	NA	NA	NA	NA	NA	NA	0.09@	0.16@
SrO	2.32	2.01	1.95	1.94	1.95	1.96	1.99	1.97	1.85	1.87
TeO ₂	0.14	NA	NA	NA	NA	NA	NA	NA	0.02	0.07
TiO ₂	0.06	0.11	0.10	0.09	0.09	0.09	0.10	0.09	0.09	0.10
ZnO	2.00	NA	NA	NA	NA	NA	NA	NA	1.79	1.81
ZrO ₂	3.56	3.50	3.39	3.58	3.51	3.55	3.50	3.65	3.44	3.54
Sum	99.99	96.05	93.96	94.26	94.77	95.24	95.01	93.88	92.16	94.38

* Analyzed by AA.

NA: Not Analyzed.

@ - Analyzed by ion chromatography.

Table 2.7. DCP Analyzed Compositions of Crucible-Melted Feed Samples (wt%) (continued).

Test#		2	3	4		5		6			7
Oxide	Target	12I-F-66A	12J-F-81A	12K-F-54A	12K-F-125A	12L-F-30A	12L-F-80A	12L-F-147A	12M-F-9A	12M-F-54A	12N-F-6A1
Al ₂ O ₃	7.40	7.16	7.26	7.89	7.31	6.81	7.51	7.14	7.16	7.37	8.29
As ₂ O ₃	0.04	0.02	0.01	0.01	0.01	0.01	0.01	0.04	0.04	0.06	0.07
B ₂ O ₃	10.00	10.39	9.77	8.84	8.52	9.77	10.73	9.24	9.38	9.62	9.50
BaO	0.04	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.05	0.05	0.04
CaO	0.25	0.27	0.28	0.29	0.26	0.26	0.28	0.68	0.65	0.66	0.59
CdO	0.37	0.29	0.31	0.30	0.27	0.32	0.32	0.28	0.31	0.30	0.26
CeO ₂	0.08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cl	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cr ₂ O ₃	0.04	0.05	0.04	0.05	0.04	0.04	0.05	0.05	0.04	0.04	0.04
Cs ₂ O*	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.06
CuO	0.03	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
F	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fe ₂ O ₃	10.39	9.30	9.61	9.94	10.38	9.60	9.71	10.11	9.42	9.89	9.80
K ₂ O	0.17	0.19	0.19	0.18	0.19	0.20	0.22	0.19	0.19	0.19	0.22
La ₂ O ₃	0.32	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Li ₂ O	6.00	4.98	4.58	4.30	3.92	4.86	5.57	4.62	4.70	4.82	4.75
MgO	0.06	1.31	1.31	1.37	1.28	1.23	1.39	1.35	1.27	1.30	0.48
MnO	3.03	2.50	2.58	2.27	3.09	3.02	1.45	2.09	2.96	2.10	2.73
Na ₂ O	6.59	6.31	6.06	5.84	5.57	5.89	6.71	5.83	5.94	6.06	5.81
NiO	0.54	0.45	0.47	0.49	0.47	0.45	0.49	0.49	0.45	0.47	0.48
P ₂ O ₅	0.13	0.38	0.26	0.37	0.28	0.25	0.31	0.28	0.28	0.25	0.11
PbO	0.15	0.18	0.18	0.18	0.15	0.15	0.11	0.16	0.18	0.18	0.20
Sb ₂ O ₃	0.21	0.17	0.17	0.15	0.18	0.17	0.13	0.18	0.21	0.18	0.19
SeO ₂	0.15	0.00	0.00	0.03	-0.00	0.02	0.01	0.02	0.02	0.03	0.05
SiO ₂	45.54	42.68	43.69	42.94	45.43	45.70	42.28	43.03	43.28	44.56	43.47
SO ₃	0.25	0.16@	0.16@	0.18@	NA	NA	NA	NA	NA	NA	NA
SrO	2.32	1.91	1.94	1.94	1.87	1.71	1.92	1.78	1.87	1.92	1.86
TeO ₂	0.14	0.06	0.03	0.04	0.12	0.12	0.12	0.11	0.10	0.09	0.09
TiO ₂	0.06	0.10	0.10	0.12	0.13	0.13	0.12	0.23	0.23	0.23	0.27
ZnO	2.00	1.78	1.84	1.89	1.94	1.84	1.93	1.99	2.03	2.05	2.05
ZrO ₂	3.56	3.59	3.60	3.76	3.64	3.38	3.51	3.54	3.68	3.75	3.66
Sum	99.99	94.39	94.60	93.50	95.23	96.09	95.06	93.59	94.54	96.30	95.10

* Analyzed by AA.

NA: Not Analyzed.

@ - Analyzed by ion chromatography.

Table 2.7. DCP Analyzed Compositions of Crucible-Melted Feed Samples (wt%) (continued).

Test#	7		8	9		Total	
Oxide	12N-F-6A2	12N-F-99A	12O-F-16A	12O-F-125A1	12O-F-125A2	Target	Avg.
Al ₂ O ₃	7.91	7.79	7.17	6.57	6.52	7.40	7.39
As ₂ O ₃	0.07	0.02	0.06	0.10	0.23	0.04	0.04
B ₂ O ₃	9.26	9.49	10.01	9.67	9.58	10.00	9.95
BaO	0.04	0.05	0.05	0.05	0.05	0.04	0.05
CaO	0.55	0.55	0.27	0.26	0.24	0.25	0.36
CdO	0.25	0.31	0.32	0.37	0.35	0.37	0.30
CeO ₂	NA	NA	NA	NA	NA	0.08	NA
Cl	NA	NA	NA	NA	NA	0.01	NA
Cr ₂ O ₃	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Cs ₂ O*	0.03	0.06	0.06	0.05	0.03	0.08	0.07
CuO	0.03	0.02	0.03	0.03	0.03	0.03	0.03
F	NA	NA	NA	NA	NA	0.04	NA
Fe ₂ O ₃	9.70	9.49	8.63	9.34	8.94	10.39	9.55
K ₂ O	0.21	0.18	0.20	0.20	0.19	0.17	0.20
La ₂ O ₃	NA	NA	NA	NA	NA	0.32	NA
Li ₂ O	4.55	4.82	5.08	4.60	4.51	6.00	4.85
MgO	0.46	0.97	1.21	1.25	1.18	0.06	1.20
MnO	2.75	2.57	2.97	3.18	3.16	3.03	2.66
Na ₂ O	5.60	5.94	6.04	5.62	5.53	6.59	6.13
NiO	0.47	0.47	0.45	0.46	0.45	0.54	0.47
P ₂ O ₅	0.14	0.21	0.33	0.25	0.23	0.13	0.27
PbO	0.18	0.17	0.16	0.19	0.17	0.15	0.17
Sb ₂ O ₃	0.22	0.19	0.19	0.20	0.21	0.21	0.18
SeO ₂	0.05	0.06	0.06	-0.05	-0.11	0.15	0.01
SiO ₂	42.82	42.61	45.67	44.48	45.07	45.54	43.82
SO ₃	NA	NA	NA	NA	NA	0.25@	0.15@
SrO	1.90	1.88	1.72	1.72	1.95	2.32	1.89
TeO ₂	0.12	0.06	0.08	0.06	0.08	0.14	0.08
TiO ₂	0.26	0.21	0.14	0.11	0.11	0.06	0.14
ZnO	2.04	1.93	1.79	1.86	1.91	2.00	1.91
ZrO ₂	3.56	3.57	3.44	3.39	3.39	3.56	3.55
Sum	93.21	93.66	96.16	93.99	94.05	99.99	94.55

* Analyzed by AA.

NA: Not Analyzed

@ - Analyzed by ion chromatography.

Table 2.8. Average Compositions and % Deviation of Major Components From Target for Feed and Discharged Glass Samples.

Oxide	Target	XRF				DCP			
		Feed		Glass		Feed		Glass	
		Avg.	%Dev.	Avg.	%Dev.	Avg.	%Dev.	Avg.	%Dev.
Al ₂ O ₃	7.40	7.58	2.43	7.54	1.89	7.39	-0.14	7.49	1.22
As ₂ O ₃	0.04	0.04	NC	0.04	NC	0.04	NC	0.03	NC
B ₂ O ₃	10.00	NA	NC	NA	NC	9.95	-0.50	10.37	3.70
BaO	0.04	<0.05	NC	<0.05	NC	0.05	NC	0.05	NC
CaO	0.25	0.44	NC	0.38	NC	0.36	NC	0.33	NC
CdO	0.37	0.35	NC	0.39	NC	0.30	NC	0.33	NC
CeO ₂	0.08	0.07	NC	0.07	NC	NA	NC	NA	NC
Cl	0.01	<0.01	NC	<0.01	NC	NA	NC	NA	NC
Cr ₂ O ₃	0.04	0.04	NC	0.05	NC	0.04	NC	0.05	NC
Cs ₂ O	0.08	0.07	NC	0.07	NC	0.07 [#]	NC	0.08 [#]	NC
CuO	0.03	0.03	NC	0.03	NC	0.03	NC	0.03	NC
F	0.04	NA	NC	NA	NC	NA	NC	NA	NC
Fe ₂ O ₃	10.39	10.35	-0.38	10.19	-1.92	9.55 [#]	-8.08	9.51	-8.47
K ₂ O	0.17	0.25	NC	0.25	NC	0.20	NC	0.19	NC
La ₂ O ₃	0.32	0.12	NC	0.12	NC	NA	NC	NA	NC
Li ₂ O	6.00	NA	NA	NA	NC	4.85	-19.17	5.20	-13.33
MgO	0.06	1.15	1817	0.98	1533	1.20	1900	1.11	1750
MnO	3.03	2.71	-10.56	3.04	0.33	2.66	-12.21	2.79	-7.92
Na ₂ O	6.59	6.67	1.21	6.79	3.03	6.13	-6.98	6.37	-3.34
NiO	0.54	0.49	9.26	0.48	-11.11	0.47	-12.96	0.47	-12.96
P ₂ O ₅	0.13	0.32	NC	0.30	NC	0.27	NC	0.34	NC
PbO	0.15	0.12	NC	0.13	NC	0.17	NC	0.17	NC
Sb ₂ O ₃	0.21	0.16	NC	0.17	NC	0.18	NC	0.17	NC
SeO ₂	0.15	0.03	NC	0.04	NC	0.01	NC	0.03	NC
SiO ₂	45.54	44.98	-1.23	44.83	-1.56	43.82	-3.78	43.30	-4.92
SO ₃	0.25	0.18	NC	0.21	NC	0.15 [@]	NC	0.22 [@]	NC
SrO	2.32	1.94	-16.38	2.00	-13.79	1.89	-18.53	1.95	-15.95
TeO ₂	0.14	0.09	NC	0.11	NC	0.08	NC	0.12	NC
TiO ₂	0.06	0.14	NC	0.11	NC	0.14	NC	0.12	NC
ZnO	2.00	1.90	-5.00	1.88	-6.00	1.91	-4.50	1.86	-7.00
ZrO ₂	3.56	3.80	6.74	3.82	7.30	3.55	-0.28	3.61	1.40

NA: Not Analyzed

NC: Not Calculated

% Dev. = 100 X [(target-measured)/target].

#- Analyzed by AA.

@ - Analyzed by ion chromatography.

Table 2.9. DCP and AA Analyzed Li₂O Concentrations for Feed and Glass Samples.

Sample I.D.		Target	DCP	AA
12G-G-57A	Glass	6.00	5.12	5.04
12G-G-79A	Glass	6.00	5.22	5.17
12J-G-52B	Glass	6.00	5.50	5.38
12J-G-52B, duplicate	Glass	6.00	5.44	5.28
12J-G-62A	Glass	6.00	5.27	5.23
12J-G-100C	Glass	6.00	5.51	5.16
12J-G-125A	Glass	6.00	5.62	5.35
12K-G-136B	Glass	6.00	5.09	5.08
12K-G-138A	Glass	6.00	5.16	5.14
12K-G-138A, duplicate	Glass	6.00	4.93	4.89
12G-F-71A	Feed	6.00	4.92	4.71
12J-F-81A	Feed	6.00	4.58	4.72
12K-F-54A	Feed	6.00	4.30	4.32

Table 3.1. DM1200 AZ-101 Melter Temperatures and Other Operational Parameters, Tests 1-4.

Test #			1			2			3			4		
			Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.
TEMPERATURE °C	Glass	1" from floor E	1130	1073	1177	1105	1062	1137	1122	1012	1147	1136	1052	1164
		13" from floor E	1135	1071	1173	1146	1106	1163	1139	1100	1166	1146	1113	1179
		18" from floor E	1140	1088	1177	1154	1119	1172	1141	1096	1168	1147	1117	1176
		27" from floor E	994	731	1172	873	436	1130	990	290	1166	1048	578	1171
		9" from floor W	1150	1075	1185	1162	1073	1178	1156	1108	1189	1155	1111	1209
		18" from floor W	1147	1057	1178	1162	1103	1180	1153	1100	1191	1143	1094	1185
		24" from floor W	1141	979	1178	1125	1014	1161	1130	884	1189	1126	1016	1173
		30" from floor W	687	356	1038	617	262	975	542	154	1095	613	129	1052
	Plenum	8" below ceiling	448	316	1025	378	284	976	509	389	1016	463	366	936
		17" below ceiling	407	287	1005	361	275	960	475	212	1004	459	289	930
		Exposed	443	290	994	381	294	976	461	191	650	425	101	926
	Discharge	TC 1	963	534	1046	1010	667	1083	1054	903	1149	1049	927	1112
		TC 2	943	510	1023	989	769	1072	1083	1022	1158	1079	989	1122
		Air Flow	325	188	398	321	133	394	291	155	369	292	215	362
		Riser	969	895	1141	981	877	1131	1093	975	1152	1057	965	1152
	Electrode	East	1071	1033	1112	1039	1023	1066	1115	1027	1140	1065	1019	1110
		West	1047	1009	1092	1015	1003	1042	1093	1024	1139	1084	1040	1110
		Bottom	1063	1023	1083	1020	997	1071	1006	808	1042	1101	1043	1120
	Lance	1 bottom	NA	NA	NA	NA	NA	NA	1120	1051	1169	1093	1021	1143
		2 bottom	NA	NA	NA	NA	NA	NA	1102	1049	1192	1068	981	1132
	Film Cooler Outlet		260	172	600	267	58	616	393	227	685	340	278	668
	Melter Pressure		-6.78	-10.98	0.37	-5.98	-11.04	-0.18	-4.77	-8.83	2.54	-5.50	-10.99	0.95
	Differential (inches water)	Transition Line	0.67	-0.18	2.28	0.79	0.00	7.98	1.37	-0.42	7.31	1.00	0.15	4.26
		Film Cooler	0.88	0.18	2.25	0.99	-0.48	7.75	2.21	0.10	7.64	1.45	0.74	5.45
	Electrode	Current (A)	1516	0	2117	1353	0	1906	1496	0	1513	1899	1670	2216
		Voltage (V)	54	0	78	51	0	85	130	0	150	69	60	88
		Power (kW)	83	0	155	69	0	162	188	0	227	131	100	195

NA: Not Analyzed

Table 3.2. DM1200 AZ-101 Melter Temperatures and Other Operational Parameters, Tests 5-8.

			Test 5			Test 6			Test 7			Test 8		
			Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.
TEMPERATURE (°C)	Glass	1" from floor E	1096	1067	1118	1094	1038	1130	1158	1055	1204	1074	1027	1085
		13" from floor E	1142	1107	1171	1138	1078	1165	1146	1082	1180	1152	1111	1167
		18" from floor E	1148	1109	1181	1142	1095	1170	1141	1063	1183	1158	1092	1173
		27" from floor E	932	780	1160	768	535	1090	982	424	1161	509	439	604
		9" from floor W	1146	1107	1176	1157	1090	1177	1138	1088	1187	1144	1107	1159
		18" from floor W	1149	1119	1182	1158	1094	1179	1132	1078	1193	1147	1102	1163
		24" from floor W	1146	1042	1174	1114	962	1170	1052	849	1183	1135	997	1156
		30" from floor W	596	434	1000	513	207	820	452	187	794	490	341	703
	Plenum	8" below ceiling	417	320	664	336	246	642	480	347	731	349	296	566
		17" below ceiling	407	319	650	307	28	2672	438	325	736	327	282	558
		Exposed	411	118	647	225	75	354	458	277	752	339	272	565
	Discharge	TC 1	1027	963	1077	1064	825	3327	1078	1018	1101	1040	849	1073
		TC 2	1046	980	1083	1067	682	1103	1130	1049	1181	1081	832	1116
		Air Flow	295	250	340	306	188	361	303	161	348	307	216	351
		Riser	960	273	2694	988	935	1142	1111	938	1186	939	896	1122
	Electrode	East	1048	1022	1072	1042	1008	1072	1101	1031	1147	1046	1019	1056
		West	1058	1036	1087	1043	996	1075	1078	1006	1100	1028	1008	1045
		Bottom	1038	990	2771	1013	981	1058	1013	913	1043	1018	986	1032
	Lance	1 Bottom	NA	NA	NA	NA	NA	NA	1104	1009	1189	NA	NA	NA
		2 Bottom	NA	NA	NA	NA	NA	NA	1117	1064	1172	NA	NA	NA
	Film Cooler Outlet		284	210	470	232	172	425	348	42	510	239	182	441
	Melter Pressure (" water)		-6.17	-12.40	1.48	-5.43	-13.21	15.17	-4.63	-11.07	-0.19	-5.71	-12.80	0.10
	Differential Pressure	Transition Line	1.03	0.00	10.05	1.12	0.09	4.14	1.73	0.00	5.63	0.57	-0.06	2.93
		Film Cooler	1.29	0.41	10.05	1.36	0.42	4.34	2.16	-0.01	6.37	0.99	0.32	3.81
		Current (A)	1389	0	1645	1372	0	1568	1248	0	1333	1278	0	1530
		Voltage (V)	54	0	68	54	0	71	128	0	153	53	0	68
		Power (kW)	75	0	111	74	0	112	160	0	204	67	0	104

NA: Not Analyzed

Table 3.3. DM1200 AZ-101 Melter Temperatures and Other Operational Parameters, Test 9.

			Test 9A			Test 9B		
			Avg	Min	Max	Avg	Min	Max
TEMPERATURE (°C)	Glass	1" from floor E	1051	1022	1088	1110	1088	1122
		13" from floor E	1153	1132	1201	1204	1184	1218
		18" from floor E	1158	1139	1202	1208	1191	1231
		27" from floor E	471	391	782	497	429	596
		1" from floor W	1104	1083	1148	1160	1146	1171
		9" from floor W	1151	1126	1193	1199	1185	1213
		18" from floor W	1152	1133	1198	1199	1177	1224
		24" from floor W	1119	1072	1171	1195	1131	1226
		30" from floor W	473	402	778	496	399	563
	Plenum	8" below ceiling	375	302	745	324	275	372
		17" below ceiling	399	332	745	355	299	392
		Exposed	392	306	728	353	290	404
	Discharge	TC 1	1037	1001	1059	1042	1007	1068
		TC 2	1071	1048	1088	1087	1063	1104
		Air Flow	298	231	325	290	247	327
		Riser	951	898	1132	1084	1001	1170
	Electrode	East	1037	1019	1064	1082	1064	1098
		West	1017	994	1044	1064	1044	1080
		Bottom	1011	992	1048	1052	1033	1064
	Film Cooler Outlet		286	204	523	257	207	295
	Melter Pressure (" water)		-5.15	-13.64	0.10	-4.92	-12.45	0.05
	Differential Pressure (" water)	Transition Line	0.52	-0.54	1.73	0.61	-0.04	1.46
		Film Cooler	0.83	0.25	2.01	0.84	0.22	2.00
	Electrode	Current (A)	1336	0	1605	1580	1386	1645
		Voltage (V)	54	0	66	51	46	57
		Power (kW)	72	0	106	81	63	93

Table 4.1. DM 1200 AZ-101 Tests Off-Gas System Measured Parameters.

Test #		1			2			3			4		
		Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.
SBS	Differential Pressure ("water)	33.4	17.2	45.5	36.7	13.6	49.5	45.4	-6.5*	73.0	44.6	33.6	54.5
	Inlet gas pressure ("water)	-8.2	-17.0	-1.4	-7.9	-14.7	-1.5	-7.6	-13.0	1.2	-7.4	-19.6	0.0
	Outlet gas pressure ("water)	-48.0	-58.6	-38.8	-48.4	-59.9	-23.0	-58.2	-77.6	-8.3	-52.5	-65.3	-38.6
	Inlet gas Temp. (°C)	228.3	150.9	497.6	205.2	149.4	462.0	312.3	187.9	528.1	266.1	193.8	487.4
	Outlet gas Temp. (°C)	23.6	19.0	52.6	22.1	18.1	47.3	40.7	24.5	64.2	34.3	26.7	57.3
	Chilled Water Inlet Temp (°C)	12.5	7.5	18.2	12.6	8.1	24.1	15.9	11.0	30.8	14.7	10.3	26.1
	Chilled Water Outlet Temp (°C)	13.9	9.8	22.4	13.6	10.0	24.0	20.2	13.2	34.2	17.4	13.6	27.8
	Submerged 48" Temp (°C)	24.0	18.4	55.8	21.8	17.7	50.9	41.3	24.3	54.1	35.0	23.8	61.5
	Submerged 60" Temp (°C)	23.8	18.2	55.2	21.8	17.7	50.9	41.2	24.3	54.1	35.0	23.8	61.6
	Submerged 72" Temp (°C)	25.0	18.8	56.4	22.5	17.8	50.9	41.5	24.9	54.7	36.0	25.6	62.7
	Submerged 78" Temp (°C)	24.0	18.2	55.8	21.8	17.6	50.9	41.3	24.9	54.1	35.0	23.8	61.6
	Recirc. pump discharge Temp (°C)	34.5	29.4	37.7	33.5	30.6	35.5	35.0	26.6	41.1	26.7	19.9	38.9
	Heat Exchanger Outlet Temp (°C)	16.5	12.5	32.0	16.0	12.8	29.6	27.9	16.9	40.3	22.5	16.7	35.7
	Chilled Water Flow (gal/min)	41.8	28.8	43.0	45.5	2.8	48.1	42.6	29.4	45.7	41.8	6.0	45.6
	Heat Exchanger Flow (gal/min)	50.6	41.6	54.3	48.0	15.2	54.3	48.7	31.3	54.3	51.2	41.0	54.3
	Recirc. pump discharge Pressure	6.9	-0.9	51.7	36.9	-0.8	41.0	36.0	-0.5	38.6	39.0	29.4	42.0
WESP	Differential Pressure ("water)	1.5	0.7	3.0	1.7	0.8	3.5	2.1	-0.0	3.2	1.9	0.7	4.5
	Inlet gas Temp. (°C)	29.4	25.5	52.8	26.9	23.2	72.2	41.6	30.3	52.4	36.2	32.3	58.0
	Outlet gas Temp. (°C)	36.0	32.2	52.2	31.2	28.4	45.0	45.0	32.1	51.1	39.9	33.4	53.8
HEME 1	Differential Pressures ("water)	1.8	1.4	2.2	2.0	1.8	2.9	1.4	1.1	2.0	1.8	1.6	2.1
HEPA 1	Differential Pressure ("water)	0.2	-0.1	0.3	0.3	-0.1	0.4	0.3	0.1	0.4	0.2	-0.2	0.4
	Outlet Gas Temp. (°C)	122.0	113.8	123.8	117.8	106.1	123.6	124.6	79.0	129.0	119.9	100.3	121.9
Packed Bed Scrubber Inlet Gas Temp. (°C)		81.4	71.3	86.7	79.7	70.0	84.7	87.8	66.2	92.9	82.3	76.9	88.3
TCO Bypass Outlet Gas Temp. (°C)		79.7	69.5	83.5	75.9	53.8	80.6	80.2	46.3	84.3	79.0	66.3	82.7

* Sensor error.

Table 4.1. DM 1200 AZ-101 Tests Off-Gas System Measured Parameters (continued).

Test #		5			6			7		
		Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.
SBS	Differential Pressure ("water)	38.9	32.0	47.6	40.2	34.0	48.6	40.7	33.1	51.0
	Inlet gas pressure ("water)	-8.8	-16.0	-1.6	-8.4	-17.1	-0.5	-8.0	-16.4	-0.4
	Outlet gas pressure ("water)	-48.3	-56.8	-38.8	-49.3	-58.5	-37.6	-50.6	-58.8	-38.9
	Inlet gas Temp. (°C)	219	168	408	182	138	395	278	224	424
	Outlet gas Temp. (°C)	25.0	21.4	42.9	23.2	18.3	46.0	37.6	22.8	49.4
	Chilled Water Inlet Temp (°C)	13.5	9.0	18.8	12.8	7.8	17.6	14.7	10.6	19.3
	Chilled Water Outlet Temp (°C)	14.6	10.8	21.4	14.2	9.5	21.1	18.1	11.7	29.4
	Submerged 48" Temp (°C)	25.0	20.8	46.2	23.3	17.7	50.5	39.2	21.4	49.8
	Submerged 60" Temp (°C)	25.0	20.8	46.2	23.3	17.7	50.5	39.2	21.5	50.2
	Submerged 72" Temp (°C)	26.2	21.4	48.5	24.1	18.3	52.2	40.2	22.1	51.0
	Submerged 78" Temp (°C)	25.0	20.8	46.7	23.3	17.7	50.5	39.2	21.4	49.8
	Recirc. pump discharge Temp (°C)	*	*	*	28.8	26.3	31.3	28.5	1.8	38.1
	Heat Exchanger Outlet Temp (°C)	17.6	13.8	28.2	16.9	13.2	29.5	24.5	14.8	42.6
	Chilled Water Flow (gal/min)	38.7	13.7	42.4	39.4	23.9	42.3	40.0	3.0	43.3
	Heat Exchanger Flow (gal/min)	47.7	40.3	54.3	49.7	40.8	54.3	52.1	3.1	54.3
	Recirc. pump discharge Pressure	38.4	32.9	42.1	39.0	32.9	42.5	23.4	-1.5	47.6
WESP	Differential Pressure ("water)	2.4	1.2	4.5	2.5	1.0	6.3	2.3	0.7	10.1
	Inlet gas Temp. (°C)	27.3	23.5	45.6	25.3	21.3	46.9	37.5	25.2	47.2
	Outlet gas Temp. (°C)	31.1	28.8	43.9	29.7	26.8	44.0	40.5	27.3	47.2
HEME 1	Differential Pressure ("water)	2.3	2.0	2.9	2.3	2.0	2.9	1.8	1.4	2.3
	Differential Pressure ("water)	0.2	-0.2	0.4	0.2	0.1	0.4	0.2	0.1	0.4
HEPA 1	Outlet Gas Temp. (°C)	111	105	120	109	97	120	116	44	122
Packed Bed Scrubber Inlet Gas Temp. (°C)		77.6	74.3	84.6	77.8	74.3	83.6	80.9	41.4	87.4
TCO Bypass Outlet Gas Temp. (°C)		119	114	124	117	112	123	117	34	125

* Sensor error.

Table 4.1. DM 1200 AZ-101 Tests Off-Gas System Measured Parameters (continued).

Test #		8			9a			9b		
		Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.
SBS	Differential Pressure ("water)	33.1	18.6	43.8	38.7	31.5	46.3	38.3	6.7	45.0
	Inlet gas pressure ("water)	-6.7	-15.4	0.9	-6.3	-14.4	0.2	-5.9	-14.7	0.3
	Outlet gas pressure ("water)	-43.5	-54.7	-26.6	-45.2	-55.2	-37.6	-45.2	-54.2	-29.6
	Inlet gas Temp. (°C)	183	146	368	198	155	348	178	148	201
	Outlet gas Temp. (°C)	23.3	20.5	41.1	21.1	19.1	33.5	21.4	18.4	22.7
	Chilled Water Inlet Temp (°C)	12.4	9.6	17.9	12.2	9.0	15.4	12.3	9.9	15.0
	Chilled Water Outlet Temp (°C)	13.5	11.2	18.9	13.2	11.0	16.9	13.3	11.5	15.4
	Submerged 48" Temp (°C)	23.3	20.4	45.0	21.2	18.8	37.4	21.5	17.4	23.4
	Submerged 60" Temp (°C)	23.3	20.4	45.0	21.2	19.2	36.8	21.6	17.4	23.7
	Submerged 72" Temp (°C)	25.0	20.8	46.7	22.7	20.4	39.1	23.0	18.7	25.8
	Submerged 78" Temp (°C)	23.2	19.8	45.0	21.2	18.8	36.8	21.5	17.4	23.7
	Recirc. pump discharge Temp (°C)	40.0	24.7	44.9	26.4	21.3	30.1	26.3	24.5	29.1
	Heat Exchanger Outlet Temp (°C)	15.5	11.0	25.9	15.2	13.7	21.8	15.4	13.8	16.7
	Chilled Water Flow (gal/min)	40.8	26.8	43.5	41.4	28.9	44.1	41.5	6.4	43.7
	Heat Exchanger Flow (gal/min)	50.7	33.6	54.3	49.1	40.8	54.3	49.0	41.5	54.3
	Recirc. pump discharge Pressure	39.7	37.1	42.1	39.5	37.1	41.8	39.9	38.1	42.3
WESP	Differential Pressure ("water)	1.8	-0.2	3.4	2.6	0.9	10.1	1.5	1.0	3.6
	Inlet gas Temp. (°C)	25.3	22.1	41.4	24.6	22.2	35.6	23.6	21.5	25.1
	Outlet gas Temp. (°C)	32.2	28.9	38.9	29.9	25.4	33.0	29.7	27.8	31.0
HEME 1	Differential Pressure ("water)	2.0	1.8	2.4	1.8	0.2	2.0	1.8	1.7	1.9
	Differential Pressure ("water)	0.2	0.0	0.3	0.2	0.1	0.3	0.2	0.0	0.3
HEPA 1	Outlet Gas Temp. (°C)	117	109	120	118	108	118	118	114	119
Packed Bed Scrubber Inlet Gas Temp. (°C)		76.2	71.4	79.5	74.7	68.2	77.7	74.4	72.2	79.1
TCO Bypass Outlet Gas Temp. (°C)		120	103	128	121	97	125	122	119	125

Table 4.2. WESP Current and Voltage Data Before and After Wash-Down.

Test Number	WESP Wash-Down Date	WESP Current, mA (WESP voltage, kV)Before Wash-Down	WESP Current, mA (WESP voltage, kV) After Wash Down
Commissioning Test #3	5/23/01	16.36(24.53)	16.37(25.50)
3	8/13/01	15.96(27.48)	18.09(28.06)
4	8/30/01	16.75(27.86)	14.89(26.39)
5	10/02/01	13.14(28.32)	16.07(27.23)
6	10/17/01	17.67(27.32)	15.62(27.18)
7	10/27/01	16.77(27.65)	16.25(24.33)
8	11/02/01	16.96(27.77)	12.58(25.12)
9	11/14/01	16.50(26.60)	-----

Table 4.3. WESP Operating Conditions During DM 1200 AZ-101 Sampling Periods.

Test #	Time Span (Date – Time)	Average Inlet Gas Temp ¹ (°C)	Average Outlet Gas Temp ¹ (°C)	Average Diff. Pressure ¹ (In-W.C.)	Liquid Level ² (Inches)	Blow Down Sample Tank ² (Gal)	Voltage Range ² (kV)	Average Voltage ² (kV)	Current Range ² (mA)	Average Current ² (mA)	Recirculation Pump On-off/ Recycle Flow Rate ² (lpm)
2	7/29/01 -10:05 7/31/01 – 19:30	24.9	29.8	1.8	11.4	0	26.39-27.12	26.74	15.54-19.31	17.41	7.9
3	8/8/01 - 07:52 8/10/01 – 14:36	42.2	45.9	2.1	11.3	0	26.94-28.09	27.90	15.98-19.10	17.27	8.0
4	8/22/01 – 07:58 8/24/01 – 19:09	35.4	39.4	1.9	11.3	0	27.75-27.75	27.75	16.03-18.18	17.24	7.9
5	9/28/01 – 08:47 9/30/01 – 19:09	26.6	30.9	2.3	11.2	0	27.00-28.32	28.23	10.31-14.95	13.39	7.8
6	10/15/01 – 08:30 10/17/01 – 19:07	23.6	28.6	2.4	11.1	0	27.32-27.32	27.32	16.02-18.78	17.62	8.0
7	10/23/01 – 07:55 10/25/01 – 10:12	36.4	39.5	2.2	13.1	0	26.93-28.58	27.90	16.18-18.01	16.89	Off
8	10/30/01 – 08:13 11/1/01 - 17:35	24.6	31.6	1.8	12.4	0	27.79-28.28	28.11	15.27-18.50	16.73	Off
9	11/7/01 – 08:00 11/9/01 – 18:30	23.4	29.7	1.5	11.0	0	26.60-27.01	26.93	15.33-17.39	16.39	Off

Note:

¹These are the average of the computer recorded values (taken at every 2 minutes), between the given time intervals.

²These values are derived from manually recorded logbook data (every 2 hours), between the given time intervals.

7/29/01, 1610, Added 17 liters of water. Water level was raised to 12".

7/30/01, 0440, Added 22 liters of water. Water level was raised to 12".

7/30/01, 1523, Added 18 liters of water. Water level was raised to 12".

8/9/01, 2054, Added 22.7 liters of water. Water level was raised from 10.5" to 12".

8/22/01, 2224, Replaced the WESP recirculation filter.

8/23/01, 0544, Added 14.4 liters of water. Water level was raised from 11" to 12".

8/23/01, 2009, Added 16 liters of water. Water level was raised from 10.8" to 12".

8/24/01, 0609, Added water. Water level was raised from 11" to 12".

9/28/01, 1445, Added water. Water level was raised from 10.8" to 12".

9/29/01, 0545, Added 13.5 liters of water. Water level was raised from 10.5" to 12".

9/30/01, 0049, Added 13.5 liters of water. Water level was raised from 10.8" to 12".

9/30/01, 1416, Added 19.6 liters of water. Water level was raised from 10.4" to 12.2".

10/15/01, 1450, Added 18.6 liters of water. Water level was raised to 12".

10/16/01, 2026, Added water. Water level was raised from 10.5" to 12".

11/17/01, 1536, Added water. Water level was raised from 10.0" to 12".

10/23/01, 0855, Adjusted WESP voltage from 20 kV to 28 kV, output current rose from 3mA to 17 mA.

10/30/01, 0640, Restarted WESP recirculation pump. But at 0650, the current oscillated between 19 mA to 3 mA, and WESP pump was secured.

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Table 4.4. Characteristics of SBS Fluid Samples from DM1200 Tests.

Test	Sampling Date	Sample Name	TSS (mg/l)	TDS (mg/l)	Filtrate pH	Cumulative Glass (kg)	Blowdown Vol. (gal)	Cumulative Blowdown Vol. (gal)
#1	06/25/01	12F-S-84A	47	284	7.80	60	30.41	77.69
		12F-S-87A	69	354	7.30	140	31.64	109.33
		12F-S-87B	88	408	5.96	220	30.84	140.17
	06/26/01	12F-S-94A	92	300	4.08	300	26.38	166.55
		12F-S-98A	102	308	4.26	380	29.00	195.55
		12F-S-105A	45	296	4.10	440	23.28	218.83
		12F-S-107A	52	404	3.77	520	25.54	244.37
	6/27/01	12F-S-116A	30	364	3.74	600	35.99	280.36
		12F-S-119A	120	392	3.67	700	27.79	308.15
		12F-S-126A	65	452	3.58	800	33.38	341.53
	06/28/01	12F-S-136A	47	648	3.56	900	28.36	369.89
		12F-S-139A	50	630	3.61	978	31.74	401.63
		12F-S-141A	47	72	3.53	1080	30.16	431.79
		12F-S-148A	27	64	3.30	1180	30.83	462.62
	06/29/01	12G-S-14A	27	820	3.32	1280	32.15	494.77
		12G-S-20A	25	740	3.33	1380	33.50	528.27
	06/30/01	12G-S-25A	10	684	3.29	1483	30.99	559.26
		12G-S-32A	20	704	3.32	1570	26.26	585.52
		12G-S-40A	27	748	3.33	1650	29.08	614.60
		12G-S-45A	20	420	3.34	1730	23.95	638.55
	07/01/01	12G-S-53A	23	772	3.45	1820	28.68	667.23
		12G-S-56A	35	1048	3.72	1900	33.25	700.48
		12G-S-58A	43	838	3.82	1980	34.65	735.13
	07/02/01	12G-S-64A	72	804	3.74	2090	28.08	763.21
		12G-S-73A	572	756	3.64	2200	0.00	763.21
	07/03/01	12G-S-79A	252	680	3.85	2301	26.44	789.65
#2	07/23/01	12G-S-116A	28	204	8.40	2350	0.00	789.65
		12G-S-116B	62	304	8.48	2400	37.23	826.88
		12G-S-124A	66	324	8.36	2460	35.04	861.92
	07/24/01	12G-S-126A	38	284	8.42	2510	33.53	895.45
		12G-S-128A	38	424	8.48	2561	29.06	924.51
		12G-S-135A	44	464	8.46	2650	31.22	955.73
		12G-S-136A	96	506	8.46	2740	35.79	991.52
	07/25/01	12G-S-139A	104	496	8.56	2827	34.76	1026.28
		12G-S-148A	84	504	8.60	2930	33.93	1060.21
		12G-S-151A	130	400	8.60	3035	32.60	1092.81
		12H-S-11A	122	436	8.51	3120	29.23	1122.04
	07/26/01	12H-S-19A	130	420	8.57	3210	30.66	1152.70
		12H-S-24A	136	428	8.54	3298	28.26	1180.96
		12H-S-33A	122	380	8.55	3360	33.00	1213.96
	07/27/01	12H-S-34A	128	436	8.56	3420	29.23	1243.19
		12H-S-43A	130	468	8.52	3452	29.21	1272.40
		12I-S-13A	118	480	8.47	3540	34.85	1307.25
	07/28/01	12I-S-17A	106	472	8.50	3699	29.86	1337.11
		12I-S-26A	101	554	8.53	3840	33.37	1370.48

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Table 4.4. Characteristics of SBS Samples from DM1200 Tests (continued).

Test	Sampling Date	Sample Name	TSS (mg/l)	TDS (mg/l)	Filtrate pH	Cumulative Glass (kg)	Blowdown Vol. (gal)	Cumulative Blowdown Vol. (gal)
#2	07/29/01	12I-S-35A	80	260	8.50	3981	30.26	1400.74
		12I-S-43A	78	308	8.49	4122	33.71	1434.45
	07/30/01	12I-S-50A	90	196	8.50	4250	32.89	1467.34
		12I-S-58A	350	532	8.40	4379	33.18	1500.52
	07/31/01	12I-S-61A	230	600	8.51	4507	30.65	1531.17
		12I-S-66A	254	568	8.49	4635	31.23	1562.40
		12I-S-74A	268	688	8.46	4765	32.24	1594.64
#3	08/01/01	12I-S-88A	268	672	8.45	4895	41.52	1636.16
		12J-S-38A	ND	ND	ND	5004	48.00	1684.16
		12J-S-39A	208	292	7.08	5106	44.00	1728.16
		12J-S-40A	ND	ND	ND	5208	43.97	1772.13
	08/06/01	12J-S-42A	ND	ND	ND	5310	39.53	1811.66
		12J-S-43A	ND	ND	ND	5412	38.19	1849.85
		12J-S-44A	488	956	5.72	5514	38.04	1887.89
		12J-S-45A	ND	ND	ND	5597	40.20	1928.09
		12J-S-45B	ND	ND	ND	5690	46.77	1974.86
		12J-S-51A	ND	ND	ND	5763	39.19	2014.05
		12J-S-52A	ND	ND	ND	5845	40.35	2054.40
		12J-S-52B	ND	ND	ND	5928	39.54	2093.94
		12J-S-53A	788	2080	4.89	6011	43.98	2137.92
		12J-S-55A	ND	ND	ND	6131	44.07	2181.99
		12J-S-55B	ND	ND	ND	6250	45.61	2227.60
		12J-S-56A	ND	ND	ND	6370	39.19	2266.79
		12J-S-62A	ND	ND	ND	6489	51.52	2318.31
		12J-S-64A	ND	ND	ND	6573	43.50	2361.81
	08/07/01	12J-S-64B	1138	2692	5.73	6657	39.88	2401.69
		12J-S-65A	ND	ND	ND	6741	41.75	2443.44
		12J-S-68A	ND	ND	ND	6825	44.39	2487.83
		12J-S-68B	ND	ND	ND	6909	36.94	2524.77
		12J-S-69A	ND	ND	ND	6993	41.18	2565.95
		12J-S-70A	ND	ND	ND	7084	45.87	2611.82
		12J-S-75A	1398	2720	6.11	7175	39.62	2651.44
		12J-S-75B	ND	ND	ND	7265	37.19	2688.63
		12J-S-76A	ND	ND	ND	7356	48.06	2736.69
		12J-S-80A	ND	ND	ND	7447	45.40	2782.09
		12J-S-82A	ND	ND	ND	7535	55.55	2837.64
		12J-S-84A	ND	ND	ND	7623	42.97	2880.61
		12J-S-86A	ND	ND	ND	7711	48.61	2929.22
		12J-S-86B	1626	2904	6.41	7798	53.06	2982.28
	08/08/01	12J-S-91A	1696	2776	6.61	7886	50.12	3032.40
		12J-S-94A	ND	ND	ND	7974	43.86	3076.26
		12J-S-94B	ND	ND	ND	8098	50.94	3127.20
		12J-S-96A	ND	ND	ND	8221	45.75	3172.95

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Table 4.4. Characteristics of SBS Fluid Samples from DM1200 Tests (continued).

Test	Sampling Date	Sample Name	TSS (mg/l)	TDS (mg/l)	Filtrate pH	Cumulative Glass (kg)	Blowdown Vol. (gal)	Cumulative Blowdown Vol. (gal)
#3	08/09/01	12J-S-99A	ND	ND	ND	8345	57.04	3229.99
		12J-S-100A	ND	ND	ND	8468	51.08	3281.07
		12J-S-106A	1732	6692	6.62	8554	53.28	3334.35
		12J-S-107A	ND	ND	ND	8640	50.48	3384.83
		12J-S-108A	ND	ND	ND	8726	53.19	3438.02
		12J-S-109A	ND	ND	ND	8812	44.69	3482.71
		12J-S-111A	ND	ND	ND	8898	71.47	3554.18
	08/10/01	12J-S-113A	ND	ND	ND	8984	54.70	3608.88
		12J-S-113B	ND	ND	ND	9088	55.79	3664.67
		12J-S-115A	ND	ND	ND	9192	65.77	3730.44
		12J-S-120A	ND	ND	ND	9296	40.32	3770.76
		12J-S-124A	2038	2656	6.94	9400	61.00	3831.76
		12J-S-126A	ND	ND	ND	9504	59.46	3891.22
		12J-S-128A	ND	ND	ND	9645	44.36	3935.58
		12J-S-131A	ND	ND	ND	9717	50.00	3985.58
		12J-S-136A	ND	ND	ND	9787	55.00	4040.58
		12J-S-136B	772	2784	4.72	10135	55.00	4095.58
		12J-S-138A	ND	ND	ND	10241	55.00	4150.58
	08/11/01	12J-S-139A	ND	ND	ND	10347	55.00	4205.58
		12J-S-139B	3584	2720	5.47	10453	55.00	4260.58
		12J-S-141A	ND	ND	ND	10559	55.00	4315.58
		12J-S-142A	ND	ND	ND	10688	0.00	4315.58
		12J-S-142B	802	2476	4.90	10817	55.00	4370.58
		12J-S-149A	ND	ND	ND	10946	55.00	4425.58
		12J-S-147A	ND	ND	ND	10882	55.00	4480.58
		12J-S-149B	2182	2688	5.96	11075	55.00	4535.58
#4	08/20/01	12K-S-36A	186	312	6.69	11145	57.34	4592.92
		12K-S-38A	ND	ND	ND	11214	45.36	4638.28
		12K-S-39A	ND	ND	ND	11284	48.79	4687.07
		12K-S-40A	ND	ND	ND	11353	46.68	4733.75
		12K-S-43A	326	760	6.82	11423	40.75	4774.50
	08/21/01	12K-S-44A	ND	ND	ND	11481	39.56	4814.06
		12K-S-46A	ND	ND	ND	11539	54.01	4868.07
		12K-S-51A	ND	ND	ND	11597	38.73	4906.80
		12K-S-53A	440	1152	6.49	11656	44.24	4951.04
		12K-S-54A	ND	ND	ND	11714	38.02	4989.06
		12K-S-55A	ND	ND	ND	11772	39.37	5028.43
		12K-S-56A	514	1250	6.09	11830	36.38	5064.81
		12K-S-64A	ND	ND	ND	11888	38.42	5103.23
	08/22/01	12K-S-67A	ND	ND	ND	11992	49.97	5153.20
		12K-S-70A	ND	ND	ND	12096	47.78	5200.98
		12K-S-71A	494	1656	5.11	12201	36.44	5237.42
		12K-S-77A	ND	ND	ND	12305	44.83	5282.25
		12K-S-80A	ND	ND	ND	12409	38.75	5321.00
		12K-S-83A	ND	ND	ND	12485	47.75	5368.75
		12K-S-84A	472	2948	4.64	12560	45.36	5414.11

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Table 4.4. Characteristics of SBS Samples from DM1200 Tests (continued).

Test	Sampling Date	Sample Name	TSS (mg/l)	TDS (mg/l)	Filtrate pH	Cumulative Glass (kg)	Blowdown Vol. (gal)	Cumulative Blowdown Vol. (gal)
#4	08/23/01	12K-S-86A	ND	ND	ND	12636	44.32	5458.43
		12K-S-86B	ND	ND	ND	12711	40.56	5498.99
		12K-S-93A	ND	ND	ND	12787	37.14	5536.13
		12K-S-94A	448	1736	4.30	12862	41.28	5577.41
		12K-S-101A	ND	ND	ND	12938	41.85	5619.26
		12K-S-102A	ND	ND	ND	13043	49.43	5668.69
		12K-S-104A	ND	ND	ND	13147	35.55	5704.24
	08/24/01	12K-S-104B	462	1832	4.16	13252	38.63	5742.87
		12K-S-105A	ND	ND	ND	13356	51.30	5794.17
		12K-S-110A	ND	ND	ND	13461	45.53	5839.70
		12K-S-113A	ND	ND	ND	13555	39.25	5878.95
		12K-S-114A	470	1816	4.23	13649	41.98	5920.93
		12K-S-121A	ND	ND	ND	13744	43.39	5964.32
		12K-S-123A	ND	ND	ND	13838	39.45	6003.77
	08/25/01	12K-S-125A	ND	ND	ND	13932	46.68	6050.45
		12K-S-127A	463	1836	4.17	14035	43.18	6093.63
		12K-S-129A	ND	ND	ND	14139	46.40	6140.03
		12K-S-134A	ND	ND	ND	14242	42.43	6182.46
		12K-S-135A	ND	ND	ND	14346	42.45	6224.91
		12K-S-136A	448	1936	ND	14449	41.16	6266.07
		12K-S-138A	ND	ND	ND	14540	24.54	6290.61
	08/29/01	12K-S-144A	ND	ND	ND	14540	0.00	6290.61
#5	09/25/01	12L-S-16A	80	268	8.04	14643	49.45	6340.06
		12L-S-21A	110	528	2.78	14746	30.30	6370.36
	09/26/01	12L-S-28A	78	688	2.47	14849	32.21	6402.57
		12L-S-37A	44	972	2.2	14952	37.54	6440.11
	09/27/01	12L-S-41A	68	1256	1.9	15056	33.23	6473.34
		12L-S-50A	92	1872	1.69	15230	35.46	6508.80
		12L-S-58A	102	2172	1.47	15404	31.53	6540.33
	09/28/01	12L-S-62A	86	2512	1.37	15578	28.01	6568.34
		12L-S-78A	430	2628	1.13	15641	37.36	6605.70
	09/29/01	12L-S-80A	470	2840	1.12	15704	27.04	6632.74
		12L-S-88A	501	3256	1.09	15767	35.31	6668.05
	09/30/01	12L-S-95A	1004	3176	1.1	15829	29.42	6697.47
		12L-S-107A	956	3176	1.04	15892	30.63	6728.10
		12L-S-109A	1024	1400	1.05	16049	29.57	6757.67
#6	10/01/01	12L-S-116A	1076	3356	1.05	16199	26.85	6784.52
		12L-S-147A	50	284	4.27	16283	42.69	6827.21
		12L-S-150A	214	284	7.13	16367	36.58	6863.79
		12L-S-155A	256	348	6.89	16452	33.99	6897.78
	10/12/01	12M-S-7A	260	288	6.71	16536	36.43	6934.21
		12M-S-10A	230	368	6.47	16621	29.86	6964.07
		12M-S-21A	248	368	6.55	16706	39.74	7003.81
		12M-S-24A	5	888	2.2	16809	30.25	7034.06

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Table 4.4. Characteristics of SBS Samples from DM1200 Tests (continued).

Test	Sampling Date	Sample Name	TSS (mg/l)	TDS (mg/l)	Filtrate pH	Cumulative Glass (kg)	Blowdown Vol. (gal)	Cumulative Blowdown Vol. (gal)
#6	10/13/01	12M-S-29A	202	440	6.61	<i>16912</i>	31.55	7065.61
		12M-S-33A	192	252	6.72	<i>17015</i>	39.77	7105.38
		12M-S-40A	190	196	6.72	<i>17118</i>	33.56	7138.94
	10/14/01	12M-S-49A	204	214	6.54	<i>17222</i>	33.70	7172.64
		12M-S-55A	206	264	6.50	<i>17321</i>	29.39	7202.03
		12M-S-61A	202	274	6.33	<i>17421</i>	34.88	7236.91
	10/15/01	12M-S-63A	195	242	6.43	<i>17521</i>	28.77	7265.68
		12M-S-78A	560	172	4.24	<i>17620</i>	38.25	7303.93
		12M-S-82A	600	230	4.51	<i>17720</i>	29.31	7333.24
	10/16/01	12M-S-90A	492	262	4.51	<i>17820</i>	33.15	7366.39
#7	10/22/01	12M-S-97A	576	234	4.36	<i>17920</i>	30.75	7397.14
		12M-S-102A	536	211	4.24	18020	29.77	7426.91
	10/23/01	12M-S-142A	136	156	4.32	18100	35.97	7462.88
		12M-S-144A	126	224	3.44	<i>18233</i>	31.11	7493.99
		12M-S-146A	156	268	3.1	<i>18366</i>	38.81	7532.80
		12M-S-148A	158	770	2.84	<i>18499</i>	34.47	7567.27
		12M-S-150A	202	572	2.7	18632	38.20	7605.47
		12N-S-6A	224	604	2.56	<i>18760</i>	38.23	7643.70
		12N-S-11A	240	774	2.51	<i>18888</i>	39.64	7683.34
		12N-S-12A	306	832	2.35	<i>19016</i>	43.46	7726.80
		12N-S-16A	342	920	2.29	19145	34.27	7761.07
		12N-S-17A	370	992	2.29	<i>19272</i>	34.84	7795.91
		12N-S-19A	412	1044	2.25	<i>19399</i>	36.08	7831.99
		12N-S-20A	442	1348	2.26	<i>19526</i>	46.51	7878.50
	10/24/01	12N-S-21A	486	1300	2.26	19653	42.09	7920.59
		No Sampling	ND	ND	ND	<i>19713</i>	44.32	7964.91
		12N-S-36A	678	2136	2.30	<i>19774</i>	35.29	8000.20
		12N-S-38A	548	2048	2.30	<i>19896</i>	38.65	8038.85
		12N-S-39A	512	2136	2.31	20017	38.05	8076.90
		12N-S-46A	476	2116	2.26	<i>20121</i>	35.51	8112.41
		12N-S-48A	486	2360	2.28	<i>20225</i>	34.30	8146.71
		12N-S-50A	478	2104	2.31	<i>20329</i>	40.13	8186.84
	10/25/01	12N-S-51A	692	2128	2.30	<i>20433</i>	37.77	8224.61
		12N-S-52A	492	2188	2.34	20538	42.87	8267.48
		12N-S-53A	540	2168	2.36	<i>20663</i>	37.51	8304.99
		12N-S-54A	428	1792	2.27	<i>20788</i>	38.96	8343.95
		12N-S-62A	420	1808	2.28	<i>20913</i>	39.29	8383.24
		12N-S-63A	400	1872	2.29	21038	43.24	8426.48
		12N-S-66A	424	1728	2.31	<i>21157</i>	45.07	8471.55
		12N-S-68A	396	1704	2.32	<i>21276</i>	43.24	8514.79
		12N-S-70A	444	1556	2.38	<i>21395</i>	36.01	8550.80
		12N-S-72A	344	1780	2.39	21514	49.10	8599.90
	10/26/01	12N-S-73A	292	1692	2.34	<i>21617</i>	40.29	8640.19
		12N-S-79A	350	1750	2.41	<i>21720</i>	42.51	8682.70
		12N-S-81A	264	1992	2.41	<i>21823</i>	39.07	8721.77
		12N-S-85A	264	1632	2.38	<i>21926</i>	40.29	8762.06

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Table 4.4. Characteristics of SBS Fluid Samples from DM1200 Tests (continued).

Test	Sampling Date	Sample Name	TSS (mg/l)	TDS (mg/l)	Filtrate pH	Cumulative Glass (kg)	Blowdown Vol. (gal)	Cumulative Blowdown Vol. (gal)
#7	10/26/01	12N-S-86A	236	1868	2.40	22029	45.55	8807.61
		12N-S-87A	248	1928	2.05	22260	39.00	8846.61
		12N-S-88A	228	2004	2.04	22492	40.25	8886.86
		12N-S-94A	224	2136	2.00	22580	40.64	8927.50
		12N-S-99A	184	1828	2.04	22669	40.04	8967.54
		12N-S-99B	188	1680	2.05	22757	44.64	9012.18
		12N-S-101A	234	2280	2.01	22845	38.65	9050.83
		12N-S-102A	192	2048	2.27	22934	37.78	9088.61
		12N-S-104A	132	1916	2.26	23022	43.64	9132.25
		12N-S-106A	352	2240	2.28	23202	53.67	9185.92
		12N-S-114A	260	2208	2.24	23372	78.35	9264.27
		12N-S-117A	384	2048	2.25	23563	34.44	9298.71
		12N-S-118A	596	2028	2.22	23734	50.89	9349.60
		12N-S-126A	232	2124	2.20	23905	53.55	9403.15
#8	10/29/01	12N-S-126B	448	2120	2.22	24076	39.27	9442.42
		12N-S-152A	84	380	6.98	24144	31.27	9473.69
	10/30/01	12N-S-153A	32	556	6.63	24212	30.22	9503.91
		12O-S-13A	24	800	5.20	24280	28.73	9532.64
		12O-S-14A	16	988	4.83	24348	37.18	9569.82
		12O-S-22A	26	1412	4.95	24416	34.63	9604.45
	10/31/01	12O-S-31A	24	1624	4.94	24484	41.45	9645.90
		12O-S-38A	16	1868	4.99	24561	22.10	9668.00
		12O-S-40A	24	2064	4.95	24637	21.98	9689.98
		12O-S-43A	12	2504	5.07	24714	29.98	9719.96
	11/01/01	12O-S-43B	20	2732	5.02	24790	24.23	9744.19
		12O-S-51A	0	2940	4.83	24867	19.17	9763.36
		12O-S-58A	8	3040	4.87	24943	19.27	9782.63
		12O-S-60A	4	3148	4.90	25020	20.09	9802.72
#9	11/05/01	12O-S-97A	88	412	7.83	25123	33.33	9836.05
	11/06/01	12O-S-107A	70	316	8.06	25227	33.42	9869.47
		12O-S-115A	60	352	8.09	25331	27.46	9896.93
	11/07/01	12O-S-118A	66	496	8.00	25469	21.19	9918.12
		12O-S-125A	66	408	7.91	25607	34.83	9952.95
	11/08/01	12O-S-135A	60	450	7.86	25743	29.92	9982.87
		12O-S-145A	50	616	7.71	25879	33.82	10016.69
		12O-S-146A	56	764	7.55	25986	32.95	10049.64
	11/09/01	12O-S-154A	52	890	6.62	26094	28.72	10078.36
		12P-S-14A	50	844	4.80	26202	36.29	10114.65
		12P-S-21A	96	955	6.11	26333	29.98	10144.63
	11/10/01	12P-S-28A	40	898	4.10	26464	31.01	10175.64
		12P-S-34A	76	1172	3.74	26595	35.53	10211.17
		12P-S-41A	72	1144	3.48	26726	35.16	10246.33

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Table 4.5. Characteristics of WESP Fluid Samples from DM1200 Tests.

Test	Sample Date	Sample Name	TSS (mg/l)	TDS (mg/l)	Filtrate pH	Glass (kg)
#1	07/03/01	12F-W-41A	334	31836	2.31	0
		12F-W-63A	137	32430	2.27	0
		12F-W-63B	43	752	3.20	0
		12G-W-80A	40	116	6.13	60
#2	07/23/01	12G-W-116A	24	1248	3.22	2350
	07/24/01	12G-W-128A	8	1260	4.08	2561
		12G-W-139A	2	1288	7.61	2827
	07/25/01	12G-W-148A	146	1292	7.73	2930
		12H-W-11A	12	1566	7.80	3120
	07/26/01	12H-W-23A	0	1408	7.82	3298
		12H-W-33A	12	1364	8.03	3360
	07/27/01	12H-W-40A	2	1580	7.97	3514
		12H-W-43A	574	1556	7.89	3699
	07/28/01	12I-W-13A	2	1408	7.95	3746
		12I-W-22A	0	1420	7.89	3842
	07/29/01	12I-W-26A	8	1308	7.92	3890
		12I-W-33A	6	1456	8.01	3981
	07/30/01	12I-W-42A	12	1544	7.92	4122
		12I-W-51A	2	1696	7.92	4250
#3	08/08/01	12I-W-61A	2	1976	7.91	4507
		12I-W-68A	6	1904	7.89	4635
	08/10/01	12I-W-73A	8	2080	7.90	4635
		12J-W-12A	50	2088	7.82	4635
	08/13/01	12J-W-65A	0	2508	3.08	6657
		12J-W-86A	6	3800	3.00	7711
#4	08/21/01	12J-W-130A	333	428	7.07	9645
	08/22/01	12K-W-6A	26	9492	2.75	
		12K-W-6B	NA	NA	NA	
		12K-W-6C	92	2060	2.5	11100
	08/23/01	12K-W-55A	0	1328	N/A	11772
		12K-W-68A	0	1764	N/A	11992
	08/24/01	12K-W-83A	0	3072	N/A	12485
		12K-W-92A	0	2440	N/A	12787
	08/25/01	12K-W-104A	4	3836	N/A	13147
#4	08/26/01	12K-W-112A	0	3724	N/A	13555
		12K-W-126A	2	4876	N/A	14035
	08/27/01	12K-W-143A	4	6360	N/A	14539

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Table 4.5. Characteristics of WESP Fluid Samples from DM1200 Tests (continued).

Test	Sample Date	Sample Name	TSS (mg/l)	TDS (mg/l)	Filtrate pH	Glass (kg)
#5	09/25/01	12L-W-20A	0	592	2.00	14746
	09/26/01	12L-W-30A	0	1612	1.27	14849
	09/27/01	12L-W-41A	4	2232	1.08	15056
		12L-W-50A	20	2880	0.91	15230
	09/28/01	12L-W-70A	86	3664	0.71	15641
	09/29/01	12L-W-80A	54	3964	0.64	15704
	09/30/01	12L-W-95A	36	4056	0.57	15829
		12L-W-107A	140	4448	0.50	15892
	10/01/01	12L-W-124A	50	5860	0.42	16200
#6	10/12/01	12M-W-10A	6	752	2.15	16621
		12M-W-24A	5	888	2.2	16809
	10/13/01	12M-W-40A	0	824	2.45	17118
	10/14/01	12M-W-61A	0	1168	N/A	17421
	10/15/01	12M-W-72A	1396	6	2.65	17620
	10/16/01	12M-W-82A	1504	10	2.68	17720
		12M-W-91A	1708	10	2.69	17820
		12M-W-109A	12	2280	2.73	18019.5
		12M-W-117A	38	2092	2.86	18019.5
		12M-W-117B	88	536	3.82	18100
#7	10/27/01	12N-W-115A	0	7392	2.47	23372
		12N-W-132A	40	7072	2.47	24075.5
		12N-W-132B	80	1452	2.68	24100
#8		12O-W-75A	0	4704	1.41	25020
		12O-W-75B	100	1916	2.68	25020
#9		12P-W-47A	2	606	7.52	26725
		12P-W-47B	1074	1890	3.91	26725

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l).

Test	1														
I.D.	12F-S-84A			12F-S-87A			12F-S-87B			12F-S-98A			12F-S-105A		
Glass (kg).	60			140			220			380			440		
pH	7.80			7.30			5.96			4.26			4.10		
	Sus*	Dis.#	Total	Sus	Dis.	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	47	284	331	69	354	432	88	408	496	102	308	410	45	296	341
Al	2.37	0.43	2.80	3.76	0.35	4.11	3.85	2.67	6.52	3.70	6.12	9.82	1.39	6.34	7.73
As	0.03	0.22	0.25	0.02	0.20	0.22	0.02	0.21	0.23	0.16	0.31	0.47	0.03	0.26	0.29
B	0.21	16.28	16.49	0.23	26.50	26.73	0.37	36.98	37.35	0.12	49.26	49.38	0.04	52.38	52.42
Ba	0.03	0.19	0.22	0.04	0.19	0.23	0.02	0.24	0.26	0.01	0.28	0.29	0.01	0.29	0.30
Ca	0.23	32.96	33.19	0.27	29.49	29.76	0.34	28.02	28.36	0.06	25.61	25.67	0.03	25.41	25.44
Cd	0.15	0.03	0.18	0.24	0.09	0.33	0.19	0.47	0.66	0.13	0.95	1.08	0.07	1.00	1.07
Cr	0.05	0.12	0.17	0.10	0.14	0.24	0.13	0.12	0.25	0.14	0.10	0.24	0.08	0.12	0.20
Cs	NA	0.27	0.27	<0.1	0.40	0.40	NA	0.56	0.56	<0.1	0.78	0.78	<0.1	0.87	0.87
Cu	0.02	0.01	0.03	0.03	0.01	0.04	0.03	0.02	0.05	0.02	0.08	0.10	0.01	0.08	0.09
Fe	4.67	0.03	4.70	8.02	0.02	8.04	10.78	0.04	10.82	14.06	0.11	14.17	8.61	0.15	8.76
K	0.09	3.14	3.23	0.13	2.52	2.65	0.16	2.50	2.66	0.07	2.67	2.74	0.04	2.72	2.76
Li	0.10	1.45	1.55	0.17	2.09	2.26	0.23	2.93	3.16	0.11	4.77	4.88	0.05	4.96	5.01
Mg	0.10	7.11	7.21	0.13	6.75	6.88	0.19	6.71	6.90	0.27	6.73	7.00	0.16	6.90	7.06
Mn	0.55	<0.01	0.55	0.56	0.02	0.58	0.58	0.18	0.76	0.72	0.79	1.51	0.21	0.78	0.99
Na	0.42	21.82	22.24	0.52	15.10	15.62	0.96	18.61	19.57	0.23	24.31	24.54	0.12	25.28	25.4
Ni	0.29	0.11	0.40	0.50	0.17	0.67	0.55	0.21	0.76	0.65	0.43	1.08	0.36	0.37	0.73
P	0.30	<0.07	0.30	0.18	0.40	0.58	0.14	0.10	0.24	0.11	0.17	0.28	0.05	0.51	0.56
Pb	0.10	0.12	0.22	0.16	0.14	0.30	0.18	0.17	0.35	0.22	0.29	0.51	0.12	0.28	0.40
Sb	0.12	0.20	0.32	0.16	0.20	0.36	0.16	0.14	0.30	0.20	0.11	0.31	0.06	0.27	0.33
Se	0.62	17.29	17.91	1.11	26.80	27.91	1.33	40.34	41.67	1.78	66.03	67.81	0.90	65.41	66.31
Si	9.06	3.14	12.20	12.73	3.94	16.67	17.28	5.50	22.78	20.82	7.55	28.37	8.04	7.84	15.88
Sr	0.16	2.15	2.31	0.21	3.04	3.25	0.14	3.57	3.71	0.08	5.26	5.34	0.04	5.56	5.60
Te	0.98	0.25	1.23	1.64	0.34	1.98	1.92	0.59	2.51	2.08	0.91	2.99	1.21	1.06	2.27
Ti	0.04	0.01	0.05	0.05	0.01	0.06	0.11	0.01	0.12	0.08	0.01	0.09	0.04	0.01	0.05
Zn	0.59	0.08	0.67	0.97	0.41	1.38	0.82	2.41	3.23	0.36	4.33	4.69	0.20	4.77	4.97
Zr	1.09	0.01	1.10	1.11	0.02	1.13	1.50	0.01	1.51	2.11	0.07	2.18	0.53	0.14	0.67
Cl	NA	25.78	25.8	NA	24.3	24.3	NA	24.30	24.3	NA	24.77	24.8	NA	24.93	24.9
F	NA	6.02	6.02	NA	8.61	8.61	NA	11.04	11.04	NA	14.74	14.74	NA	15.18	15.18
I	<0.1	5.78	5.78	<0.1	17.48	17.48	<0.1	36.24	36.24	<0.1	60.79	60.79	<0.1	63.44	63.44
Nitrate	NA	1.58	1.58	NA	4.28	4.28	NA	4.52	4.52	NA	24.33	24.33	NA	33.68	33.68
Nitrite	NA	0.64	0.64	NA	8.55	8.55	NA	18.57	18.57	NA	11.90	11.90	NA	7.25	7.25
Sulfate	0.49	56.91	57.40	0.20	56.61	56.81	0.66	63.63	64.29	<0.1	74.47	74.47	<0.1	72.61	72.61

* Suspended

Dissolved

NA – Not Analyzed

NC – Not Calculated

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	1														
I.D.	12F-S-107A			12F-S-116A			12F-S-119A			12F-S-126A			12F-S-136A		
Glass (kg)	520			600			700			800			900		
pH	3.77			3.74			3.67			3.58			3.56		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	52	404	456	30	364	394	120	392	512	65	452	517	47	648	695
Al	1.29	7.09	8.38	0.57	7.40	7.97	3.80	12.02	15.82	1.54	10.65	12.19	0.88	11.49	12.37
As	0.04	0.41	0.45	0.06	0.38	0.44	0.03	0.36	0.39	0.04	0.34	0.38	0.05	0.35	0.40
B	0.05	58.73	58.78	0.03	62.07	62.10	0.09	72.49	72.58	0.07	80.73	80.80	0.05	85.00	85.05
Ba	0.01	0.28	0.29	<0.01	0.27	0.27	0.01	0.27	0.28	0.01	0.28	0.29	0.01	0.27	0.28
Ca	0.03	23.10	23.13	0.02	22.58	22.60	0.04	21.92	21.96	0.03	17.56	17.59	0.02	16.57	16.59
Cd	0.10	1.17	1.27	0.06	1.25	1.31	0.16	1.51	1.67	0.12	1.62	1.74	0.09	1.70	1.79
Cr	0.10	0.14	0.24	0.05	0.13	0.18	0.18	0.16	0.34	0.14	0.14	0.28	0.11	0.16	0.27
Cs	<0.1	0.97	0.97	<0.1	1.00	1.00	<0.1	1.20	1.20	<0.1	1.31	1.31	<0.1	1.37	1.37
Cu	0.01	0.10	0.11	0.01	0.09	0.10	0.02	0.09	0.11	0.01	0.11	0.12	0.01	0.11	0.12
Fe	10.70	0.34	11.04	6.16	0.41	6.57	21.42	0.40	21.82	15.41	0.62	16.03	11.54	0.71	12.25
K	0.07	2.95	3.02	0.03	2.61	2.64	0.08	2.58	2.66	0.08	3.06	3.14	0.06	2.34	2.40
Li	0.06	4.27	4.33	0.03	4.77	4.80	0.11	6.80	6.91	0.07	7.00	7.07	0.05	7.23	7.28
Mg	0.17	6.86	7.03	0.09	6.94	7.03	0.35	7.94	8.29	0.21	7.23	7.44	0.11	7.19	7.30
Mn	0.22	0.99	1.21	0.11	1.21	1.32	0.51	1.80	2.31	0.24	2.09	2.33	0.17	2.32	2.49
Na	0.12	28.02	28.14	0.06	29.39	29.45	0.16	33.95	34.11	0.09	35.36	35.45	0.07	37.03	37.10
Ni	0.41	0.37	0.78	0.21	0.35	0.56	0.85	0.44	1.29	0.53	0.48	1.01	0.38	0.49	0.87
P	0.10	0.40	0.50	0.21	0.68	0.89	0.33	0.66	0.99	0.13	0.26	0.39	0.06	<0.07	0.06
Pb	0.13	0.29	0.42	0.08	0.29	0.37	0.26	0.34	0.60	0.17	0.15	0.32	0.13	0.16	0.29
Sb	0.13	0.19	0.32	0.09	0.25	0.34	0.22	0.16	0.38	0.20	0.06	0.26	0.16	0.04	0.20
Se	1.00	80.73	81.73	0.55	78.64	79.19	2.15	104.8	107.0	1.17	115.8	117.0	0.90	122.6	123.5
Si	8.71	8.32	17.03	4.60	8.37	12.97	23.06	9.71	32.77	9.49	9.96	19.45	7.89	10.27	18.16
Sr	0.04	6.33	6.37	0.02	6.62	6.64	0.06	9.13	9.19	0.03	8.88	8.91	0.02	9.40	9.42
Te	1.32	1.47	2.79	0.78	1.55	2.33	2.34	1.55	3.89	1.49	1.50	2.99	1.15	1.65	2.80
Ti	0.05	0.01	0.06	0.03	0.01	0.04	0.09	<0.01	0.09	0.06	0.02	0.08	0.05	0.02	0.07
Zn	0.20	5.42	5.62	0.13	5.86	5.99	0.32	7.28	7.60	0.19	8.64	8.83	0.15	9.13	9.28
Zr	0.47	0.24	0.71	0.21	0.27	0.48	1.33	0.31	1.64	0.52	0.37	0.89	0.36	0.39	0.75
Cl	NA	26.22	26.22	NA	25.67	25.67	NA	26.90	26.90	NA	31.01	31.01	NA	34.64	34.64
F	NA	17.70	17.70	NA	18.71	18.71	NA	23.08	23.08	NA	27.18	27.18	NA	28.55	28.55
I	<0.1	78.60	78.60	<0.1	77.23	77.23	<0.1	80.44	80.44	<0.1	95.69	95.69	<0.1	80.05	80.05
Nitrate	NA	45.88	45.88	NA	45.01	45.01	NA	43.96	43.96	NA	54.21	54.21	NA	64.83	64.83
Nitrite	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1
Sulfate	0.61	76.33	76.94	1.29	83.11	84.40	<0.1	94.80	94.80	<0.1	109.7	109.7	<0.1	125.7	125.7

* Suspended

Dissolved

NA – Not Analyzed

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	#1														
I.D.	12F-S-139A			12F-S-141A			12F-S-148A			12G-S-14A			12G-S-20A		
Glass (kg)	978			1080			1180			1280			1380		
pH	3.61			3.53			3.30			3.32			3.33		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	50	630	680	47	72	119	27	64	91	27	820	847	25	740	765
Al	1.01	11.40	12.41	0.89	13.05	13.94	0.39	13.40	13.79	0.42	13.20	13.62	0.46	13.69	14.15
As	0.15	0.30	0.45	0.07	0.40	0.47	0.06	0.35	0.41	0.07	0.41	0.48	0.04	0.40	0.44
B	0.04	84.96	85.00	0.04	93.67	93.71	0.02	97.90	97.92	0.04	95.01	95.05	0.01	95.64	95.65
Ba	<0.01	0.28	0.28	<0.01	0.28	0.28	<0.01	0.27	0.27	<0.01	0.27	0.27	0.01	0.26	0.27
Ca	0.03	16.24	16.27	0.02	14.45	14.47	0.01	13.32	13.33	0.04	12.61	12.65	0.04	11.10	11.14
Cd	0.09	1.73	1.82	0.10	1.92	2.02	0.08	1.97	2.05	0.04	1.97	2.01	0.04	1.97	2.01
Cr	0.09	0.15	0.24	0.09	0.17	0.26	0.07	0.20	0.27	0.07	0.19	0.26	0.05	0.22	0.27
Cs	<0.1	1.50	1.50	<0.1	1.61	1.61	0.10	1.67	1.77	<0.1	1.59	1.59	<0.1	1.57	1.57
Cu	0.01	0.11	0.12	0.01	0.12	0.13	<0.01	0.12	0.12	<0.01	0.12	0.12	<0.01	0.13	0.13
Fe	11.08	0.58	11.66	12.26	0.81	13.07	7.86	1.28	9.14	7.02	1.08	8.10	7.05	1.12	8.17
K	0.04	2.45	2.49	0.04	2.41	2.45	0.04	2.40	2.44	0.04	2.36	2.40	0.01	2.31	2.32
Li	0.03	7.61	7.64	0.04	8.87	8.91	0.03	8.62	8.65	0.03	8.71	8.74	0.01	9.06	9.07
Mg	0.13	7.39	7.52	0.11	7.67	7.78	0.04	7.48	7.52	0.05	7.57	7.62	0.05	7.50	7.55
Mn	0.17	2.37	2.54	0.15	2.69	2.84	0.08	2.87	2.95	0.09	2.89	2.98	0.08	3.06	3.14
Na	0.15	37.59	37.74	0.21	42.26	42.47	0.07	40.86	40.93	0.10	40.33	40.43	0.05	40.97	41.02
Ni	0.35	0.52	0.87	0.38	0.55	0.93	0.22	0.54	0.76	0.23	0.51	0.74	0.20	0.58	0.78
P	0.15	0.34	0.49	0.14	0.33	0.47	0.27	0.59	0.86	0.06	0.40	0.46	0.04	0.58	0.62
Pb	0.13	0.17	0.30	0.13	0.19	0.32	0.09	0.22	0.31	0.07	0.20	0.27	0.08	0.20	0.28
Sb	0.05	0.05	0.10	0.09	0.13	0.22	0.09	0.13	0.22	0.07	0.15	0.22	0.04	0.13	0.17
Se	1.00	119.9	120.9	0.85	135.6	136.5	0.39	143.7	144.1	0.42	145.1	145.5	0.40	151.8	152.2
Si	8.11	10.55	18.66	7.29	11.54	18.83	4.40	11.42	15.82	4.31	11.67	15.98	3.17	11.86	15.03
Sr	0.02	9.42	9.44	0.02	10.86	10.88	0.01	10.59	10.60	0.02	10.25	10.27	0.01	10.65	10.66
Te	1.13	1.55	2.68	1.09	1.93	3.02	0.55	2.91	3.46	0.59	2.24	2.83	0.58	2.12	2.70
Ti	0.05	0.02	0.07	0.05	0.02	0.07	0.03	0.02	0.05	0.03	0.01	0.04	0.71	0.02	0.73
Zn	0.16	9.27	9.43	0.14	10.66	10.80	0.08	10.87	10.95	0.08	10.54	10.62	0.08	10.96	11.04
Zr	0.39	0.35	0.74	0.27	0.36	0.63	0.12	0.43	0.55	0.17	0.44	0.61	0.12	0.46	0.58
Cl	NA	30.48	30.48	NA	32.14	32.14	NA	35.51	35.51	NA	34.05	34.05	NA	29.32	29.32
F	NA	29.48	29.48	NA	34.35	34.35	NA	39.15	39.15	NA	34.72	34.72	NA	34.35	34.35
I	<0.1	80.83	80.83	<0.1	85.52	85.52	<0.1	75.36	75.36	<0.1	69.88	69.88	<0.1	59.99	59.99
Nitrate	NA	57.34	57.34	NA	66.66	66.66	NA	60.45	60.45	NA	56.71	56.71	NA	53.10	53.10
Nitrite	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1
Sulfate	<0.1	104.6	104.6	<0.10	127.2	127.2	<0.1	137.2	137.2	0.49	123.1	123.6	0.28	128.3	128.6

* Suspended

Dissolved

NA – Not Analyzed.

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	1														
I.D.	12G-S-25A			12G-S-32A			12G-S-40A			12G-S-45A			12G-S-53A		
Glass (kg)	1483			1570			1650			1730			1820		
pH	3.29			3.32			3.33			3.34			3.45		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	10	684	694	20	704	724	27	748	775	20	420	440	23	772	795
Al	0.19	13.43	13.62	0.38	13.58	13.96	0.52	13.43	13.95	0.40	14.17	14.57	0.44	15.21	15.65
As	0.04	0.37	0.41	0.02	0.39	0.41	0.14	0.40	0.54	0.03	0.35	0.38	0.05	0.36	0.41
B	0.03	94.12	94.15	0.02	<0.15	0.02	0.03	97.69	97.72	0.02	97.42	97.44	0.02	101.2	101.2
Ba	<0.01	0.24	0.24	<0.01	0.24	0.24	<0.01	0.24	0.24	<0.01	0.24	0.24	<0.01	0.24	0.24
Ca	0.01	10.13	10.14	0.01	10.03	10.04	0.02	<0.01	0.02	0.02	9.40	9.42	0.01	9.13	9.14
Cd	0.01	1.95	1.96	0.03	1.98	2.01	0.03	2.01	2.04	0.04	1.95	1.99	0.03	2.09	2.12
Cr	0.05	0.21	0.26	0.06	0.20	0.26	0.08	0.21	0.29	0.06	0.22	0.28	0.04	0.25	0.29
Cs	<0.1	1.64	1.64	<0.1	1.67	1.67	<0.1	1.67	1.67	<0.1	1.68	1.68	<0.1	1.69	1.69
Cu	<0.01	0.12	0.12	<0.1	0.12	0.12	0.01	0.13	0.14	<0.01	0.13	0.13	<0.01	0.14	0.14
Fe	3.03	1.14	4.17	5.50	1.06	6.56	7.66	1.07	8.73	5.35	1.12	6.47	6.20	0.94	7.14
K	0.07	2.19	2.26	0.02	2.17	2.19	0.10	2.11	2.21	0.06	2.00	2.06	0.03	2.15	2.18
Li	0.03	8.95	8.98	0.02	9.01	9.03	0.04	9.35	9.39	0.03	9.41	9.44	0.01	9.53	9.54
Mg	0.02	7.23	7.25	0.04	7.29	7.33	0.06	7.24	7.30	0.04	7.21	7.25	0.04	7.84	7.88
Mn	0.03	3.02	3.05	0.07	2.94	3.01	0.09	2.97	3.06	0.07	3.08	3.15	0.07	3.22	3.29
Na	0.04	39.63	39.67	0.03	<0.03	0.03	0.04	40.72	40.76	0.03	40.94	40.97	0.03	45.01	45.04
Ni	0.14	0.54	0.68	0.19	0.54	0.73	0.29	0.56	0.85	0.21	0.58	0.79	0.19	0.64	0.83
P	0.15	0.46	0.61	0.09	0.53	0.62	0.14	0.41	0.55	0.05	0.56	0.61	0.05	0.64	0.69
Pb	0.03	0.21	0.24	0.06	0.20	0.26	0.08	0.21	0.29	0.05	0.19	0.24	0.06	0.20	0.26
Sb	0.02	0.15	0.17	0.04	0.11	0.15	0.06	0.13	0.19	0.06	0.10	0.16	0.02	0.09	0.11
Se	0.13	157.5	157.6	0.33	154.5	154.8	0.41	159.4	159.8	0.29	160.0	160.3	0.45	171.8	172.3
Si	1.62	11.54	13.16	3.27	11.56	14.83	4.08	11.75	15.83	3.43	11.73	15.16	3.53	12.98	16.51
Sr	<0.01	10.28	10.28	0.01	10.46	10.47	0.01	10.35	10.36	0.01	11.00	11.01	0.01	12.12	12.13
Te	0.24	2.42	2.66	0.41	2.15	2.56	0.56	2.14	2.70	0.40	2.06	2.46	0.43	1.88	2.31
Ti	0.02	0.01	0.03	0.03	0.01	0.04	0.04	0.01	0.05	0.03	0.03	0.06	0.02	0.03	0.05
Zn	0.03	10.45	10.48	0.04	11.29	11.33	0.06	11.65	11.71	0.05	11.70	11.75	0.07	12.69	12.76
Zr	0.04	0.45	0.49	0.13	0.44	0.57	0.16	0.42	0.58	0.14	0.43	0.57	0.16	0.39	0.55
Cl	NA	28.30	28.30	NA	29.32	29.32	NA	33.16	33.16	NA	28.05	28.05	NA	28.05	28.05
F	NA	34.09	34.09	NA	33.33	33.33	NA	33.33	33.33	NA	33.33	33.33	NA	36.13	36.13
I	<0.1	48.74	48.74	<0.1	48.74	48.74	<0.1	49.51	49.51	<0.1	52.38	52.38	<0.1	56.06	56.06
Nitrate	NA	53.10	53.10	NA	57.28	57.28	NA	67.41	67.41	NA	57.87	57.87	NA	61.45	61.45
Nitrite	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1
Sulfate	<0.1	127.3	127.3	0.11	129.2	129.3	0.65	122.5	123.2	0.86	125.4	126.3	0.15	137.9	0.15

* Suspended

Dissolved

NA – Not Analyzed.

The Catholic University of America
Vitreous State Laboratory

DuraMelter 1200 Tests with AZ-101HLW Simulants
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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	1														
I.D.	12G-S-56A			12G-S-58A			12G-S-64A			12G-S-73A			12G-S-79A		
Glass (kg)	1900			1980			2090			2200			2301		
pH	3.72			3.82			3.74			3.64			3.85		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	35	1048	1083	43	838	881	72	804	876	572	756	1328	252	680	932
Al	1.13	15.66	16.79	0.99	15.45	16.44	1.90	16.26	18.16	15.29	19.95	35.24	6.81	19.89	26.70
As	0.08	0.36	0.44	0.12	0.43	0.55	0.22	0.44	0.66	0.66	0.41	1.07	0.14	0.43	0.57
B	0.05	105.8	105.9	0.04	107.9	107.9	0.05	109.3	109.4	0.56	111.4	112.0	0.22	109.6	109.8
Ba	0.01	0.25	0.26	<0.01	0.26	0.26	0.01	0.25	0.26	0.08	0.29	0.37	0.03	0.28	0.31
Ca	0.05	8.44	8.49	0.02	7.96	7.98	0.03	6.92	6.95	0.18	7.04	7.22	0.07	7.74	7.81
Cd	0.05	2.28	2.33	0.07	2.36	2.43	0.06	2.35	2.41	0.78	2.50	3.28	0.27	2.43	2.70
Cr	0.11	0.26	0.37	0.07	0.25	0.32	0.12	0.23	0.35	0.83	0.22	1.05	0.35	0.20	0.55
Cs	<0.1	1.82	1.82	<0.1	2.03	2.03	<0.1	2.06	2.06	<0.1	1.90	1.90	<0.1	1.90	1.90
Cu	<0.01	0.15	0.15	<0.1	0.16	0.16	0.01	0.16	0.17	0.08	0.17	0.25	0.04	0.17	0.21
Fe	13.99	0.58	14.57	12.03	0.48	12.51	18.46	0.58	19.04	99.36	0.49	99.85	39.87	0.22	40.09
K	0.07	2.28	2.35	0.03	2.56	2.59	0.06	2.44	2.50	0.34	3.24	3.58	0.14	3.10	3.24
Li	0.05	10.96	11.01	0.04	11.45	11.49	0.07	12.14	12.21	0.46	14.07	14.53	0.22	13.18	13.40
Mg	0.18	7.66	7.84	0.17	7.62	7.79	0.26	7.90	8.16	1.05	8.91	9.96	0.51	8.74	9.25
Mn	0.16	3.35	3.51	0.11	3.29	3.40	0.19	3.30	3.49	4.26	3.95	8.21	1.77	3.75	5.52
Na	0.09	50.84	50.93	0.06	54.45	54.51	0.20	53.98	54.18	0.75	56.96	57.71	0.39	55.30	55.69
Ni	0.45	0.70	1.15	0.37	0.66	1.03	0.61	0.67	1.28	4.00	0.75	4.75	1.68	0.75	2.43
P	0.20	0.90	1.10	0.35	0.84	1.19	0.10	0.93	1.03	1.18	0.99	2.17	0.36	1.04	1.40
Pb	0.12	0.23	0.35	0.08	0.24	0.32	0.14	0.24	0.38	1.20	0.24	1.44	0.51	0.24	0.75
Sb	0.08	0.12	0.20	0.19	0.10	0.29	0.09	0.14	0.23	1.33	0.12	1.45	0.47	0.16	0.63
Se	1.18	178.1	179.3	0.96	183.6	184.6	1.37	187.6	189.0	13.75	200.4	214.2	5.46	188.4	193.9
Si	8.22	13.99	22.21	6.43	14.71	21.14	11.33	14.92	26.25	120.2	16.02	136.2	52.75	15.80	68.55
Sr	0.02	13.65	13.67	0.02	14.25	14.27	0.03	15.26	15.29	0.32	18.17	18.49	0.15	17.35	17.50
Te	1.10	1.56	2.66	0.73	1.56	2.29	1.21	1.59	2.80	9.44	1.40	10.84	4.49	1.25	5.74
Ti	0.05	0.04	0.09	0.04	0.03	0.07	0.06	0.02	0.08	0.51	0.01	0.52	0.18	0.01	0.19
Zn	0.14	14.73	14.87	0.13	15.13	15.26	0.17	15.84	16.01	1.50	16.20	17.70	0.67	15.66	16.33
Zr	0.42	0.25	0.67	0.24	0.18	0.42	0.37	0.14	0.51	14.17	0.15	14.32	5.32	0.05	5.37
Cl	NA	32.14	32.14	NA	33.27	33.27	NA	32.52	32.52	NA	32.80	32.80	NA	32.30	32.30
F	NA	36.89	36.89	NA	34.93	34.93	NA	37.28	37.28	NA	37.96	37.96	NA	35.96	35.96
I	<0.1	69.16	69.16	<0.1	82.05	82.05	<0.1	89.58	89.58	<0.1	89.84	89.84	<0.1	84.63	84.63
Nitrate	NA	75.17	75.17	NA	81.25	81.25	NA	91.28	91.28	NA	75.37	75.37	NA	73.14	73.14
Nitrite	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1
Sulfate	<0.1	136.0	136.0	0.88	143.7	144.6	0.08	143.7	143.8	<0.1	160.0	160.0	<0.1	139.4	139.4

* Suspended

Dissolved

NA – Not Analyzed.

The Catholic University of America
Vitreous State Laboratory

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	2														
I.D.	12G-S-116A			12G-S-116B			12G-S-124A			12G-S-126A			12G-S-128A		
Glass (kg)	2350			2400			2460			2510			2561		
pH	8.40			8.48			8.36			8.42			8.48		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	28	204	232	62	304	366	66	324	390	38	284	322	38	424	462
Al	1.61	0.94	2.55	3.45	0.78	4.23	3.51	0.67	4.18	1.90	0.52	2.42	1.72	0.46	2.18
As	0.04	0.17	0.21	0.04	0.16	0.20	0.11	0.23	0.34	0.06	0.22	0.28	0.05	0.28	0.33
B	0.07	27.63	27.70	0.11	30.45	30.56	0.20	36.13	36.33	0.11	44.25	44.36	0.01	50.53	50.54
Ba	0.01	0.03	0.04	0.02	0.03	0.05	0.02	0.04	0.06	0.01	0.05	0.06	0.01	0.05	0.06
Ca	0.21	29.26	29.47	0.47	28.02	28.49	0.51	26.60	27.11	0.26	23.93	24.19	0.27	21.31	21.58
Cd	0.04	0.03	0.07	0.12	0.03	0.15	0.22	0.08	0.30	0.44	0.23	0.67	1.10	0.24	1.34
Cr	0.04	0.05	0.09	0.09	0.07	0.16	0.09	0.08	0.17	0.04	0.10	0.14	0.06	0.09	0.15
Cs	<0.1	0.40	0.40	<0.1	0.40	0.40	<0.1	0.50	0.50	<0.1	0.60	0.60	<0.1	0.70	0.70
Cu	0.01	<0.01	0.01	0.02	<0.01	0.02	0.02	0.02	0.04	0.01	0.02	0.03	0.01	0.03	0.04
Fe	3.72	0.01	3.73	9.58	0.01	9.59	10.18	<0.01	10.18	6.10	0.01	6.11	6.30	<0.01	6.30
K	0.03	3.27	3.30	0.06	3.19	3.25	0.08	3.36	3.44	0.04	3.17	3.21	0.01	3.08	3.09
Li	0.10	12.23	12.33	0.23	14.01	14.24	0.23	15.98	16.21	0.13	17.17	17.30	0.11	17.35	17.46
Mg	0.13	7.78	7.91	0.31	7.63	7.94	0.33	7.52	7.85	0.19	7.43	7.62	0.20	7.31	7.51
Mn	0.19	0.03	0.22	0.28	0.04	0.32	0.28	0.04	0.32	0.14	0.06	0.20	0.14	0.06	0.20
Na	0.10	26.94	27.04	0.19	27.93	28.12	0.23	30.98	31.21	0.14	34.19	34.33	0.15	35.72	35.87
Ni	0.20	0.05	0.25	0.47	0.04	0.51	0.57	0.08	0.65	0.26	0.09	0.35	0.25	0.11	0.36
P	0.03	0.18	0.21	0.04	<0.07	0.04	0.06	0.26	0.32	0.04	0.40	0.44	0.10	0.27	0.37
Pb	0.05	0.05	0.10	0.11	0.05	0.16	0.13	0.07	0.20	0.14	0.08	0.22	0.21	0.09	0.30
Sb	0.07	0.13	0.20	0.11	0.14	0.25	0.13	0.12	0.25	0.05	0.14	0.19	0.05	0.12	0.17
Se	0.21	36.58	36.79	0.50	37.87	38.37	0.54	40.06	40.60	0.37	43.24	43.61	0.45	47.51	47.96
Si	5.73	3.54	9.27	10.87	3.48	14.35	10.02	3.63	13.65	5.29	4.03	9.32	4.87	4.29	9.16
Sr	0.09	3.09	3.18	0.20	3.40	3.60	0.24	4.00	4.24	0.17	4.90	5.07	0.21	5.50	5.71
Te	0.41	0.23	0.64	1.05	0.31	1.36	3.34	0.39	3.73	1.23	0.92	2.15	2.37	1.28	3.65
Ti	0.03	<0.01	0.03	0.05	0.01	0.06	0.09	<0.01	0.09	0.02	<0.01	0.02	0.03	0.01	0.04
Zn	0.32	0.02	0.34	0.81	0.02	0.83	0.96	0.06	1.02	0.71	0.06	0.77	0.85	0.04	0.89
Zr	0.45	0.01	0.46	0.48	0.01	0.49	0.39	<0.01	0.39	0.19	0.01	0.20	0.15	<0.01	0.15
Cl	NA	27.62	27.62	NA	29.10	29.10	NA	26.31	26.31	NA	25.60	25.60	NA	24.55	24.55
F	NA	7.86	7.86	NA	9.25	9.25	NA	9.77	9.77	NA	11.61	11.61	NA	13.47	13.47
I	<0.1	1.80	1.80	<0.1	2.19	2.19	<0.1	4.88	4.88	<0.1	16.23	16.23	<0.1	25.82	25.82
Nitrate	NA	3.82	3.82	NA	3.67	3.67	NA	3.77	3.77	NA	3.80	3.80	NA	4.14	4.14
Nitrite	NA	<0.1	<0.1	NA	0.87	0.87	NA	0.92	0.92	NA	1.51	1.51	NA	2.17	2.17
Sulfate	<0.1	13.17	13.17	<0.1	62.50	62.50	1.95	67.28	69.23	<0.1	87.10	87.10	<0.1	104.0	104.0

* Suspended

Dissolved

NA – Not Analyzed.

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	2														
I.D.	12G-S-135A			12G-S-136A			12G-S-139A			12G-S-148A			12G-S-151A		
Glass (kg)	2650			2740			2827			2930			3035		
pH	8.46			8.46			8.56			8.60			8.60		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	44	464	508.0	96	506	602.0	104	496	600.0	84	504	588.0	130	400	530.0
Al	1.72	0.44	2.16	4.55	0.38	4.93	4.71	0.67	5.38	3.30	0.40	3.70	5.19	0.36	5.55
As	0.08	0.28	0.36	0.12	0.33	0.45	0.20	0.41	0.61	0.18	0.46	0.64	0.34	0.60	0.94
B	0.14	55.61	55.75	0.21	63.18	63.39	0.20	69.39	69.59	0.03	75.32	75.35	0.24	79.65	79.89
Ba	0.02	0.05	0.07	0.02	0.05	0.07	0.02	0.05	0.07	0.02	0.05	0.07	0.03	0.05	0.08
Ca	0.28	19.30	19.58	0.44	17.52	17.96	0.43	15.17	15.60	0.38	13.32	13.70	0.45	12.34	12.79
Cd	1.74	0.19	1.93	2.81	0.22	3.03	3.26	0.23	3.49	3.36	0.20	3.56	5.18	0.25	5.43
Cr	0.07	0.09	0.16	0.10	0.08	0.18	0.14	0.08	0.22	0.11	0.07	0.18	0.16	0.07	0.23
Cs	<0.1	0.80	0.80	<0.1	0.90	0.90	<0.1	1.30	1.30	<0.1	1.20	1.20	0.10	1.30	1.40
Cu	0.01	0.04	0.05	0.01	0.05	0.06	0.02	0.06	0.08	0.02	0.05	0.07	0.03	0.06	0.09
Fe	7.21	0.01	7.22	14.05	0.01	14.06	16.01	0.01	16.02	11.64	<0.01	11.64	20.13	<0.01	20.13
K	0.03	3.65	3.68	0.10	3.96	4.06	0.08	3.04	3.12	0.05	2.98	3.03	0.09	2.84	2.93
Li	0.12	17.24	17.36	0.25	17.30	17.55	0.26	16.65	16.91	0.20	16.67	16.87	0.28	16.16	16.44
Mg	0.26	7.08	7.34	0.52	7.05	7.57	0.62	6.72	7.34	0.58	6.57	7.15	0.83	6.28	7.11
Mn	0.15	0.06	0.21	0.31	0.06	0.37	0.33	0.06	0.39	0.26	0.05	0.31	0.37	0.06	0.43
Na	0.19	37.26	37.45	0.41	39.12	39.53	0.48	50.62	51.10	0.39	42.03	42.42	0.61	42.11	42.72
Ni	0.30	0.13	0.43	0.56	0.14	0.70	0.63	0.14	0.77	0.51	0.16	0.67	0.71	0.19	0.90
P	0.04	0.27	0.31	0.03	0.13	0.16	0.03	0.41	0.44	0.06	0.10	0.16	0.03	0.40	0.43
Pb	0.30	0.09	0.39	0.13	0.11	0.24	0.61	0.13	0.74	0.51	0.12	0.63	0.88	0.13	1.01
Sb	0.08	0.08	0.16	0.14	0.12	0.26	0.18	0.10	0.28	0.12	0.13	0.25	0.19	0.13	0.32
Se	0.57	51.87	52.44	0.83	57.40	58.23	1.25	62.76	64.01	1.05	64.41	65.46	1.79	72.72	74.51
Si	4.92	4.45	9.37	13.29	4.50	17.79	13.61	4.53	18.14	9.73	4.72	14.45	14.47	4.68	19.15
Sr	0.27	5.91	6.18	0.59	6.58	7.17	0.71	6.88	7.59	0.70	7.00	7.70	0.97	7.17	8.14
Te	3.81	1.52	5.33	5.01	1.83	6.84	8.33	1.95	10.28	8.40	2.07	10.47	13.11	2.36	15.47
Ti	0.02	0.01	0.03	0.04	0.01	0.05	0.05	<0.01	0.05	0.04	<0.01	0.04	0.05	0.01	0.06
Zn	1.03	0.03	1.06	1.90	0.06	1.96	2.18	0.11	2.29	1.90	0.10	2.00	2.70	0.13	2.83
Zr	0.16	0.01	0.17	0.54	<0.01	0.54	0.56	<0.01	0.56	0.34	0.01	0.35	0.63	0.01	0.64
Cl	NA	25.46	25.46	NA	26.20	26.20	NA	23.84	23.84	NA	24.02	24.02	NA	23.76	23.76
F	NA	14.48	14.48	NA	16.47	16.47	NA	18.07	18.07	NA	19.05	19.05	NA	20.42	20.42
I	<0.1	37.73	37.73	<0.1	53.91	53.91	<0.1	72.13	72.13	<0.1	99.18	99.18	<0.1	117.5	117.5
Nitrate	NA	4.90	4.90	NA	5.22	5.22	NA	15.97	15.97	NA	7.06	7.06	NA	6.10	6.10
Nitrite	NA	2.78	2.78	NA	4.13	4.13	NA	9.50	9.50	NA	8.09	8.09	NA	9.37	9.37
Sulfate	<0.1	123.9	123.9	0.01	170.3	170.3	<0.1	180.7	180.7	<0.1	194.6	194.6	0.07	226.8	226.9

* Suspended

Dissolved

NA – Not Analyzed.

The Catholic University of America
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DuraMelter 1200 Tests with AZ-101HLW Simulants
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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	2														
I.D.	12H-S-11A			12H-S-19A			12H-S-24A			12H-S-33A			12H-S-34A		
Glass (kg)	3120			3210			3298			3360			3420		
pH	8.51			8.57			8.54			8.55			8.56		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	122	436	558	130	420	550	136	428	564	122	380	502	128	436	564
Al	4.57	0.35	4.92	4.19	0.36	4.55	4.21	0.36	4.57	3.62	0.33	3.95	3.87	0.30	4.17
As	0.31	0.64	0.95	0.57	0.72	1.29	0.62	0.84	1.46	0.68	0.93	1.61	0.59	0.88	1.47
B	0.22	84.35	84.57	0.15	87.17	87.32	0.21	90.93	91.14	0.11	93.80	93.91	0.16	97.16	97.32
Ba	0.02	0.05	0.07	0.03	0.05	0.08	0.02	0.05	0.07	0.03	0.05	0.08	0.03	0.05	0.08
Ca	0.38	11.29	11.70	0.46	10.68	11.10	0.36	9.49	9.90	0.40	9.22	9.60	0.39	8.47	8.90
Cd	5.98	0.25	6.23	8.84	0.26	9.10	9.09	0.30	9.39	8.58	0.24	8.82	8.11	0.24	8.35
Cr	0.14	0.06	0.20	0.16	0.05	0.21	0.15	0.06	0.21	0.14	0.05	0.19	0.15	0.05	0.20
Cs	0.12	1.30	1.42	0.13	1.30	1.43	0.15	1.40	1.55	0.13	1.40	1.53	0.15	1.60	1.75
Cu	0.01	0.06	0.07	0.02	0.07	0.09	0.02	0.07	0.09	0.02	0.08	0.10	0.02	0.08	0.10
Fe	17.16	<0.01	17.16	17.52	<0.01	17.52	17.20	0.01	17.21	15.18	0.01	15.19	16.13	0.01	16.14
K	0.10	2.79	2.89	0.07	2.75	2.82	0.13	2.63	2.76	0.09	2.61	2.70	0.08	2.64	2.72
Li	0.25	15.58	15.83	0.27	15.66	15.93	0.26	14.96	15.22	0.21	14.91	15.12	0.20	14.93	15.13
Mg	0.70	6.04	6.74	0.85	5.72	6.57	0.76	5.57	6.33	0.77	5.33	6.10	0.88	5.23	6.11
Mn	0.31	0.07	0.38	0.34	0.06	0.40	0.30	0.05	0.35	0.29	0.04	0.33	0.32	0.06	0.38
Na	0.61	42.64	43.25	0.71	42.62	43.33	0.78	42.59	43.37	0.68	43.35	44.03	0.67	45.35	46.02
Ni	0.61	0.21	0.82	0.69	0.24	0.93	0.58	0.24	0.82	0.58	0.24	0.82	0.62	0.25	0.87
P	0.05	0.28	0.33	0.06	0.35	0.41	0.15	0.31	0.46	0.06	0.33	0.39	0.12	0.21	0.33
Pb	0.31	0.14	0.45	1.13	0.14	1.27	1.29	0.15	1.44	1.16	0.15	1.31	1.11	0.16	1.27
Sb	0.18	0.13	0.31	0.18	0.14	0.32	0.24	0.14	0.38	0.18	0.21	0.39	0.17	0.21	0.38
Se	1.01	79.16	80.17	1.93	84.96	86.89	1.88	91.26	93.14	1.74	99.19	100.9	1.72	103.3	105.0
Si	13.44	4.65	18.09	13.25	4.62	17.87	12.52	4.50	17.02	11.52	4.35	15.87	12.43	4.38	16.81
Sr	0.86	7.18	8.04	1.12	6.99	8.11	0.93	7.03	7.96	0.99	6.98	7.97	1.13	7.10	8.23
Te	11.44	2.65	14.09	19.67	3.08	22.75	22.37	3.61	25.98	22.22	3.93	26.15	22.63	3.79	26.42
Ti	0.05	<0.1	0.05	0.05	<0.1	0.05	0.05	0.01	0.06	0.05	0.01	0.06	0.05	0.01	0.06
Zn	2.46	0.14	2.60	2.74	0.13	2.87	2.55	0.14	2.69	2.32	0.11	2.43	2.49	0.14	2.63
Zr	0.51	0.01	0.52	0.41	<0.01	0.41	0.44	0.01	0.45	0.39	<0.01	0.39	0.45	0.01	0.46
Cl	NA	25.19	25.19	NA	24.53	24.53	NA	25.39	25.39	NA	26.38	26.38	NA	26.13	26.13
F	NA	23.18	23.18	NA	23.67	23.67	NA	25.29	25.29	NA	27.49	27.49	NA	28.13	28.13
I	<0.1	137.7	137.7	<0.1	147.1	147.1	<0.1	164.1	164.1	<0.1	189.7	189.7	<0.1	204.0	204.0
Nitrate	NA	6.14	6.14	NA	5.98	5.98	NA	6.31	6.31	NA	6.75	6.75	NA	7.31	7.31
Nitrite	NA	9.82	9.82	NA	9.89	9.89	NA	10.29	10.29	NA	10.34	10.34	NA	11.80	11.80
Sulfate	0.27	241.8	242.1	<0.1	266.4	266.4	0.47	311.7	312.2	<0.1	358.3	358.3	<0.1	365.6	365.6

* Suspended

Dissolved

NA – Not Analyzed.

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	2														
I.D.	12H-S-43A			12I-S-13A			12I-S-17A			12I-S-26A			12I-S-35A		
Glass (kg)	3452			3540			3699			3840			3981		
pH	8.52			8.47			8.50			8.53			8.50		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	130	468	598	118	480	598	106	472	578	101	554	655	80	260	340
Al	3.74	0.30	4.04	3.14	0.26	3.40	2.68	0.28	2.96	2.27	0.32	2.59	2.05	0.26	2.31
As	0.63	0.86	1.49	0.63	0.89	1.52	0.55	0.78	1.33	0.58	0.75	1.33	0.42	0.73	1.15
B	0.15	<0.03	0.15	0.10	102.1	102.2	0.14	102.7	102.8	0.21	103.8	104.0	0.10	104.1	104.2
Ba	0.03	0.05	0.08	0.02	0.07	0.09	0.02	0.07	0.09	0.02	0.07	0.09	0.02	0.07	0.09
Ca	0.39	<0.01	0.40	0.32	6.88	7.20	0.22	6.42	6.60	0.24	5.84	6.10	0.18	5.39	5.60
Cd	8.82	0.25	9.07	9.75	0.22	9.97	8.86	0.26	9.12	9.92	0.27	10.19	6.67	0.27	6.94
Cr	0.15	0.05	0.20	0.14	0.04	0.18	0.12	0.05	0.17	0.12	0.05	0.17	0.09	0.05	0.14
Cs	0.15	1.70	1.85	0.15	1.50	1.65	0.13	1.30	1.43	0.14	1.30	1.44	0.11	1.40	1.51
Cu	0.02	0.08	0.10	0.02	0.07	0.09	0.02	0.08	0.10	0.02	0.06	0.08	0.02	0.05	0.07
Fe	16.02	<0.01	16.02	13.92	0.03	13.95	11.89	0.03	11.92	11.16	0.03	11.19	9.30	0.03	9.33
K	0.08	2.69	2.77	0.08	2.43	2.51	0.12	2.31	2.43	0.07	2.27	2.34	0.05	2.34	2.39
Li	0.20	<0.02	0.20	0.18	14.41	14.59	0.15	13.94	14.09	0.12	13.12	13.24	0.10	13.52	13.62
Mg	0.88	<0.01	0.88	0.76	4.61	5.37	0.59	4.44	5.03	0.61	4.21	4.82	0.53	4.23	4.76
Mn	0.30	0.05	0.35	0.25	0.05	0.30	0.19	0.04	0.23	0.19	0.05	0.24	0.17	0.04	0.21
Na	0.68	<0.01	0.68	0.63	43.94	44.57	0.55	42.04	42.59	0.53	41.35	41.88	0.39	43.78	44.17
Ni	0.60	0.25	0.85	0.52	0.19	0.71	0.41	0.18	0.59	0.43	0.15	0.58	0.36	0.13	0.49
P	0.10	0.46	0.56	0.13	0.38	0.51	0.03	0.42	0.45	0.12	0.36	0.48	0.08	0.41	0.49
Pb	1.16	0.17	1.33	1.13	0.18	1.31	1.20	0.18	1.38	1.31	0.18	1.49	0.92	0.19	1.11
Sb	0.19	0.16	0.35	0.18	0.09	0.27	0.16	0.08	0.24	0.15	0.08	0.23	0.12	0.07	0.19
Se	1.67	104.9	106.6	1.61	122.4	124.0	1.56	124.0	125.6	1.60	130.1	131.7	1.24	135.0	136.2
Si	11.96	4.35	16.31	10.07	4.44	14.51	8.34	4.35	12.69	7.39	4.36	11.75	6.40	4.41	10.81
Sr	1.10	<0.01	1.10	0.98	6.68	7.66	0.66	6.51	7.17	0.70	6.41	7.11	0.63	6.66	7.29
Te	25.73	3.74	29.47	22.61	3.72	26.33	21.99	3.90	25.89	22.23	3.96	26.19	16.52	3.70	20.22
Ti	0.05	0.01	0.06	0.05	<0.01	0.05	0.04	<0.01	0.04	0.04	<0.01	0.04	0.03	0.01	0.04
Zn	2.47	0.15	2.62	2.39	0.14	2.53	1.82	0.14	1.96	1.80	0.15	1.95	1.45	0.21	1.66
Zr	0.40	0.01	0.41	0.31	<0.01	0.31	0.25	0.01	0.26	0.24	0.01	0.25	0.22	0.01	0.23
Cl	NA	26.87	26.87	NA	26.26	26.26	NA	25.03	25.03	NA	NA	NA	NA	25.03	25.03
F	NA	28.76	28.76	NA	28.78	28.78	NA	28.32	28.32	NA	NA	NA	NA	27.70	27.70
I	<0.1	213.9	213.9	<0.1	219.5	219.5	<0.1	228.2	228.2	<0.1	NA	NC	<0.1	248.4	248.4
Nitrate	NA	7.64	7.64	NA	7.51	7.51	NA	8.01	8.01	NA	NA	NA	NA	8.01	8.01
Nitrite	NA	12.08	12.08	NA	11.64	11.64	NA	12.80	12.80	NA	NA	NA	NA	14.07	14.07
Sulfate	<0.1	363.1	363.1	0.14	387.3	387.4	0.42	351.5	351.9	0.27	NA	NC	0.19	379.0	379.2

* Suspended

Dissolved

NA – Not Analyzed.

The Catholic University of America
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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	2														
I.D.	12I-S-43A			12I-S-50A			12I-S-58A			12I-S-61A			12I-S-66A		
Glass (kg)	4122			4250			4379			4507			4635		
pH	8.49						8.40			8.51			8.49		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	78	308	386	90	196	286	350	532	882	230	600	830	254	568	822
Al	2.07	0.22	2.29	2.23	0.21	2.44	14.41	0.19	14.6	8.10	0.27	8.37	8.67	0.24	8.91
As	0.39	0.68	1.07	0.48	0.74	1.22	0.91	0.72	1.63	0.75	0.79	1.54	0.86	0.78	1.64
B	0.09	105.8	105.9	0.10	108.5	108.6	0.63	109.3	109.9	0.27	111.3	111.6	0.33	111.4	111.7
Ba	0.01	0.07	0.08	0.02	0.07	0.09	0.08	0.07	0.15	0.05	0.07	0.12	0.05	0.07	0.12
Ca	0.14	5.11	5.25	0.20	4.70	4.90	0.82	4.80	5.62	0.53	4.77	5.30	0.60	4.50	5.10
Cd	6.07	0.27	6.34	7.37	0.27	7.64	14.73	0.33	15.06	12.55	0.32	12.87	13.98	0.30	14.28
Cr	0.08	0.05	0.13	0.11	0.05	0.16	0.37	0.05	0.42	0.27	0.05	0.32	0.29	0.05	0.34
Cs	<0.1	1.40	1.40	0.10	1.40	1.50	0.24	1.70	1.94	0.17	1.60	1.77	0.16	1.60	1.76
Cu	0.02	0.06	0.08	0.02	0.06	0.08	0.06	0.07	0.13	0.06	0.06	0.12	0.08	0.06	0.14
Fe	9.44	0.03	9.47	10.77	0.03	10.8	43.71	0.03	43.74	32.05	0.04	32.09	34.57	0.04	34.61
K	0.07	2.43	2.50	0.07	2.33	2.40	0.21	2.33	2.54	0.13	2.44	2.57	0.16	2.53	2.69
Li	0.09	14.44	14.53	0.11	14.15	14.26	0.47	13.56	14.03	0.32	14.54	14.86	0.30	14.47	14.77
Mg	0.49	4.35	4.84	0.64	4.28	4.92	2.26	4.23	6.49	1.66	4.38	6.04	NA	4.39	4.39
Mn	0.15	0.05	0.20	0.18	0.05	0.23	1.58	0.05	1.63	0.70	0.04	0.74	0.72	0.04	0.76
Na	0.35	47.45	47.8	0.46	47.78	48.24	1.30	46.99	48.29	0.91	49.90	50.81	0.96	51.93	52.89
Ni	0.33	0.14	0.47	0.42	0.16	0.58	2.03	0.19	2.22	1.35	0.14	1.49	1.46	0.13	1.59
P	0.02	0.53	0.55	0.05	0.46	0.51	0.35	0.44	0.79	0.15	0.48	0.63	0.28	0.51	0.79
Pb	0.81	0.20	1.01	0.95	0.19	1.14	1.85	0.20	2.05	1.57	0.20	1.77	1.74	0.21	1.95
Sb	0.11	0.07	0.18	0.11	0.10	0.21	0.48	0.08	0.56	0.27	0.13	0.4	0.26	0.13	0.39
Se	1.12	136.7	137.8	1.42	144.3	145.7	4.14	151.6	155.7	3.09	161.2	164.3	3.60	169.5	173.1
Si	5.51	4.57	10.08	5.16	4.49	9.65	49.17	4.37	53.54	27.09	4.60	31.69	28.32	4.59	32.91
Sr	0.58	6.97	7.55	0.83	6.87	7.70	3.13	6.94	10.07	1.99	7.73	9.72	2.28	7.93	10.21
Te	15.03	3.37	18.4	17.76	3.61	21.37	35.93	2.49	38.42	29.57	2.80	32.37	33.76	2.92	36.68
Ti	0.03	0.01	0.04	0.03	<0.01	0.03	0.15	0.01	0.16	0.09	0.01	0.10	0.10	<0.01	0.10
Zn	1.48	0.27	1.75	1.71	0.26	1.97	6.78	0.33	7.11	4.57	0.27	4.84	4.81	0.27	5.08
Zr	0.21	0.01	0.22	0.24	0.01	0.25	2.96	0.01	2.97	1.12	0.01	1.13	1.21	0.01	1.22
Cl	NA	25.28	25.28	NA	24.79	24.79	NA	24.30	24.3	NA	21.95	21.95	NA	24.44	24.44
F	NA	27.70	27.7	NA	28.01	28.01	NA	28.47	28.47	NA	26.57	26.57	NA	29.99	29.99
I	<0.1	274.3	274.3	<0.1	303.2	303.2	<0.1	306.1	306.1	<0.1	272.7	272.7	<0.1	326.1	326.1
Nitrate	NA	8.39	8.39	NA	8.64	8.64	NA	8.41	8.41	NA	8.80	8.80	NA	8.96	8.96
Nitrite	NA	16.50	16.5	NA	18.29	18.29	NA	18.48	18.48	NA	17.87	17.87	NA	18.12	18.12
Sulfate	0.26	329.4	329.7	0.77	387.3	388.1	0.85	357.0	357.9	0.42	390.5	390.9	0.42	407.6	408.0

* Suspended

Dissolved

NA – Not Analyzed.

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	2						3								
I.D.	12I-S-74A			12I-S-88A			12J-S-39A			12J-S-44A			12J-S-53A		
Glass (kg)	4765			4895			5106			5514			6011		
pH	8.46			8.45			7.08			5.72			4.89		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	268	688	956	268	672	940	208	292	500	488	956	1444	788	2080	2868
Al	9.76	0.24	10.00	10.59	0.26	10.85	11.34	0.44	11.78	24.27	22.22	46.49	38.85	49.81	88.66
As	0.88	0.83	1.71	0.83	0.84	1.67	0.23	0.13	0.36	0.75	0.22	0.97	1.10	0.49	1.59
B	0.43	110.3	110.7	0.27	113.1	113.4	0.26	15.77	16.03	1.15	120.7	121.9	2.08	251.8	253.9
Ba	0.06	0.07	0.13	0.06	0.07	0.13	0.04	0.11	0.15	0.13	0.35	0.48	0.38	0.33	0.71
Ca	0.59	4.73	5.32	0.57	4.25	4.82	0.51	31.49	32.00	0.56	25.27	25.83	0.44	17.38	17.82
Cd	14.17	0.29	14.46	12.89	0.28	13.17	1.44	0.90	2.34	2.96	4.79	7.75	3.70	7.09	10.79
Cr	0.30	0.05	0.35	0.29	0.04	0.33	0.18	0.02	0.20	0.73	0.04	0.77	1.40	0.09	1.49
Cs	0.21	1.70	1.91	0.16	NA	0.16	<0.1	0.37	0.37	0.26	3.20	3.46	0.51	6.40	6.91
Cu	0.05	0.07	0.12	0.05	0.07	0.12	0.05	<0.1	0.05	0.16	0.04	0.20	0.24	0.16	0.40
Fe	35.58	0.03	35.61	33.80	0.02	33.82	22.59	0.02	22.61	70.75	0.09	70.84	121.9	0.15	122.1
K	0.16	2.49	2.65	0.15	2.47	2.62	0.06	2.88	2.94	0.17	4.92	5.09	0.29	7.82	8.11
Li	0.33	14.81	15.14	0.32	14.05	14.37	0.19	1.92	2.11	1.00	19.14	20.14	1.89	42.56	44.45
Mg	1.99	4.40	6.39	1.92	4.19	6.11	0.69	10.23	10.92	1.58	15.48	17.06	2.63	23.82	26.45
Mn	0.83	0.04	0.87	0.93	0.03	0.96	1.71	0.21	1.92	3.20	3.81	7.01	5.33	10.42	15.75
Na	1.00	52.27	53.27	0.96	49.91	50.87	0.39	17.93	18.32	1.85	72.03	73.88	3.59	139.5	143.1
Ni	1.54	0.15	1.69	1.46	0.11	1.57	1.20	0.07	1.27	3.85	0.51	4.36	6.76	0.98	7.74
P	0.27	0.46	0.73	0.21	0.39	0.60	0.27	0.08	0.35	0.94	0.41	1.35	1.64	0.77	2.41
Pb	1.69	0.20	1.89	1.55	0.20	1.75	0.41	0.05	0.46	1.18	0.35	1.53	1.95	0.70	2.65
Sb	0.27	0.13	0.40	0.30	0.14	0.44	0.37	<0.03	0.37	1.07	0.27	1.34	1.87	0.40	2.27
Se	3.76	166.8	170.6	3.61	165.0	168.6	3.08	44.97	48.05	15.24	109.9	125.1	33.91	218.1	252.0
Si	32.07	4.43	36.5	33.11	4.22	37.33	44.16	3.59	47.75	81.98	28.95	110.9	120.9	62.18	183.1
Sr	2.35	8.13	10.48	2.27	8.07	10.34	0.25	4.24	4.49	1.20	22.47	23.67	2.66	42.95	45.61
Te	34.57	3.23	37.8	34.04	3.50	37.54	5.54	0.41	5.95	17.13	1.37	18.5	26.45	1.86	28.31
Ti	0.11	<0.01	0.11	0.11	0.01	0.12	0.12	<0.01	0.12	0.26	<0.01	0.26	0.42	0.01	0.43
Zn	5.30	0.26	5.56	5.18	0.23	5.41	1.90	1.27	3.17	4.09	16.46	20.55	6.39	34.75	41.14
Zr	1.46	0.01	1.47	1.87	<0.01	1.87	4.30	<0.01	4.30	7.29	0.01	7.30	12.11	0.02	12.13
Cl	NA	24.05	24.05	NA	23.94	23.94	NA	33.63	33.63	NA	54.88	54.88	NA	81.70	81.7
F	NA	27.70	27.7	NA	29.18	29.18	NA	10.92	10.92	NA	62.28	62.28	NA	98.75	98.75
I	<0.1	332.1	332.1	<0.1	334.9	334.9	<0.1	13.50	13.5	<0.1	258.1	258.1	<0.1	450.2	450.2
Nitrate	NA	8.87	8.87	NA	9.12	9.12	NA	1.82	1.82	NA	12.00	12.00	NA	19.06	19.06
Nitrite	NA	18.74	18.74	NA	18.12	18.12	NA	<0.1	<0.1	NA	12.09	12.09	NA	26.21	26.21
Sulfate	0.65	351.5	352.2	0.57	390.5	391.1	NA	94.32	94.32	1.48	245.3	246.8	3.10	494.2	497.3

* Suspended

Dissolved

NA – Not Analyzed.

The Catholic University of America
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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	3														
I.D.	12J-S-64B			12J-S-75A			12J-S-86B			12J-S-91A			12J-S-106A		
Glass (kg)	6657			7175			7798			7886			8554		
pH	5.73			6.11			6.41			6.61			6.62		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	1138	2692	3830	1398	2720	4118	1626	2904	4530	1696	2776	4472	1732	6692	8424
Al	63.75	47.14	110.9	82.27	38.30	120.6	93.82	31.67	125.5	100.5	26.67	127.2	98.57	27.70	126.3
As	1.51	0.19	1.70	1.95	0.24	2.19	2.19	0.33	2.52	2.28	0.29	2.57	2.05	0.28	2.33
B	3.28	304.2	307.5	5.11	346.2	351.3	6.69	366.8	373.5	7.59	371.3	378.9	7.51	390.3	397.8
Ba	0.35	0.38	0.73	0.57	0.28	0.85	0.66	0.22	0.88	0.70	0.19	0.89	0.70	0.16	0.86
Ca	0.66	12.00	12.66	1.34	9.92	11.26	1.75	8.53	10.28	2.19	8.36	10.55	2.16	7.08	9.24
Cd	5.78	3.35	9.13	8.97	1.57	10.54	10.48	1.09	11.57	10.96	0.83	11.79	11.38	0.85	12.23
Cr	1.79	0.14	1.93	2.23	0.21	2.44	2.52	0.24	2.76	2.57	0.29	2.86	2.57	0.29	2.86
Cs	1.20	7.50	8.7	1.81	8.50	10.31	2.08	8.80	10.88	2.31	8.10	10.41	2.25	7.90	10.15
Cu	0.41	0.04	0.45	0.43	0.02	0.45	0.48	0.02	0.50	0.51	0.02	0.53	0.51	0.03	0.54
Fe	169.84	0.21	170.1	195.0	0.22	195.2	220.2	0.23	220.4	223.8	0.23	224.0	226.4	0.20	226.6
K	-0.67	9.19	9.86	0.97	7.52	8.49	1.08	8.25	9.33	1.10	8.77	9.87	1.21	9.11	10.32
Li	2.89	52.18	55.07	4.14	62.04	66.18	4.77	66.69	71.46	5.22	65.82	71.04	5.12	65.54	70.66
Mg	3.53	24.78	28.31	5.11	26.46	31.57	6.14	27.45	33.59	6.76	29.12	35.88	6.97	29.21	36.18
Mn	6.80	8.66	15.46	9.44	5.72	15.16	11.00	3.89	14.89	11.75	3.72	15.47	11.91	2.60	14.51
Na	6.15	169.7	175.9	9.49	190.6	200.1	11.66	201.2	212.7	13.32	202.1	215.4	13.46	209.8	223.3
Ni	7.94	1.08	9.02	10.72	1.03	11.75	12.45	0.94	13.39	13.23	0.86	14.09	13.03	0.73	13.76
P	1.63	0.61	2.24	2.48	0.44	2.92	3.34	0.60	3.94	3.10	0.65	3.75	3.17	0.35	3.52
Pb	2.64	0.84	3.48	2.84	0.92	3.76	3.21	0.98	4.19	3.19	0.99	4.18	3.14	0.97	4.11
Sb	2.49	0.50	2.99	2.80	0.58	3.38	3.43	0.60	4.03	3.59	0.59	4.18	3.51	0.65	4.16
Se	49.22	274.1	323.3	57.95	285.4	343.4	65.58	289.8	355.4	62.71	263.7	326.4	63.21	286.6	349.8
Si	162.78	65.35	228.1	210.8	57.97	268.8	243.8	57.43	301.2	237.4	54.70	292.1	248.3	47.30	295.6
Sr	5.02	47.32	52.34	11.63	47.12	58.75	15.58	44.95	60.53	18.80	40.44	59.24	19.33	39.68	59.01
Te	33.68	1.16	34.84	38.21	0.55	38.76	44.81	0.33	45.14	45.39	0.27	45.66	46.43	0.37	46.8
Ti	0.51	0.01	0.52	0.68	0.01	0.69	0.73	0.02	0.75	0.81	0.02	0.83	0.75	0.01	0.76
Zn	11.41	33.25	44.66	25.05	22.71	47.76	32.66	15.76	48.42	14.25	10.74	24.99	14.42	10.48	24.9
Zr	18.74	0.02	18.76	17.79	0.03	17.82	20.21	0.03	20.24	20.74	0.04	20.78	20.86	0.02	20.88
Cl	NA	90.58	90.58	NA	95.16	95.16	NA	91.46	91.46	NA	89.34	89.34	NA	83.72	83.72
F	NA	109.0	109.0	NA	107.5	107.5	NA	97.70	97.7	NA	95.36	95.36	NA	88.92	88.92
I	<0.1	437.4	437.4	<0.1	435.5	435.5	<0.1	507.3	507.3	<0.1	517.7	517.7	<0.1	509.4	509.4
Nitrate	NA	49.85	49.85	NA	43.75	43.75	NA	10.55	10.55	NA	10.13	10.13	NA	10.18	10.18
Nitrite	NA	33.01	33.01	NA	54.39	54.39	NA	77.94	77.94	NA	86.40	86.4	NA	89.58	89.58
Sulfate	2.00	603.6	605.6	5.10	644.0	649.1	2.89	578.3	581.2	0.48	505.9	506.4	0.49	490.4	490.9

* Suspended

Dissolved

NA – Not Analyzed.

The Catholic University of America
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DuraMelter 1200 Tests with AZ-101HLW Simulants
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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	3														
I.D.	12J-S-124A			12J-S-136B			12J-S-139B			12J-S-142B			12J-S-149B		
Glass (kg)	9400			10135			10453			10817			11075		
pH	6.94			4.72			5.47			4.90			5.96		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	2038	2656	4694	772	2784	3556	3584	2720	6304	802	2476	3278	2182	2688	4870
Al	116.41	30.50	146.9	37.91	54.18	92.09	173.8	57.00	230.8	35.96	58.03	93.99	103.7	42.23	145.9
As	3.02	0.44	3.46	1.20	0.92	2.12	3.55	0.69	4.24	1.18	1.06	2.24	2.35	0.55	2.90
B	9.27	394.2	403.5	2.46	396.2	398.7	12.06	368.1	380.2	2.70	337.2	339.9	7.61	336.1	343.7
Ba	0.77	0.19	0.96	0.32	0.48	0.80	1.27	0.47	1.74	0.52	0.26	0.78	0.85	0.29	1.14
Ca	2.05	7.22	9.27	0.39	9.15	9.54	1.71	9.42	11.13	0.34	8.83	9.17	1.52	8.80	10.32
Cd	12.66	1.04	13.7	3.89	4.24	8.13	17.66	4.35	22.01	4.36	5.35	9.71	11.38	2.36	13.74
Cr	2.80	0.44	3.24	1.35	0.22	1.57	4.87	0.17	5.04	1.42	0.18	1.60	2.46	0.23	2.69
Cs	2.39	8.50	10.89	0.80	8.50	9.30	3.42	8.00	11.42	0.79	8.40	9.19	2.14	7.40	9.54
Cu	0.60	0.03	0.63	0.24	0.12	0.36	1.08	0.09	1.17	0.26	0.16	0.42	0.68	0.05	0.73
Fe	253.51	0.20	253.7	112.4	0.24	112.6	422.0	0.24	422.2	107.7	0.24	107.9	235.9	0.25	236.2
K	1.17	8.94	10.11	0.41	9.34	9.75	1.48	8.92	10.40	0.40	9.60	10.00	1.02	8.99	10.01
Li	5.92	66.24	72.16	2.12	65.29	67.41	8.85	61.62	70.47	2.06	58.34	60.4	5.29	58.15	63.44
Mg	7.34	28.38	35.72	2.74	28.99	31.73	10.74	28.61	39.35	2.69	26.58	29.27	6.32	27.95	34.27
Mn	15.10	2.47	17.57	5.73	5.05	10.78	39.26	7.12	46.38	6.33	8.64	14.97	31.93	6.83	38.76
Na	15.46	198.6	214.1	4.97	205.7	210.7	21.24	188.4	209.6	4.74	170.7	175.4	13.89	173.1	187.0
Ni	14.64	0.78	15.42	6.04	1.23	7.27	24.35	1.41	25.76	6.24	1.35	7.59	13.35	1.23	14.58
P	3.38	0.41	3.79	1.26	0.99	2.25	8.65	0.95	9.6	1.75	1.20	2.95	3.96	0.85	4.81
Pb	3.68	0.98	4.66	1.69	1.01	2.70	7.20	1.03	8.23	1.77	1.08	2.85	4.39	1.07	5.46
Sb	4.21	0.70	4.91	1.79	0.63	2.42	8.47	0.64	9.11	1.74	0.72	2.46	5.48	0.77	6.25
Se	65.67	253.7	319.4	30.81	319.1	349.9	127.3	297.3	424.6	34.88	286.7	321.6	74.44	260.1	334.5
Si	334.92	51.33	386.3	128.1	72.45	200.6	608.6	72.53	681.1	132.8	73.17	206.0	433.6	63.23	496.8
Sr	20.54	42.44	62.98	3.73	55.57	59.3	17.51	57.08	74.59	4.31	54.73	59.04	14.63	49.30	63.93
Te	52.48	0.44	52.92	22.33	1.81	24.14	85.43	1.62	87.05	23.53	2.14	25.67	45.72	1.33	47.05
Ti	0.89	0.01	0.90	0.38	0.02	0.40	2.52	0.02	2.54	0.38	0.02	0.40	1.11	0.02	1.13
Zn	40.87	13.23	54.1	7.60	37.41	45.01	38.64	40.90	79.54	8.02	42.35	50.37	29.34	30.03	59.37
Zr	29.05	0.03	29.08	12.94	0.03	12.97	86.32	0.03	86.35	13.66	0.04	13.7	66.60	0.04	66.64
Cl	NA	68.56	68.56	NA	93.27	93.27	NA	87.09	87.09	NA	85.29	85.29	NA	80.38	80.38
F	NA	74.60	74.6	NA	106.8	106.8	NA	102.2	102.2	NA	107.1	107.1	NA	86.83	86.83
I	<0.1	442.1	442.1	<0.1	523.7	523.7	<0.1	583.3	583.3	<0.1	531.5	531.5	<0.1	494.6	494.6
Nitrate	NA	23.48	23.48	NA	73.15	73.15	NA	23.62	23.62	NA	40.52	40.52	NA	39.87	39.87
Nitrite	NA	105.6	105.6	NA	76.55	76.55	NA	104.2	104.2	NA	65.56	65.56	NA	59.04	59.04
Sulfate	2.43	488.0	490.4	0.24	587.5	587.7	8.67	587.5	596.2	1.95	581.7	583.7	3.89	453.5	457.4

* Suspended

Dissolved

NA – Not Analyzed.

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	4														
I.D.	12K-S-36A			12K-S-43A			12K-S-53A			12K-S-56A			12K-S-71A		
Glass (kg)	11145			11423			11656			11830			12201		
pH	6.69			6.82			6.49			6.09			5.11		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	186	313	499	326	760	1086	440	1152	1592	514	1250	1764	494	1656	2150
Al	10.27	0.68	10.95	18.14	4.13	22.27	21.82	12.13	33.95	24.06	22.23	46.29	20.36	32.62	52.98
As	0.35	<0.05	0.35	0.49	<0.05	0.49	0.63	0.08	0.71	<0.05	0.16	0.16	0.67	0.38	1.05
B	0.62	22.18	22.8	1.18	98.21	99.39	1.40	143.7	145.1	1.44	183.0	184.4	1.06	219.2	220.3
Ba	0.07	0.08	0.15	0.11	0.16	0.27	0.15	0.22	0.37	0.19	0.29	0.48	0.16	0.48	0.64
Ca	0.63	29.68	30.31	1.05	20.95	22.00	0.77	15.13	15.9	0.56	12.68	13.24	0.20	10.53	10.73
Cd	1.19	0.37	1.56	2.24	0.45	2.69	3.04	0.80	3.84	3.69	1.57	5.26	2.56	4.04	6.60
Cr	0.24	0.07	0.31	0.62	0.10	0.72	0.90	0.16	1.06	1.16	0.12	1.28	1.24	0.08	1.32
Cs	0.14	0.75	0.89	0.21	2.40	2.61	0.28	4.20	4.48	0.28	5.00	5.28	0.26	5.90	6.16
Cu	0.07	0.01	0.08	0.11	0.01	0.12	0.14	0.02	0.16	0.18	0.03	0.21	0.14	0.13	0.27
Fe	19.86	0.05	19.91	48.14	0.09	48.23	71.59	0.12	71.71	89.04	0.08	89.12	95.91	0.11	96.02
K	0.12	2.83	2.95	0.19	3.46	3.65	0.25	4.11	4.36	0.27	5.19	5.46	0.25	6.24	6.49
Li	0.41	3.24	3.65	0.87	18.11	18.98	1.17	28.64	29.81	1.34	35.48	36.82	1.17	42.55	43.72
Mg	1.91	8.33	10.24	0.59	10.80	11.39	1.43	13.14	14.57	2.29	15.53	17.82	2.35	17.63	19.98
Mn	1.85	0.56	2.41	1.75	0.80	2.55	2.11	1.10	3.21	2.28	2.03	4.31	2.01	3.97	5.98
Na	1.08	19.74	20.82	2.04	53.30	55.34	2.39	82.85	85.24	2.60	99.70	102.3	1.94	122.9	124.8
Ni	1.21	0.16	1.37	2.53	0.30	2.83	3.59	0.48	4.07	4.40	0.58	4.98	4.45	0.83	5.28
P	0.38	0.48	0.86	0.67	0.52	1.19	0.97	0.60	1.57	1.12	0.22	1.34	1.13	0.48	1.61
Pb	0.41	0.06	0.47	0.67	0.22	0.89	0.92	0.36	1.28	1.19	0.48	1.67	1.27	0.58	1.85
Sb	0.34	0.05	0.39	0.60	0.17	0.77	0.81	0.29	1.10	0.97	0.46	1.43	0.94	0.42	1.36
Se	5.80	25.51	31.31	7.72	63.92	71.64	11.40	97.21	108.6	16.98	118.9	135.9	20.52	166.5	187.0
Si	33.05	5.77	38.82	48.62	16.26	64.88	62.90	24.99	87.89	68.51	35.27	103.8	63.61	45.40	109.0
Sr	0.65	4.62	5.27	<0.1	14.23	14.23	2.13	22.76	24.89	2.27	25.81	28.08	1.26	32.97	34.23
Te	5.22	<0.20	5.22	11.03	<0.20	11.03	16.79	<0.20	16.79	22.13	0.31	22.44	22.68	1.00	23.68
Ti	0.10	0.01	0.11	0.19	0.01	0.20	0.27	0.01	0.28	0.34	<0.1	0.34	0.33	0.01	0.34
Zn	2.20	1.35	3.55	5.66	4.09	9.75	6.89	9.24	16.13	6.87	15.20	22.07	3.94	25.06	29.00
Zr	4.39	0.02	4.41	3.65	0.03	3.68	4.38	0.03	4.41	5.09	0.01	5.10	4.98	0.01	4.99
Cl	NA	28.30	28.3	NA	31.23	31.23	NA	42.00	42.00	NA	52.27	52.27	NA	73.04	73.04
F	NA	9.85	9.85	NA	28.21	28.21	NA	42.10	42.10	NA	53.99	53.99	NA	73.52	73.52
I	<0.1	14.50	14.5	<0.1	131.7	131.7	<0.1	245.7	245.7	<0.1	287.3	287.3	<0.1	384.2	384.2
Nitrate	NA	3.73	3.73	NA	6.67	6.67	NA	8.43	8.43	NA	44.39	44.39	NA	16.57	16.57
Nitrite	NA	0.93	0.93	NA	16.83	16.83	NA	40.18	40.18	NA	20.70	20.70	NA	31.05	31.05
Sulfate	0.33	100.4	100.7	<0.1	172.6	172.6	0.21	233.1	233.3	<0.1	336.8	336.8	0.97	426.3	427.3

* Suspended

Dissolved

NA – Not Analyzed

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	4														
I.D.	12K-S-84A			12K-S-94A			12K-S-104B			12K-S-114A			12K-S-127A		
Glass (kg)	12560			12862			13252			13649			14035		
pH	4.64			4.30			4.16			4.23			4.17		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	472	2948	3420	448	1736	2184	462	1832	2294	470	1816	2286	463	1836	2299
Al	17.79	37.67	55.46	17.26	40.71	57.97	17.74	42.36	60.1	19.25	42.10	61.35	19.13	42.61	61.74
As	0.66	0.49	1.15	0.63	0.50	1.13	0.54	0.65	1.19	0.54	0.77	1.31	0.49	0.73	1.22
B	0.81	226.0	226.8	0.72	233.3	234.0	0.76	246.2	247.0	0.86	242.6	243.5	0.84	239.7	240.5
Ba	0.24	0.36	0.60	0.27	0.31	0.58	0.29	0.28	0.57	0.28	0.27	0.55	0.24	0.29	0.53
Ca	0.17	8.55	8.72	0.16	7.12	7.28	0.15	6.59	6.74	0.11	6.11	6.22	0.11	5.76	5.87
Cd	1.78	5.22	7.00	1.52	5.63	7.15	1.47	5.95	7.42	1.44	5.68	7.12	1.41	5.56	6.97
Cr	1.22	0.13	1.35	1.16	0.15	1.31	1.16	0.18	1.34	1.14	0.19	1.33	1.08	0.18	1.26
Cs	0.13	6.30	6.43	0.13	6.60	6.73	0.16	6.90	7.06	0.20	6.60	6.80	0.18	6.10	6.28
Cu	0.09	0.22	0.31	0.08	0.25	0.33	0.08	0.27	0.35	0.08	0.28	0.36	0.08	0.29	0.37
Fe	91.80	0.13	91.93	85.53	0.13	85.66	85.85	0.14	85.99	59.98	0.13	60.11	84.34	0.14	84.48
K	0.20	6.12	6.32	0.20	6.20	6.40	0.18	6.25	6.43	0.18	6.18	6.36	0.21	6.37	6.58
Li	1.00	42.04	43.04	0.93	41.77	42.7	0.94	40.45	41.39	0.99	39.36	40.35	0.95	39.91	40.86
Mg	1.98	17.31	19.29	1.73	17.27	19.00	1.63	18.36	19.99	1.60	18.10	19.7	1.64	17.44	19.08
Mn	1.82	6.30	8.12	1.72	8.15	9.87	1.75	10.20	11.95	1.82	11.02	12.84	1.73	10.48	12.21
Na	1.44	121.1	122.5	1.26	122.0	123.3	1.27	124.4	125.7	1.31	122.6	123.9	1.27	120.5	121.8
Ni	4.24	0.88	5.12	4.03	0.92	4.95	4.06	0.98	5.04	4.06	0.97	5.03	3.90	0.99	4.89
P	0.98	0.68	1.66	0.93	0.69	1.62	1.00	0.86	1.86	0.91	0.82	1.73	0.92	0.80	1.72
Pb	1.24	0.58	1.82	1.20	0.59	1.79	1.24	0.61	1.85	1.14	0.63	1.77	1.13	0.62	1.75
Sb	0.89	0.40	1.29	0.89	0.40	1.29	0.97	0.35	1.32	1.09	0.36	1.45	1.00	0.34	1.34
Se	22.16	189.0	211.2	22.66	192.8	215.5	26.01	206.1	232.1	25.32	211.9	237.2	24.51	221.9	246.4
Si	62.07	46.06	108.1	57.20	47.20	104.4	58.23	49.92	108.2	63.31	49.27	112.6	64.17	48.08	112.3
Sr	1.00	32.49	33.49	1.04	32.91	33.95	1.18	32.43	33.61	1.26	32.29	33.55	1.21	32.71	33.92
Te	21.25	1.34	22.59	20.07	1.51	21.58	20.08	1.67	21.75	19.05	1.83	20.88	18.43	1.95	20.38
Ti	0.35	<0.01	0.35	0.32	0.01	0.33	0.37	<0.01	0.37	0.38	<0.01	0.38	0.38	0.01	0.39
Zn	3.04	26.47	29.51	2.75	26.93	29.68	2.71	27.87	30.58	2.90	28.33	31.23	2.96	28.40	31.36
Zr	5.18	0.02	5.20	4.96	0.02	4.98	5.39	0.02	5.41	4.75	0.02	4.77	4.57	0.02	4.59
Cl	NA	86.33	86.33	NA	99.61	99.61	NA	96.15	96.15	NA	113.5	113.5	NA	85.75	85.75
F	NA	78.55	78.55	NA	80.87	80.87	NA	78.16	78.16	NA	92.09	92.09	NA	65.78	65.78
I	<0.1	382.8	382.8	<0.1	341.0	341	NA	322.9	322.9	<0.1	286.3	286.3	<0.1	262.0	262
Nitrate	NA	16.89	16.89	NA	18.38	18.38	NA	14.22	14.22	NA	23.28	23.28	NA	32.96	32.96
Nitrite	NA	6.61	6.61	NA	4.95	4.95	NA	3.05	3.05	NA	4.71	4.71	NA	3.88	3.88
Sulfate	0.64	450.1	450.7	1.01	465.0	466.0	NA	436.7	436.7	2.15	481.4	483.5	2.28	350.4	352.7

* Suspended

Dissolved

NA – Not Analyzed

The Catholic University of America
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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	4			5											
I.D.	12K-S-136A			12L-S-16A			12L-S-21A			12L-S-28A			12L-S-37A		
Glass (kg)	14449			14643			14746			14849			14952		
pH	NA			8.04			2.78			2.47			2.20		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	448	1036	1484	80	268	348	110	528	638	78	688	766	44	972	1016
Al	18.51	40.25	58.76	4.04	0.30	4.34	3.58	7.00	10.58	1.98	9.00	10.98	0.76	16.55	17.31
As	0.53	0.78	1.31	0.25	0.14	0.39	0.16	0.13	0.29	0.03	0.27	0.30	0.09	0.14	0.23
B	0.76	141.7	142.5	0.23	9.17	9.40	0.14	35.10	35.24	0.10	50.51	50.61	0.05	75.78	75.83
Ba	0.24	0.06	0.30	0.03	0.05	0.08	0.01	0.26	0.27	0.01	0.34	0.35	<0.01	0.51	0.51
Ca	0.12	4.50	4.62	0.54	30.40	30.94	0.07	31.63	31.7	0.03	30.97	31.00	0.02	31.99	32.01
Cd	1.48	5.26	6.74	0.30	0.04	0.34	0.07	2.08	2.15	0.07	2.95	3.02	0.03	4.49	4.52
Cr	1.15	0.18	1.33	0.13	0.03	0.16	0.16	0.14	0.30	0.13	0.21	0.34	0.07	0.40	0.47
Cs	0.15	6.80	6.95	<0.1	0.54	0.54	<0.1	1.09	1.09	<0.1	1.34	1.34	<0.1	2.22	2.22
Cu	0.08	0.25	0.33	0.02	<0.1	0.02	0.02	0.08	0.1	0.02	0.12	0.14	0.01	0.17	0.18
Fe	88.19	0.05	88.24	8.97	0.01	8.98	18.02	0.99	19.01	18.85	2.27	21.12	10.46	5.21	15.67
K	0.19	4.83	5.02	0.04	3.63	3.67	0.04	4.73	4.77	0.04	4.07	4.11	0.03	7.96	7.99
Li	0.94	35.78	36.72	0.15	4.48	4.63	0.26	13.04	13.3	0.19	16.40	16.59	0.09	25.34	25.43
Mg	1.76	16.11	17.87	0.28	10.51	10.79	0.22	12.67	12.89	0.16	13.55	13.71	0.08	15.84	15.92
Mn	2.09	8.59	10.68	0.78	0.31	1.09	0.35	2.84	3.19	0.17	4.45	4.62	0.08	7.30	7.38
Na	1.35	64.93	66.28	0.36	27.10	27.46	0.20	43.81	44.01	0.14	50.10	50.24	0.06	88.37	88.43
Ni	3.99	1.08	5.07	0.59	0.10	0.69	0.91	0.60	1.51	0.69	0.84	1.53	0.33	1.70	2.03
P	0.88	1.09	1.97	0.17	<0.07	0.17	0.27	0.21	0.48	0.31	0.33	0.64	0.16	0.29	0.45
Pb	1.15	0.54	1.69	0.14	0.04	0.18	0.14	0.25	0.39	0.08	0.47	0.55	0.05	0.87	0.92
Sb	0.92	0.18	1.10	0.19	<0.03	0.19	0.23	<0.03	0.23	0.17	<0.03	0.17	0.08	<0.03	0.08
Se	27.63	208.8	236.4	2.20	33.81	36.01	4.04	35.45	39.49	2.79	37.91	40.7	1.27	45.70	46.97
Si	62.90	44.26	107.2	14.50	3.52	18.02	18.94	6.91	25.85	10.59	7.59	18.18	4.69	9.13	13.82
Sr	1.47	28.96	30.43	0.20	3.01	3.21	0.07	7.60	7.67	0.04	9.78	9.82	0.02	14.86	14.88
Te	19.43	2.33	21.76	2.28	0.26	2.54	2.72	1.06	3.78	1.87	2.14	4.01	0.86	4.24	5.10
Ti	0.43	0.03	0.46	0.07	<0.01	0.07	0.12	0.01	0.13	0.09	0.01	0.10	0.06	0.01	0.07
Zn	2.86	28.46	31.32	0.85	0.03	0.88	0.36	5.20	5.56	0.27	7.06	7.33	0.14	11.42	11.56
Zr	4.66	0.02	4.68	1.60	<0.01	1.60	3.15	0.07	3.22	2.57	0.16	2.73	1.59	0.73	2.32
Cl	NA	116.4	116.4	NA	38.09	38.09	NA	NA	NA	NA	NA	NA	NA	NA	NA
F	NA	82.34	82.34	NA	5.15	5.15	NA	NA	NA	NA	NA	NA	NA	NA	NA
I	NA	224.0	224.0	NA	0.61	0.61	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate	NA	48.99	48.99	NA	2.44	2.44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	NA	446.7	446.7	NA	107.1	107.1	NA	NA	NA	NA	NA	NA	NA	NA	NA

* Suspended

Dissolved

NA – Not Analyzed

The Catholic University of America
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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	5														
I.D.	12L-S-41A			12L-S-50A			12L-S-58A			12L-S-62A			12L-S-78A		
Glass (kg)	15056			15230			15404			15578			15641		
pH	1.90			1.69			1.47			1.37			1.13		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	68	1256	1324	92	1872	1964	102	2172	2274	86	2512	2598	430	2628	3058
Al	1.07	21.21	22.28	1.30	30.00	31.3	1.42	33.02	34.44	1.15	38.97	40.12	9.61	54.57	64.18
As	0.14	0.25	0.39	0.07	0.39	0.46	0.05	0.52	0.57	0.03	0.51	0.54	0.14	0.63	0.77
B	0.07	106.8	106.9	0.08	135.6	135.7	0.07	165.5	165.6	0.05	187.4	187.5	0.27	233.4	233.7
Ba	<0.01	0.65	0.65	<0.01	0.86	0.86	<0.01	1.02	1.02	<0.01	1.15	1.15	0.02	1.38	1.40
Ca	0.03	30.92	30.95	0.03	29.64	29.67	0.03	28.16	28.19	0.03	25.63	25.66	0.11	27.56	27.67
Cd	0.03	5.44	5.47	0.06	6.74	6.80	0.06	7.44	7.50	0.05	8.05	8.10	0.18	8.66	8.84
Cr	0.10	0.61	0.71	0.12	0.79	0.91	0.13	0.89	1.02	0.10	0.94	1.04	0.44	0.98	1.42
Cs	<0.1	2.40	2.40	<0.1	3.00	3.00	<0.1	3.30	3.30	<0.1	3.50	3.50	<0.1	4.00	4.00
Cu	0.02	0.23	0.25	0.02	0.29	0.31	0.03	0.33	0.36	0.02	0.36	0.38	0.04	0.41	0.45
Fe	17.44	9.01	26.45	24.03	13.19	37.22	27.65	16.43	44.08	23.60	18.54	42.14	88.05	23.26	111.3
K	0.04	5.45	5.49	0.05	6.39	6.44	0.05	7.02	7.07	0.04	7.29	7.33	0.16	18.07	18.23
Li	0.12	29.95	30.07	0.15	41.05	41.2	0.15	49.23	49.38	0.11	56.37	56.48	0.47	66.24	66.71
Mg	0.11	18.18	18.29	0.13	21.66	21.79	0.12	23.87	23.99	0.09	24.87	24.96	0.35	27.27	27.62
Mn	0.11	11.63	11.74	0.14	18.26	18.4	0.14	23.59	23.73	0.10	27.35	27.45	0.37	29.95	30.32
Na	0.08	82.15	82.23	0.07	104.6	104.7	0.09	106.7	106.8	0.07	113.2	113.3	0.31	131.7	132.0
Ni	0.42	2.40	2.82	0.45	3.45	3.90	0.38	4.45	4.83	0.25	4.67	4.92	1.09	7.32	8.41
P	0.30	0.62	0.92	0.36	0.89	1.25	0.36	1.13	1.49	0.27	1.45	1.72	1.14	1.85	2.99
Pb	0.05	1.51	1.56	0.02	2.27	2.29	0.01	2.76	2.77	<0.01	3.16	3.16	0.17	3.75	3.92
Sb	0.11	<0.03	0.11	0.11	<0.03	0.11	0.07	<0.03	0.07	0.05	<0.03	0.05	0.56	0.11	0.67
Se	1.90	51.88	53.78	2.16	64.45	66.61	2.19	74.68	76.87	1.88	84.16	86.04	7.37	102.9	110.3
Si	7.20	10.21	17.41	9.65	12.10	21.75	11.29	13.33	24.62	9.63	13.90	23.53	78.79	15.95	94.74
Sr	0.02	20.40	20.42	0.03	28.26	28.29	0.03	26.97	27.00	0.02	30.71	30.73	0.14	36.12	36.26
Te	1.06	7.52	8.58	1.00	8.24	9.24	0.60	11.29	11.89	0.40	9.68	10.08	1.60	10.45	12.05
Ti	0.09	0.03	0.12	0.12	0.06	0.18	0.13	0.08	0.21	0.10	0.11	0.21	0.46	0.18	0.64
Zn	0.20	15.49	15.69	0.24	20.22	20.46	0.25	24.75	25.00	0.19	27.60	27.79	0.71	32.03	32.74
Zr	2.41	1.98	4.39	2.95	4.22	7.17	2.57	6.84	9.41	1.94	9.31	11.25	9.29	16.82	26.11
Cl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	24.95	24.95	NA	NA	NC
F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1	<0.1	NA	NA	NC
I	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11.83	11.83	<0.1	NA	NC
Nitrate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7175	7175	NA	NA	NA
Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.97	2.97	NA	NA	NA
Sulfate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	91.49	91.49	NA	NA	NC
Sum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	24.95	24.95	1.50	NA	NC

* Suspended

Dissolved

NA - Not Analyzed

NC - Not Calculated

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	5														
I.D.	12L-S-80A			12L-S-88A			12L-S-95A			12L-S-107A			12L-S-109A		
Glass (kg)	15704			15767			15829			15892			16049		
pH	1.12			1.09			1.10			1.04			1.05		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	470	2840	3310	501	3256	3757	1004	3176	4180	956	3176	4132	1024	1400	2424
Al	9.76	60.84	70.6	10.16	2.04	12.2	19.43	72.26	91.69	17.32	75.84	93.16	19.09	80.20	99.29
As	0.14	0.90	1.04	0.12	0.90	1.02	0.23	0.70	0.93	<0.01	0.67	0.67	0.41	0.70	1.11
B	0.30	256.6	256.9	0.32	15.66	15.98	0.70	301.9	302.6	0.59	296.7	297.3	0.64	391.5	392.1
Ba	0.02	1.48	1.50	0.02	1.72	1.74	0.04	1.88	1.92	0.04	1.93	1.97	0.04	2.09	2.13
Ca	0.10	27.06	27.16	0.12	23.73	23.85	0.19	25.87	26.06	0.19	24.32	24.51	0.21	23.90	24.11
Cd	0.21	9.49	9.70	0.20	10.57	10.77	0.44	11.14	11.58	0.40	11.51	11.91	0.45	12.53	12.98
Cr	0.55	1.02	1.57	0.54	1.10	1.64	1.11	1.13	2.24	1.10	1.16	2.26	1.08	1.17	2.25
Cs	<0.1	5.50	5.50	<0.1	5.50	5.50	<0.1	6.40	6.4	<0.1	6.20	6.20	<0.1	6.80	6.80
Cu	0.05	0.47	0.52	0.08	0.51	0.59	0.13	0.51	0.64	0.16	0.52	0.68	0.14	0.56	0.70
Fe	109.1	25.56	134.7	112.9	25.55	138.5	233.6	28.72	262.3	213.9	29.00	242.9	222.2	29.58	251.8
K	0.18	8.45	8.63	0.18	9.39	9.57	0.36	11.00	11.36	0.30	11.61	11.91	0.36	12.34	12.7
Li	0.53	75.28	75.81	0.58	3.01	3.59	1.19	92.19	93.38	1.13	97.21	98.34	1.21	103.9	105.1
Mg	0.38	24.36	24.74	0.40	1.53	1.93	0.81	26.62	27.43	0.75	27.27	28.02	0.79	28.14	28.93
Mn	0.39	31.53	31.92	0.44	1.67	2.11	0.95	34.73	35.68	0.86	36.26	37.12	0.93	38.38	39.31
Na	0.32	147.3	147.6	0.46	5.61	6.07	0.72	186.9	187.6	0.71	186.7	187.4	0.72	228.2	228.9
Ni	1.18	8.36	9.54	1.19	8.89	10.08	2.52	10.14	12.66	2.40	10.46	12.86	2.68	10.91	13.59
P	1.15	2.20	3.35	1.33	2.22	3.55	2.75	2.64	5.39	1.62	2.79	4.41	3.11	2.77	5.88
Pb	0.16	4.22	4.38	0.18	4.59	4.77	0.33	4.32	4.65	0.36	4.41	4.77	0.34	4.71	5.05
Sb	0.57	0.12	0.69	0.71	0.15	0.86	1.06	<0.03	1.06	0.94	<0.03	0.94	0.58	0.08	0.66
Se	7.67	117.3	125.0	8.37	121.1	129.5	16.97	125.4	142.4	16.26	135.0	151.3	17.93	135.4	153.3
Si	79.53	17.75	97.28	86.45	19.86	106.3	165.6	21.78	187.4	174.8	22.06	196.9	160.6	23.31	183.9
Sr	0.15	40.07	40.22	0.16	2.03	2.19	0.34	47.65	47.99	0.32	50.30	50.62	0.35	53.36	53.71
Te	1.59	11.25	12.84	1.61	10.70	12.31	2.86	9.20	12.06	2.82	9.38	12.2	3.02	9.53	12.55
Ti	0.54	0.24	0.78	0.55	0.26	0.81	1.13	0.28	1.41	1.08	0.29	1.37	1.16	0.29	1.45
Zn	0.78	37.12	37.9	0.84	43.68	44.52	1.68	42.20	43.88	1.59	44.90	46.49	1.65	47.61	49.26
Zr	9.92	21.39	31.31	11.10	21.40	32.5	22.03	24.97	47.00	21.20	25.34	46.54	23.70	26.81	50.51
Cl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I	<0.1	NA	NC	<0.1	NA	NC	<0.1	NA	NC	<0.1	NA	NC	<0.1	NA	NC
Nitrate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	0.88	NA	NC	1.24	NA	NC	2.53	NA	NC	<0.1	NA	NC	<0.1	NA	NC

* Suspended

Dissolved

NA - Not Analyzed

NC - Not Calculated

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	5			6											
I.D.	12L-S-116A			12L-S-147A			12L-S-150A			12L-SS-155A			12M-S-7A		
Glass (kg)	16199			16283			16367			16452			16536		
pH	1.05			4.27			7.13			6.89			6.71		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	1076	3356	4432	50	284	334	214	284	498	256	348	604	260	288	548
Al	19.56	82.36	101.9	1.51	2.82	4.33	11.44	0.31	11.75	11.94	1.22	13.16	12.06	3.54	15.6
As	0.30	0.70	1.00	0.03	<0.05	0.03	<0.01	<0.05	<0.05	0.12	<0.05	0.12	0.18	<0.05	0.18
B	0.70	393.6	394.3	0.06	12.92	12.98	2.23	22.66	24.89	2.73	31.20	33.93	2.61	40.11	42.72
Ba	0.05	2.06	2.11	<0.01	0.07	0.07	0.06	0.07	0.13	0.07	0.07	0.14	0.07	0.07	0.14
Ca	0.24	22.76	23.00	0.06	29.16	29.22	1.09	26.64	27.73	1.26	28.52	29.78	1.21	25.46	26.67
Cd	0.51	12.46	12.97	0.03	0.39	0.42	0.65	0.40	1.05	0.89	0.61	1.50	1.11	1.00	2.11
Cr	1.16	1.14	2.30	0.06	0.09	0.15	0.22	0.02	0.24	0.24	0.02	0.26	0.28	0.03	0.31
Cs	<0.1	7.30	7.30	<0.1	0.23	0.23	<0.1	0.66	0.66	<0.1	0.88	0.88	<0.1	0.99	0.99
Cu	0.16	0.56	0.72	0.02	0.01	0.03	0.06	0.01	0.07	0.07	0.02	0.09	0.07	0.02	0.09
Fe	246.0	29.05	275.1	7.03	0.21	7.24	28.70	0.01	28.71	36.27	0.01	36.28	38.10	0.02	38.12
K	0.40	12.57	12.97	0.01	4.01	4.02	0.16	4.51	4.67	0.16	4.12	4.28	0.18	3.63	3.81
Li	1.28	89.84	91.12	0.06	3.69	3.75	1.76	5.64	7.40	2.18	6.29	8.47	2.09	6.48	8.57
Mg	0.84	28.79	29.63	0.06	8.96	9.02	1.63	9.26	10.89	2.09	8.87	10.96	2.26	8.24	10.5
Mn	1.00	40.09	41.09	0.08	1.13	1.21	0.93	0.91	1.84	1.21	0.87	2.08	1.18	0.87	2.05
Na	0.78	217.3	218.1	0.09	19.95	20.04	3.15	25.12	28.27	3.44	26.46	29.9	3.68	25.97	29.65
Ni	2.89	11.04	13.93	0.24	0.51	0.75	1.53	0.37	1.90	1.78	0.39	2.17	1.95	0.44	2.39
P	3.31	2.58	5.89	0.18	<0.07	0.18	0.44	<0.07	0.44	0.30	<0.07	0.30	0.49	0.17	0.66
Pb	0.36	4.87	5.23	<0.01	0.08	0.08	0.33	0.09	0.42	0.44	0.12	0.56	0.54	0.14	0.68
Sb	0.73	0.10	0.83	0.05	<0.03	0.05	0.37	<0.03	0.37	0.24	0.06	0.30	0.36	0.06	0.42
Se	19.94	139.9	159.8	0.86	9.77	10.63	2.64	26.53	29.17	2.74	39.44	42.18	3.06	53.66	56.72
Si	164.3	23.32	187.6	9.98	2.97	12.95	33.91	4.50	38.41	42.31	5.26	47.57	41.79	5.24	47.03
Sr	0.37	55.37	55.74	0.02	2.22	2.24	0.54	6.39	6.93	0.74	7.53	8.27	0.73	7.79	8.52
Te	3.09	9.49	12.58	0.29	0.31	0.60	1.58	0.31	1.89	2.62	0.30	2.92	3.78	0.49	4.27
Ti	1.25	0.28	1.53	0.06	0.01	0.07	0.25	<0.01	0.25	0.30	<0.01	0.3	0.33	0.01	0.34
Zn	1.75	31.91	33.66	0.12	1.44	1.56	2.55	1.03	3.58	2.71	1.23	3.94	2.77	1.61	4.38
Zr	25.42	26.89	52.31	1.23	0.23	1.46	3.36	0.02	3.38	3.64	0.01	3.65	3.93	0.03	3.96
Cl	NA	NA	NA	NA	31.98	31.98	NA	NA	NA	NA	NA	NA	NA	NA	NA
F	NA	NA	NA	NA	2.42	2.42	NA	NA	NA	NA	NA	NA	NA	NA	NA
I	<0.1	NA	NC	NA	2.26	2.26	<0.1	NA	NC	<0.1	NA	NC	<0.1	NA	NC
Nitrate	NA	NA	NA	NA	209.1	209.1	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	NA	NA	NA	NA	<0.1	<0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	3.33	NA	NC	NA	56.32	56.32	<0.1	NA	NC	0.20	NA	NC	<0.1	NA	NC

* Suspended

Dissolved

NA - Not Analyzed

NC - Not Calculated

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	6														
I.D.	12M-S-10A			12M-S-21A			12M-S-24A			12M-S-29A			12M-S-33A		
Glass (kg)	16621			16706			16809			16912			17015		
pH	6.47			6.55			2.2			6.61			6.72		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	230	368	598	248	368	616	5	888	893	202	440	642	192	252	444
Al	9.39	4.57	13.96	10.11	4.67	14.78	0.21	4.19	4.40	8.22	4.35	12.57	7.40	4.55	11.95
As	0.11	<0.05	0.11	0.08	0.64	0.72	<0.05	0.57	0.57	0.08	0.66	0.74	0.11	0.63	0.74
B	2.23	46.65	48.88	2.42	50.62	53.04	0.05	52.02	52.07	1.75	54.48	56.23	1.63	53.95	55.58
Ba	0.07	0.06	0.13	0.08	0.06	0.14	<0.01	0.06	0.06	0.06	0.06	0.12	0.05	0.05	0.10
Ca	1.02	22.87	23.89	1.05	21.07	22.12	0.02	18.95	18.97	0.76	17.81	18.57	0.65	16.09	16.74
Cd	1.13	1.17	2.30	1.29	1.18	2.47	0.03	1.06	1.09	1.26	1.22	2.48	1.23	1.18	2.41
Cr	0.27	0.04	0.31	0.30	0.01	0.31	0.01	0.02	0.03	0.27	0.05	0.32	0.26	0.02	0.28
Cs	<0.1	1.10	1.10	<0.1	1.20	1.20	0.11	1.20	1.31	0.16	1.30	1.46	<0.1	1.30	1.30
Cu	0.08	0.01	0.09	0.08	0.01	0.09	<0.01	0.02	0.02	0.06	0.02	0.08	0.06	0.01	0.07
Fe	37.51	0.03	37.54	41.21	0.02	41.23	0.80	0.02	0.82	33.35	0.05	33.4	31.85	<0.01	31.85
K	0.15	3.22	3.37	0.17	3.11	3.28	<0.01	2.82	2.82	0.15	2.58	2.73	0.14	2.51	2.65
Li	1.78	6.25	8.03	1.93	6.41	8.34	0.04	6.05	6.09	1.44	5.85	7.29	1.28	5.72	7.00
Mg	2.09	7.66	9.75	2.40	7.22	9.62	0.05	6.58	6.63	1.95	6.39	8.34	1.76	5.89	7.65
Mn	1.06	0.87	1.93	1.17	0.83	2.00	0.02	0.76	0.78	0.94	0.74	1.68	0.99	0.70	1.69
Na	2.81	24.14	26.95	3.04	24.09	27.13	0.06	22.76	22.82	2.40	21.61	24.01	2.21	20.83	23.04
Ni	1.82	0.43	2.25	1.99	0.39	2.38	0.04	0.37	0.41	1.68	0.41	2.09	1.52	0.31	1.83
P	0.27	0.26	0.53	0.29	<0.07	0.29	0.01	<0.07	0.01	0.33	0.13	0.46	0.33	0.12	0.45
Pb	0.54	0.14	0.68	0.59	0.13	0.72	0.01	0.13	0.14	0.53	0.16	0.69	0.45	0.09	0.54
Sb	0.21	0.10	0.31	0.21	0.15	0.36	0.01	0.24	0.25	0.27	0.29	0.56	0.17	0.19	0.36
Se	2.49	65.82	68.31	2.81	76.55	79.36	0.07	77.67	77.74	2.85	78.32	81.17	3.09	88.95	92.04
Si	40.86	5.65	46.51	42.08	6.28	48.36	0.74	6.20	6.94	30.61	6.54	37.15	27.88	6.82	34.7
Sr	0.64	7.72	8.36	0.75	8.30	9.05	0.02	7.98	8.00	0.57	7.91	8.48	0.50	7.76	8.26
Te	4.47	0.77	5.24	4.76	1.01	5.77	0.10	1.29	1.39	4.82	1.67	6.49	4.96	1.40	6.36
Ti	0.30	0.01	0.31	0.35	<0.01	0.35	0.01	0.01	0.02	0.29	0.03	0.32	0.27	<0.01	0.27
Zn	2.29	1.61	3.90	2.49	1.57	4.06	0.05	1.33	1.38	1.96	1.47	3.43	1.87	1.41	3.28
Zr	3.19	0.03	3.22	3.32	0.01	3.33	0.07	0.01	0.08	2.53	0.04	2.57	2.36	<0.01	2.36
Cl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I	<0.1	NA	NC	<0.1	NA	NC	<0.1	NA	NC	<0.1	NA	NC	NA	NA	NA
Nitrate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	0.18	NA	NC	<0.1	NA	NC	<0.1	NA	NC	<0.1	NA	NC	NA	NA	NA

* Suspended

Dissolved

NA - Not Analyzed

NC - Not Calculated

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	6														
I.D.	12M-S-40A			12M-S-49A			12M-S-55A			12M-S-61A			12M-S-63A		
Glass (kg)	17118			17222			17321			17421			17521		
pH	6.72			6.54			6.50			6.33			6.43		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	190	196	386	204	214	418	206	264	470	202	274	476	195	242	437
Al	7.52	4.25	11.77	8.21	4.25	12.46	8.07	4.85	12.92	7.91	4.69	12.6	7.21	5.52	12.73
As	0.13	0.61	0.74	0.23	0.66	0.89	0.13	0.81	0.94	0.05	0.96	1.01	0.06	0.95	1.01
B	1.71	53.96	55.67	1.88	<0.03	1.88	1.79	57.85	59.64	1.68	58.94	60.62	1.58	60.90	62.48
Ba	0.06	0.05	0.11	0.05	0.06	0.11	0.06	0.05	0.11	0.05	0.05	0.10	0.05	0.06	0.11
Ca	0.65	14.53	15.18	0.61	2.34	2.95	0.55	12.55	13.1	0.51	11.73	12.24	0.43	10.98	11.41
Cd	1.32	1.06	2.38	1.46	1.19	2.65	1.39	1.39	2.78	1.45	1.52	2.97	1.34	1.84	3.18
Cr	0.27	0.01	0.28	0.26	0.03	0.29	0.29	0.03	0.32	0.29	0.04	0.33	0.30	0.06	0.36
Cs	<0.1	1.30	1.30	<0.1	1.30	1.30	<0.1	1.30	1.30	<0.1	1.40	1.40	<0.1	1.40	1.40
Cu	0.06	0.01	0.07	0.06	0.01	0.07	0.06	0.02	0.08	0.05	0.02	0.07	0.06	0.02	0.08
Fe	32.00	0.01	32.01	34.74	0.03	34.77	34.06	0.01	34.07	35.14	0.03	35.17	34.19	0.03	34.22
K	0.14	2.42	2.56	0.15	2.30	2.45	0.15	2.30	2.45	0.16	2.05	2.21	0.14	1.90	2.04
Li	1.31	5.46	6.77	1.41	2.54	3.95	1.45	5.61	7.06	1.38	5.55	6.93	1.24	5.70	6.94
Mg	1.87	5.43	7.30	1.98	1.34	3.32	2.00	5.13	7.13	1.93	4.90	6.83	1.67	4.78	6.45
Mn	0.96	0.66	1.62	1.00	0.61	1.61	0.87	0.64	1.51	0.85	0.60	1.45	0.95	0.62	1.57
Na	2.26	19.80	22.06	2.55	0.11	2.66	2.46	19.78	22.24	2.34	19.45	21.79	2.15	19.50	21.65
Ni	1.56	0.28	1.84	1.61	0.31	1.92	1.65	0.32	1.97	1.69	0.33	2.02	1.65	0.37	2.02
P	0.37	0.22	0.59	0.35	0.63	0.98	0.40	0.47	0.87	0.26	0.32	0.58	0.25	0.42	0.67
Pb	0.49	0.11	0.6	0.47	0.12	0.59	0.53	0.11	0.64	0.54	0.14	0.68	0.48	0.14	0.62
Sb	0.14	0.36	0.5	0.19	0.47	0.66	0.16	0.48	0.64	0.25	0.47	0.72	0.21	0.45	0.66
Se	3.61	91.45	95.06	4.08	100.5	104.6	4.64	109.8	114.4	4.79	110.2	115.0	5.17	112.1	117.3
Si	27.50	6.89	34.39	29.82	2.05	31.87	28.52	7.71	36.23	28.60	7.88	36.48	25.85	8.45	34.3
Sr	0.53	7.67	8.20	0.55	2.05	2.60	0.54	8.26	8.80	0.52	8.30	8.82	0.45	8.34	8.79
Te	4.93	1.76	6.69	5.04	2.03	7.07	5.12	2.35	7.47	5.26	2.66	7.92	5.32	2.68	8.00
Ti	0.27	0.01	0.28	0.29	0.01	0.30	0.30	0.02	0.32	0.31	0.02	0.33	0.33	0.03	0.36
Zn	1.92	1.24	3.16	1.94	1.38	3.32	1.84	1.52	3.36	1.75	1.57	3.32	1.56	1.77	3.33
Zr	2.20	0.01	2.21	2.33	0.02	2.35	2.20	0.02	2.22	2.06	0.02	2.08	2.06	0.03	2.09
Cl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I	NA	NA	NA	NA	NA	NA	<0.1	NA	NC	<0.1	NA	NC	NA	NA	NA
Nitrate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	NA	NA	NA	NA	NA	NA	0.15	NA	NC	<0.1	NA	NC	NA	NA	NA

* Suspended

Dissolved

NA - Not Analyzed

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	6														
I.D.	12M-S-78A			12M-S-82A			12M-S-90A			12M-S-97A			12M-S-102A		
Glass (kg)	17620			17720			17820			17920			18020		
pH	4.24			4.51			4.51			4.36			4.24		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	560	172	732	600	230	830	492	262	754	576	234	810	536	211	747
Al	14.21	9.64	23.85	18.30	10.16	28.46	15.68	10.82	26.5	16.00	11.44	27.44	13.48	11.46	24.94
As	0.24	0.99	1.23	0.21	1.19	1.40	0.24	1.26	1.50	0.28	1.05	1.33	<0.01	1.22	1.22
B	3.07	71.87	74.94	3.62	73.36	76.98	3.03	74.22	77.25	3.11	76.31	79.42	3.36	74.60	77.96
Ba	0.11	0.11	0.22	0.14	0.11	0.25	0.11	0.12	0.23	0.13	0.09	0.22	0.12	0.08	0.20
Ca	0.59	10.99	11.58	0.72	10.39	11.11	0.57	9.79	10.36	0.62	8.96	9.58	0.54	8.02	8.56
Cd	0.99	3.67	4.66	1.29	3.77	5.06	1.61	4.21	5.82	1.72	4.42	6.14	1.42	4.75	6.17
Cr	0.92	0.05	0.97	0.80	0.04	0.84	0.93	0.04	0.97	1.18	0.05	1.23	1.11	0.06	1.17
Cs	<0.1	1.40	1.40	0.15	1.50	1.65	<0.1	2.30	2.3	<0.1	2.30	2.30	0.15	2.40	2.55
Cu	0.12	0.05	0.17	0.15	0.05	0.20	0.10	0.06	0.16	0.12	0.06	0.18	0.12	0.06	0.18
Fe	128.1	0.39	128.5	120.8	0.25	121.1	96.46	0.14	96.6	119.8	0.18	112.0	110.1	0.26	110.4
K	0.44	2.25	2.69	0.42	2.40	2.82	0.36	2.85	3.21	0.45	2.01	2.46	0.37	1.79	2.16
Li	2.44	6.18	8.62	2.89	6.94	9.83	2.42	7.76	10.18	2.49	7.37	9.86	2.00	7.13	9.13
Mg	0.93	6.54	7.47	1.67	6.41	8.08	1.52	6.28	7.8	1.23	6.09	7.32	0.88	5.65	6.53
Mn	2.99	0.85	3.84	3.04	1.02	4.06	2.16	1.13	3.29	2.55	0.96	3.51	2.18	0.96	3.14
Na	4.43	19.96	24.39	5.36	21.38	26.74	4.38	24.09	28.47	4.54	22.13	26.67	4.62	20.93	25.55
Ni	5.80	0.33	6.13	5.54	0.34	5.88	4.49	0.37	4.86	5.46	0.30	5.76	5.04	0.31	5.35
P	0.77	0.81	1.58	0.88	0.78	1.66	1.10	0.96	2.06	1.23	0.45	1.68	0.81	0.81	1.62
Pb	1.52	0.15	1.67	1.42	0.17	1.59	1.50	0.20	1.70	1.89	0.18	2.07	1.77	0.21	1.98
Sb	0.71	0.19	0.90	0.58	0.32	0.90	0.45	0.48	0.93	0.25	0.09	0.34	0.59	0.33	0.92
Se	20.24	120.8	141.0	19.47	131.8	151.3	16.64	133.4	150.0	23.10	135.8	158.9	23.91	135.7	159.6
Si	80.71	13.84	94.55	86.45	14.08	100.5	67.75	14.56	82.31	75.83	14.78	90.61	80.92	14.87	95.79
Sr	0.61	8.92	9.53	0.86	10.08	10.94	0.83	10.69	11.52	0.90	10.00	10.9	0.74	9.37	10.11
Te	13.80	5.18	18.98	14.25	3.67	17.92	18.93	4.65	23.58	22.60	5.58	28.18	3.47	6.56	10.03
Ti	1.01	0.03	1.04	1.02	0.02	1.04	0.88	0.02	0.90	1.05	0.02	1.07	0.92	0.03	0.95
Zn	2.36	2.94	5.30	2.83	3.57	6.40	2.31	3.83	6.14	2.38	4.07	6.45	1.96	4.10	6.06
Zr	3.05	2.22	5.27	4.93	2.10	7.03	4.26	1.87	6.13	4.18	1.58	5.76	2.76	1.83	4.59
Cl	NA	NA	NA	NA	54.66	54.66	NA	NA	NA	NA	NA	NA	NA	NA	NA
F	NA	NA	NA	NA	84.48	84.48	NA	NA	NA	NA	NA	NA	NA	NA	NA
I	NA	NA	NA	NA	57.52	57.52	<0.1	NA	NC	<0.1	NA	NC	<0.1	NA	NC
Nitrate	NA	NA	NA	NA	115.9	115.9	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	NA	NA	NA	NA	<0.1	<0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	NA	NA	NA	NA	312.8	312.8	<0.1	NA	NC	0.42	NA	NC	<0.1	NA	NC

* Suspended

Dissolved

NA - Not Analyzed

NC - Not Calculated

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	7														
I.D.	12M-S-142A			12M-S-144A			12M-S-146A			12M-S-148A			12M-S-150A		
Glass (kg)	18100			18233			18366			18499			18632		
pH	4.32			3.44			3.10			2.84			2.70		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	136	156	292	126	224	350	156	268	424	158	770	928	202	572	774
Al	3.53	7.05	10.58	2.25	11.32	13.57	2.37	14.94	17.31	2.02	18.00	20.02	2.23	20.91	23.14
As	0.03	0.48	0.51	0.18	0.67	0.85	0.06	0.88	0.94	<0.01	1.27	1.27	<0.01	1.48	1.48
B	1.06	16.58	17.64	0.95	28.75	29.7	1.15	44.83	45.98	1.06	66.21	67.27	1.16	83.88	85.04
Ba	0.02	0.10	0.12	0.02	0.11	0.13	0.02	0.13	0.15	0.03	0.15	0.18	0.04	0.15	0.19
Ca	0.24	39.43	39.67	0.22	34.60	34.82	0.25	34.15	34.4	0.24	29.66	29.9	0.26	27.48	27.74
Cd	0.19	1.22	1.41	0.14	2.28	2.42	0.14	3.59	3.73	0.15	4.90	5.05	0.16	5.52	5.68
Cr	0.15	0.05	0.20	0.15	0.11	0.26	0.18	0.17	0.35	0.19	0.22	0.41	0.23	0.26	0.49
Cs	<0.1	0.64	0.64	<0.1	0.37	0.37	<0.1	1.70	1.70	<0.1	2.20	2.20	<0.1	2.80	2.80
Cu	0.04	0.03	0.07	0.04	0.06	0.10	0.04	0.08	0.12	0.04	0.09	0.13	0.04	0.11	0.15
Fe	20.34	0.25	20.59	25.73	1.20	26.93	33.67	2.10	35.77	33.86	3.13	36.99	41.77	4.00	45.77
K	0.08	3.23	3.31	0.08	2.91	2.99	0.10	3.17	3.27	0.10	3.26	3.36	0.10	3.26	3.36
Li	0.81	3.64	4.45	0.73	4.43	5.16	0.91	5.41	6.32	0.89	6.71	7.60	0.95	8.00	8.95
Mg	0.26	11.30	11.56	0.20	10.81	11.01	0.24	10.19	10.43	0.24	9.39	9.63	0.29	8.96	9.25
Mn	0.56	0.82	1.38	0.25	1.72	1.97	0.16	2.88	3.04	0.08	4.10	4.18	0.09	4.65	4.74
Na	1.50	24.12	25.62	1.34	24.69	26.03	1.64	26.05	27.69	1.57	28.27	29.84	1.71	37.68	39.39
Ni	1.13	0.18	1.31	1.36	0.23	1.59	1.73	0.28	2.01	1.68	0.33	2.01	1.98	0.35	2.33
P	0.12	<0.07	0.12	0.08	0.22	0.3	0.11	0.73	0.84	0.05	0.50	0.55	0.08	0.57	0.65
Pb	0.34	0.10	0.44	0.27	0.36	0.63	0.28	0.64	0.92	0.27	0.91	1.18	0.28	1.14	1.42
Sb	0.20	0.22	0.42	0.20	0.27	0.47	0.29	0.43	0.72	0.27	0.93	1.20	0.29	0.54	0.83
Se	2.72	50.30	53.02	3.54	73.54	77.08	5.71	87.79	93.5	17.44	91.74	109.2	45.56	98.66	144.2
Si	25.29	4.62	29.91	23.04	10.52	33.56	26.68	15.91	42.59	23.18	21.88	45.06	27.90	27.14	55.04
Sr	0.19	3.56	3.75	0.13	4.69	4.82	0.18	5.68	5.86	0.20	6.70	6.90	0.25	7.68	7.93
Te	2.84	2.79	5.63	2.54	7.88	10.42	2.86	12.75	15.61	2.23	17.80	20.03	2.49	22.18	24.67
Ti	0.25	0.02	0.27	0.22	0.08	0.30	0.27	0.11	0.38	0.27	0.16	0.43	0.30	0.18	0.48
Zn	0.80	1.53	2.33	0.75	2.11	2.86	0.90	2.68	3.58	0.88	3.22	4.10	0.93	4.56	5.49
Zr	1.55	0.85	2.40	0.55	3.04	3.59	0.56	4.98	5.54	0.49	6.99	7.48	0.54	8.34	8.88
Cl	NA	48.53	48.53	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F	NA	38.72	38.72	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I	NA	16.17	16.17	NA	NA	NA	NA	NA	NA	<0.1	NA	NC	<0.1	NA	NC
Nitrate	NA	9.29	9.29	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	NA	<0.1	<0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	NA	143.0	143.0	NA	NA	NA	NA	NA	NA	<0.1	NA	NC	<0.1	NA	NC

* Suspended

Dissolved

NA - Not Analyzed

NC - Not Calculated

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	7														
I.D.	12N-S-6A			12N-S-11A			12N-S-12A			12N-S-16A			12N-S-17A		
Glass (kg)	18760			18888			19016			19145			19272		
pH	2.56			2.51			2.35			2.29			2.29		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	224	604	828	240	774	1014	306	832	1138	342	920	1262	370	992	1362
Al	2.13	23.26	25.39	1.94	23.70	25.64	2.18	25.47	27.65	2.37	27.12	29.49	2.53	29.23	31.76
As	0.06	2.11	2.17	<0.01	2.26	2.26	0.32	2.65	2.97	<0.01	2.83	2.83	<0.01	3.27	3.27
B	1.07	90.21	91.28	1.06	100.1	101.2	1.23	111.6	112.8	1.34	121.2	122.5	1.37	127.8	129.2
Ba	0.04	0.19	0.23	0.04	0.18	0.22	0.05	0.17	0.22	0.06	0.17	0.23	0.07	0.16	0.23
Ca	0.24	25.40	25.64	0.22	23.17	23.39	0.24	21.00	21.24	0.27	19.31	19.58	0.28	17.87	18.15
Cd	0.15	7.34	7.49	0.15	8.66	8.81	0.17	9.79	9.96	0.19	11.27	11.46	0.20	12.58	12.78
Cr	0.21	0.28	0.49	0.21	0.31	0.52	0.24	0.33	0.57	0.25	0.36	0.61	0.28	0.40	0.68
Cs	<0.1	3.30	3.30	<0.1	3.70	3.70	<0.1	4.00	4.00	<0.1	4.40	4.40	0.10	4.70	4.80
Cu	0.03	0.12	0.15	0.02	0.13	0.15	0.04	0.15	0.19	0.07	0.15	0.22	0.04	0.17	0.21
Fe	38.22	4.65	42.87	37.01	4.92	41.93	45.15	5.29	50.44	50.71	5.71	56.42	55.70	6.26	61.96
K	0.10	4.52	4.62	0.10	4.42	4.52	0.11	4.49	4.6	0.12	4.35	4.47	0.14	4.65	4.79
Li	0.90	9.34	10.24	0.86	9.74	10.6	0.94	10.51	11.45	1.03	11.29	12.32	1.04	12.14	13.18
Mg	0.26	8.53	8.79	0.25	7.88	8.13	0.28	7.34	7.62	0.32	6.93	7.25	0.35	6.62	6.97
Mn	0.08	5.78	5.86	0.07	6.31	6.38	0.09	7.02	7.11	0.08	7.54	7.62	0.10	8.07	8.17
Na	1.55	32.69	34.24	1.49	32.69	34.18	1.65	33.34	34.99	1.88	34.85	36.73	1.88	35.29	37.17
Ni	1.82	0.47	2.29	1.74	0.52	2.26	2.02	0.62	2.64	2.20	0.69	2.89	2.41	0.79	3.20
P	0.06	0.79	0.85	0.10	0.86	0.96	0.21	1.02	1.23	0.06	0.95	1.01	<0.01	0.88	0.88
Pb	0.23	1.43	1.66	0.21	1.59	1.80	0.22	1.82	2.04	0.27	1.96	2.23	0.31	2.04	2.35
Sb	0.30	0.69	0.99	0.31	0.78	1.09	0.41	0.83	1.24	0.33	0.86	1.19	0.50	0.94	1.44
Se	78.52	95.98	174.5	102.8	91.92	194.7	134.6	82.33	216.9	77.76	75.10	152.9	192.8	67.21	260.0
Si	23.78	33.72	57.5	19.78	36.47	56.25	23.30	39.64	62.94	28.45	42.82	71.27	27.25	45.80	73.05
Sr	0.24	8.40	8.64	0.24	8.53	8.77	0.27	8.97	9.24	0.33	9.40	9.73	0.38	10.02	10.4
Te	2.15	29.89	32.04	1.96	31.27	33.23	2.31	34.90	37.21	4.05	37.73	41.78	2.67	41.68	44.35
Ti	0.28	0.21	0.49	0.28	0.23	0.51	0.32	0.26	0.58	0.35	0.28	0.63	0.38	0.30	0.68
Zn	0.92	4.52	5.44	0.90	4.71	5.61	1.03	4.94	5.97	1.10	5.26	6.36	1.13	5.65	6.78
Zr	0.47	9.72	10.19	0.44	10.15	10.59	0.49	10.76	11.25	0.55	11.44	11.99	0.57	12.05	12.62
Cl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I	<0.1	NA	NC	<0.1	NA	NC	NA	NA	NA	<0.1	NA	NC	<0.1	NA	NC
Nitrate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	<0.1	NA	NC	<0.1	NA	NC	NA	NA	NA	0.26	NA	NC	<0.1	NA	NC

* Suspended

Dissolved

NA - Not Analyzed

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	7														
I.D.	12N-S-19A			12N-S-20A			12N-S-21A			12N-S-36A			12N-S-38A		
Glass (kg)	19399			19526			19653			19774			19896		
pH	2.25			2.26			2.26			2.30			2.30		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	412	1044	1456	442	1348	1790	486	1300	1786	678	2136	2814	548	2048	2596
Al	2.71	29.52	32.23	2.89	32.00	34.89	2.99	31.99	34.98	4.05	36.54	40.59	2.95	36.58	39.53
As	0.12	3.54	3.66	0.52	3.88	4.40	0.52	4.32	4.84	0.36	4.94	5.30	0.47	4.87	5.34
B	1.49	139.6	141.1	1.57	141.7	143.3	1.77	148.8	150.6	2.18	164.0	166.2	1.72	166.7	168.4
Ba	0.08	0.12	0.20	0.09	0.10	0.19	0.10	0.08	0.18	0.17	0.10	0.27	0.13	0.10	0.23
Ca	0.30	16.60	16.9	0.30	15.40	15.7	0.31	13.70	14.01	0.44	11.89	12.33	0.30	11.55	11.85
Cd	0.21	13.77	13.98	0.23	15.02	15.25	0.26	12.35	12.61	0.44	14.26	14.7	0.29	15.51	15.8
Cr	0.30	0.40	0.7	0.33	0.42	0.75	0.33	0.41	0.74	0.58	0.50	1.08	0.37	0.52	0.89
Cs	0.11	5.00	5.11	<0.1	5.20	5.20	<0.1	5.40	5.40	<0.1	5.40	5.40	<0.1	5.80	5.80
Cu	0.04	0.17	0.21	0.04	0.17	0.21	0.05	0.17	0.22	0.03	0.18	0.21	0.05	0.18	0.23
Fe	55.13	6.64	61.77	65.44	7.18	72.62	68.76	7.32	76.08	94.00	8.61	102.6	68.56	8.72	77.28
K	0.15	4.46	4.61	0.17	4.54	4.71	0.17	4.59	4.76	0.27	4.72	4.99	0.18	4.86	5.04
Li	1.20	12.80	14.00	1.18	13.53	14.71	1.29	13.76	15.05	1.73	16.34	18.07	1.26	16.97	18.23
Mg	0.37	6.27	6.64	0.40	6.02	6.42	0.41	5.61	6.02	0.55	5.38	5.93	0.38	5.36	5.74
Mn	0.11	8.59	8.70	0.13	9.11	9.24	0.13	9.09	9.22	0.17	10.98	11.15	0.16	11.17	11.33
Na	2.11	36.37	38.48	2.07	38.09	40.16	2.27	37.88	40.15	3.01	42.18	45.19	2.19	42.54	44.73
Ni	2.57	0.83	3.40	3.12	0.95	4.07	3.49	0.98	4.47	4.98	1.34	6.32	3.23	1.29	4.52
P	0.14	1.03	1.17	0.24	0.98	1.22	0.16	0.97	1.13	0.25	1.16	1.41	0.16	1.01	1.17
Pb	0.32	2.03	2.35	0.36	2.02	2.38	0.38	2.13	2.51	0.66	2.38	3.04	0.50	2.35	2.85
Sb	0.46	0.99	1.45	0.50	1.10	1.6	0.57	1.07	1.64	1.18	1.24	2.42	0.68	1.27	1.95
Se	208.9	54.99	263.9	198.4	43.03	241.4	234.5	40.59	275.1	328.3	53.88	382.2	278.1	53.25	331.4
Si	28.15	46.89	75.04	30.56	51.14	81.7	32.22	52.03	84.25	41.95	57.99	99.94	32.81	58.61	91.42
Sr	0.42	10.27	10.69	0.45	10.83	11.28	0.52	10.90	11.42	1.02	11.82	12.84	0.72	12.36	13.08
Te	2.99	43.07	46.06	3.23	43.97	47.2	3.93	47.29	51.22	5.28	52.04	57.32	4.26	50.76	55.02
Ti	0.41	0.32	0.73	0.45	0.32	0.77	0.47	0.33	0.80	0.74	0.35	1.09	0.51	0.37	0.88
Zn	1.26	5.95	7.21	1.37	6.25	7.62	1.50	6.39	7.89	1.97	7.30	9.27	1.49	7.57	9.06
Zr	0.58	12.60	13.18	0.63	13.10	13.73	0.71	13.28	13.99	1.29	14.46	15.75	0.84	15.06	15.9
Cl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I	<0.1	NA	NC	NA	NA	NA	NA	NA	NA	<0.1	NA	NC	NA	NA	NA
Nitrate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	1.01	NA	NC	NA	NA	NA	NA	NA	NA	<0.1	NA	NC	NA	NA	NA

* Suspended

Dissolved

NA - Not Analyzed

NC - Not Calculated

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	7														
I.D.	12N-S-39A			12N-S-46A			12N-S-48A			12N-S-50A			12N-S-51A		
Glass (kg)	20017			20121			20225			20329			20433		
pH	2.31			2.26			2.28			2.31			2.30		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	512	2136	2648	476	2116	2592	486	2360	2846	478	2104	2582	692	2128	2820
Al	2.73	37.48	40.21	2.73	35.88	38.61	2.77	36.36	39.13	2.72	35.17	37.89	3.83	33.76	37.59
As	0.19	5.01	5.20	0.19	4.98	5.17	0.10	4.97	5.07	0.68	5.07	5.75	1.06	5.08	6.14
B	1.48	170.9	172.4	1.48	174.0	175.5	1.51	168.1	169.6	1.46	168.5	170.0	1.97	171.0	173.0
Ba	0.12	0.08	0.20	0.12	0.08	0.20	0.13	0.08	0.21	0.11	0.08	0.19	0.15	0.08	0.23
Ca	0.27	10.28	10.55	0.27	9.19	9.46	0.26	9.62	9.88	0.26	8.41	8.67	0.35	7.69	8.04
Cd	0.24	15.66	15.9	0.24	15.74	15.98	0.23	15.60	15.83	0.24	16.63	16.87	0.32	15.97	16.29
Cr	0.34	0.53	0.87	0.34	0.52	0.86	0.33	0.53	0.86	0.30	0.51	0.81	0.47	0.51	0.98
Cs	<0.1	6.30	6.30	<0.1	5.70	5.70	0.14	6.20	6.34	<0.1	5.70	5.70	<0.1	6.10	6.10
Cu	0.04	0.18	0.22	0.04	0.17	0.21	0.04	0.17	0.21	0.04	0.17	0.21	0.06	0.17	0.23
Fe	57.32	8.61	65.93	57.32	8.38	65.7	61.27	8.50	69.77	61.25	8.09	69.34	87.14	7.81	94.95
K	0.18	4.99	5.17	0.18	4.82	5.00	0.07	4.93	5.00	0.18	4.72	4.90	0.24	4.53	4.77
Li	1.15	16.88	18.03	1.15	16.65	17.8	1.13	16.68	17.81	1.06	16.26	17.32	1.45	15.64	17.09
Mg	0.35	5.00	5.35	0.35	4.67	5.02	0.34	4.73	5.07	0.34	4.85	5.19	0.48	4.65	5.13
Mn	0.12	10.99	11.11	0.12	10.68	10.8	0.10	10.68	10.78	0.13	10.32	10.45	0.19	9.72	9.91
Na	2.26	43.10	45.36	2.26	41.29	43.55	2.02	42.06	44.08	1.87	40.67	42.54	2.54	39.48	42.02
Ni	2.57	1.24	3.81	2.57	1.17	3.74	2.59	1.21	3.80	2.75	1.16	3.91	3.91	1.16	5.07
P	0.21	1.12	1.33	0.21	1.01	1.22	<0.01	1.09	1.09	0.14	0.88	1.02	0.34	1.00	1.34
Pb	0.46	2.39	2.85	0.46	2.37	2.83	0.53	2.31	2.84	0.42	2.33	2.75	0.60	2.26	2.86
Sb	0.70	1.28	1.98	0.70	1.34	2.04	0.58	1.27	1.85	0.66	1.30	1.96	0.88	1.34	2.22
Se	253.1	45.18	298.3	253.1	36.36	289.5	258.4	38.04	296.4	271.4	31.05	302.5	372.1	28.51	400.6
Si	29.34	59.76	89.1	29.34	57.73	87.07	30.84	58.67	89.51	28.45	57.06	85.51	36.29	56.72	93.01
Sr	0.65	12.13	12.78	0.65	11.90	12.55	0.66	11.99	12.65	0.62	11.64	12.26	0.87	11.16	12.03
Te	3.25	49.50	52.75	3.25	52.60	55.85	3.33	52.80	56.13	3.87	53.17	57.04	5.85	53.54	59.39
Ti	0.43	0.38	0.81	0.43	0.36	0.79	0.42	0.37	0.79	0.43	0.35	0.78	0.59	0.35	0.94
Zn	1.30	7.47	8.77	1.30	7.19	8.49	1.28	7.22	8.50	1.24	6.96	8.20	1.65	6.83	8.48
Zr	0.65	14.99	15.64	0.65	14.67	15.32	0.67	14.72	15.39	0.62	14.21	14.83	0.84	13.58	14.42
Cl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I	<0.1	NA	NC	<0.1	NA	NC	<0.1	NA	NC	NA	NA	NA	NA	NA	NA
Nitrate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	<0.1	NA	NC	<0.1	NA	NC	<0.1	NA	NC	NA	NA	NA	NA	NA	NA

* Suspended

Dissolved

NA - Not Analyzed

NC - Not Calculated

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	7														
I.D.	12N-S-52A			12N-S-53A			12N-S-54A			12N-S-62A			12N-S-63A		
Glass (kg)	20538			20663			20788			20913			21038		
pH	2.34			2.36			2.27			2.28			2.29		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	492	2188	2680	540	2168	2708	428	1792	2220	420	1808	2228	400	1872	2272
Al	3.07	32.98	36.05	3.37	32.19	35.56	2.57	31.62	34.19	2.47	31.67	34.14	2.05	31.52	33.57
As	0.10	5.31	5.41	0.75	5.23	5.98	<0.01	5.48	5.48	0.04	5.50	5.54	<0.01	5.55	5.55
B	1.42	172.6	174.0	1.44	171.0	172.4	1.36	173.4	174.8	1.58	175.9	177.5	1.13	177.1	178.2
Ba	0.12	0.08	0.20	0.13	0.08	0.21	0.13	0.07	0.20	0.12	0.08	0.20	0.11	0.09	0.20
Ca	0.28	6.90	7.18	0.32	6.36	6.68	0.24	6.10	6.34	0.23	5.81	6.04	0.21	5.35	5.56
Cd	0.27	16.34	16.61	0.27	16.71	16.98	0.24	17.31	17.55	0.24	17.75	17.99	0.19	17.09	17.28
Cr	0.40	0.48	0.88	0.41	0.49	0.90	0.33	0.48	0.81	0.28	0.48	0.76	0.25	0.49	0.74
Cs	<0.1	6.00	6.00	<0.1	5.40	5.40	<0.1	5.70	5.70	<0.1	6.10	6.10	<0.1	5.70	5.70
Cu	0.04	0.17	0.21	0.05	0.17	0.22	0.04	0.16	0.20	0.03	0.16	0.19	0.03	0.15	0.18
Fe	66.97	7.58	74.55	76.21	7.46	83.67	68.51	7.23	75.74	59.95	6.94	66.89	48.07	6.65	54.72
K	0.19	4.30	4.49	0.22	4.42	4.64	0.20	4.35	4.55	0.18	4.31	4.49	0.10	4.33	4.43
Li	1.10	15.22	16.32	1.07	15.05	16.12	1.03	15.21	16.24	1.18	15.11	16.29	0.85	14.94	15.79
Mg	0.37	4.62	4.99	0.38	4.82	5.20	0.31	4.47	4.78	0.28	4.57	4.85	0.22	4.54	4.76
Mn	0.12	9.30	9.42	0.17	9.24	9.41	0.13	9.23	9.36	0.09	9.11	9.20	0.08	8.81	8.89
Na	1.86	38.95	40.81	1.93	37.97	39.9	1.79	37.65	39.44	2.09	37.99	40.08	1.49	38.10	39.59
Ni	3.12	1.13	4.25	3.42	1.16	4.58	2.85	1.14	3.99	2.43	1.06	3.49	2.02	1.08	3.10
P	<0.01	0.95	0.95	0.31	0.93	1.24	0.16	1.04	1.20	<0.01	0.91	0.91	<0.01	1.07	1.07
Pb	0.48	2.28	2.76	0.50	2.29	2.79	0.47	2.24	2.71	0.50	2.23	2.73	0.42	2.30	2.72
Sb	0.50	1.36	1.86	0.61	1.47	2.08	0.51	1.43	1.94	0.52	1.37	1.89	0.22	1.39	1.61
Se	266.6	24.77	291.4	293.5	23.47	317.0	207.9	20.07	228.0	206.6	21.81	228.4	237.1	25.78	262.9
Si	32.07	55.95	88.02	28.14	55.61	83.75	26.02	55.06	81.08	28.47	56.01	84.48	25.21	56.10	81.31
Sr	0.70	10.68	11.38	0.72	10.58	11.30	0.59	10.66	11.25	0.58	10.49	11.07	0.46	10.26	10.72
Te	4.74	56.38	61.12	7.07	52.13	59.2	6.17	53.66	59.83	6.19	53.37	59.56	4.81	54.42	59.23
Ti	0.49	0.33	0.82	0.52	0.33	0.85	0.44	0.32	0.76	0.40	0.31	0.71	0.34	0.31	0.65
Zn	1.19	6.67	7.86	1.27	6.50	7.77	1.14	6.67	7.81	1.32	6.46	7.78	0.95	6.33	7.28
Zr	0.61	13.20	13.81	0.79	13.06	13.85	0.55	13.05	13.6	0.61	12.86	13.47	0.47	12.60	13.07
Cl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I	<0.1	NA	NC	NA	NA	NA	NA	NA	NA	<0.1	NA	NC	<0.1	NA	NC
Nitrate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	1.20	NA	NC	NA	NA	NAC	NA	NA	NA	<0.1	NA	NC	<0.1	NA	NC

* Suspended

Dissolved

NA - Not Analyzed

NC - Not Calculated

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	7														
I.D.	12N-S-66A			12N-S-68A			12N-S-70A			12N-S-72A			12N-S-73A		
Glass (kg)	21157			21276			21395			21514			21617		
pH	2.31			2.32			2.38			2.39			2.34		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	424	1728	2152	396	1704	2100	444	1556	2000	344	1780	2124	292	1692	1984
Al	1.88	30.94	32.82	1.97	31.06	33.03	2.54	30.02	32.56	1.62	28.99	30.61	1.37	28.32	29.69
As	<0.01	5.22	5.22	0.24	4.87	5.11	0.10	4.97	5.07	0.33	5.09	5.42	0.31	4.98	5.29
B	1.18	177.1	178.3	1.22	175.6	176.8	1.76	176.8	178.6	1.20	176.4	177.6	0.68	173.5	174.2
Ba	0.12	0.08	0.20	0.11	0.09	0.20	0.13	0.08	0.21	0.08	0.09	0.17	0.07	0.09	0.16
Ca	0.18	5.17	5.35	0.19	4.77	4.96	0.25	4.33	4.58	0.14	4.25	4.39	0.12	5.00	5.12
Cd	0.18	18.13	18.31	0.24	18.17	18.41	0.26	17.34	17.6	0.18	18.10	18.28	0.12	17.28	17.4
Cr	0.22	0.45	0.67	0.23	0.46	0.69	0.35	0.43	0.78	0.18	0.43	0.61	0.14	0.40	0.54
Cs	<0.1	5.60	5.60	<0.1	6.20	6.20	<0.1	6.00	6.00	<0.1	6.00	6.00	<0.1	6.10	6.10
Cu	0.03	0.15	0.18	0.02	0.15	0.17	0.04	0.15	0.19	0.01	0.15	0.16	0.03	0.14	0.17
Fe	49.44	6.41	55.85	56.12	6.40	62.52	63.05	5.87	68.92	39.11	5.80	44.91	30.66	5.02	35.68
K	0.14	4.03	4.17	0.15	4.17	4.32	0.14	3.95	4.09	0.13	3.94	4.07	0.09	3.83	3.92
Li	0.86	15.17	16.03	0.89	15.18	16.07	1.33	14.61	15.94	0.89	14.38	15.27	0.50	13.68	14.18
Mg	0.22	4.72	4.94	0.23	4.87	5.10	0.28	4.75	5.03	0.17	4.82	4.99	0.13	4.63	4.76
Mn	0.10	8.74	8.84	0.11	8.94	9.05	0.11	8.43	8.54	0.09	8.17	8.26	0.05	7.43	7.48
Na	1.72	37.56	39.28	1.64	37.38	39.02	2.32	36.31	38.63	1.60	35.25	36.85	0.92	35.07	35.99
Ni	2.02	1.01	3.03	2.14	1.01	3.15	2.86	0.98	3.84	1.71	0.90	2.61	1.26	0.82	2.08
P	0.21	1.14	1.35	0.14	1.18	1.32	<0.01	1.13	1.13	0.06	0.97	1.03	<0.01	1.09	1.09
Pb	0.42	2.25	2.67	0.31	2.30	2.61	0.51	2.24	2.75	0.28	2.10	2.38	0.26	2.07	2.33
Sb	0.37	1.50	1.87	0.51	1.43	1.94	0.54	1.41	1.95	0.43	1.37	1.8	0.28	1.36	1.64
Se	238.3	28.03	266.3	237.6	28.69	266.3	232.0	29.11	261.1	199.0	28.02	227.0	140.3	27.94	168.2
Si	20.83	55.54	76.37	24.60	55.73	80.33	29.18	55.74	84.92	20.37	53.17	73.54	12.72	49.55	62.27
Sr	0.42	10.34	10.76	0.42	10.35	10.77	0.56	9.89	10.45	0.31	9.99	10.3	0.21	9.53	9.74
Te	6.66	50.09	56.75	5.33	48.86	54.19	5.53	48.57	54.1	4.24	46.95	51.19	2.20	47.01	49.21
Ti	0.33	0.29	0.62	0.34	0.29	0.63	0.51	0.26	0.77	0.30	0.25	0.55	0.22	0.24	0.46
Zn	0.96	6.30	7.26	1.00	6.20	7.20	1.38	6.30	7.68	0.99	6.12	7.11	0.57	5.95	6.52
Zr	0.43	12.52	12.95	0.45	12.48	12.93	0.73	11.90	12.63	0.45	11.87	12.32	0.31	11.17	11.48
Cl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1	NA	NC
Nitrate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1	NA	NC

* Suspended

Dissolved

NA - Not Analyzed

NC - Not Calculated

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	#7														
I.D.	12N-S-79A			12N-S-81A			12N-S-85A			12N-S-86A			12N-S-87A		
Glass (kg)	21720			21823			21926			22029			22260		
pH	2.41			2.41			2.38			2.40			2.05		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	350	1750	2100	264	1992	2256	264	1632	1896	236	1868	2104	248	1928	2176
Al	2.38	29.98	32.36	1.66	29.22	30.88	2.40	29.44	31.84	1.58	29.59	31.17	1.39	29.03	30.42
As	0.11	4.86	4.97	0.08	5.43	5.51	0.03	5.39	5.42	0.07	5.40	5.47	0.04	5.34	5.38
B	1.67	173.0	174.7	1.03	173.4	174.4	1.48	176.7	178.2	1.14	174.2	175.3	0.82	178.2	179.0
Ba	0.09	0.09	0.18	0.07	0.09	0.16	0.08	0.09	0.17	0.07	0.10	0.17	0.07	0.10	0.17
Ca	0.20	4.83	5.03	0.15	4.68	4.83	0.17	4.63	4.80	0.14	4.49	4.63	0.12	4.15	4.27
Cd	0.25	17.19	17.44	0.18	17.02	17.2	0.25	17.28	17.53	0.20	16.84	17.04	0.18	17.57	17.75
Cr	0.26	0.41	0.67	0.19	0.38	0.57	0.24	0.38	0.62	0.17	0.37	0.54	0.16	0.35	0.51
Cs	<0.1	5.80	5.80	<0.1	5.80	5.80	<0.1	5.20	5.20	<0.1	5.70	5.70	<0.1	5.50	5.50
Cu	0.03	0.14	0.17	0.02	0.14	0.16	0.03	0.14	0.17	0.02	0.14	0.16	0.02	0.14	0.16
Fe	48.27	5.14	53.41	35.51	5.21	40.72	41.91	4.89	46.8	31.07	4.84	35.91	29.18	4.65	33.83
K	0.07	3.86	3.93	0.10	3.69	3.79	0.11	3.80	3.91	0.11	3.74	3.85	0.04	3.56	3.6
Li	1.20	13.84	15.04	0.77	13.60	14.37	1.11	13.44	14.55	0.86	13.59	14.45	0.60	13.49	14.09
Mg	0.24	4.74	4.98	0.18	4.87	5.05	0.24	4.77	5.01	0.19	4.86	5.05	0.15	4.82	4.97
Mn	0.10	7.41	7.51	0.06	7.15	7.21	0.08	6.77	6.85	0.06	6.92	6.98	0.05	6.43	6.48
Na	2.21	35.34	37.55	1.36	34.73	36.09	2.01	34.78	36.79	1.61	34.61	36.22	1.09	33.80	34.89
Ni	2.03	0.83	2.86	1.64	0.80	2.44	2.04	0.76	2.80	1.53	0.75	2.28	1.36	0.71	2.07
P	0.22	1.28	1.50	<0.01	1.05	1.05	<0.01	1.07	1.07	0.06	1.00	1.06	0.07	1.04	1.11
Pb	0.41	2.04	2.45	0.29	2.15	2.44	0.39	2.02	2.41	0.27	2.02	2.29	0.28	2.04	2.32
Sb	0.62	1.39	2.01	0.31	1.38	1.69	0.58	1.39	1.97	0.49	1.35	1.84	0.33	1.31	1.64
Se	172.8	31.08	203.9	132.1	29.26	161.4	98.43	32.60	131.0	113.2	35.42	148.6	157.4	44.51	201.9
Si	32.05	52.56	84.61	18.07	51.51	69.58	25.88	49.84	75.72	18.10	50.29	68.39	14.59	47.17	61.76
Sr	0.35	9.51	9.86	0.24	9.61	9.85	0.29	9.59	9.88	0.22	9.87	10.09	0.19	9.97	10.16
Te	3.61	52.43	56.04	2.98	50.97	53.95	3.21	51.86	55.07	2.80	49.41	52.21	2.65	48.80	51.45
Ti	0.42	0.23	0.65	0.30	0.23	0.53	0.39	0.22	0.61	0.28	0.22	0.50	0.25	0.21	0.46
Zn	1.24	6.17	7.41	0.80	6.04	6.84	1.10	6.00	7.10	0.90	5.98	6.88	0.65	5.87	6.52
Zr	0.63	11.33	11.96	0.42	11.19	11.61	0.61	10.98	11.59	0.41	11.26	11.67	0.33	10.93	11.26
Cl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I	<0.1	NA	NC	<0.1	NA	NC	<0.1	NA	NC	<0.1	NA	NC	<0.1	NA	NC
Nitrate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	<0.1	NA	NC	0.37	NA	NC	<0.1	NA	NC	<0.1	NA	NC	<0.1	NA	NC

* Suspended

Dissolved

NA - Not Analyzed

NC - Not Calculated

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	#7														
I.D.	12N-S-88A			12N-S-94A			12N-S-99A			12N-S-99B			12N-S-101A		
Glass (kg)	22492			22580			22669			22757			22845		
pH	2.04			2.00			2.04			2.05			2.01		
2280	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	228	2004	2232	224	2136	2360	184	1828	2012	188	1680	1868	234	2280	2514
Al	1.48	29.83	31.31	1.12	28.04	29.16	0.96	27.68	28.64	0.76	28.51	29.27	0.93	28.35	29.28
As	0.23	5.47	5.70	0.17	5.32	5.49	0.02	5.50	5.52	0.34	5.34	5.68	<0.01	5.87	5.87
B	1.09	184.0	185.09	0.83	184.8	185.6	0.48	180.7	181.2	0.23	195.8	196.0	0.31	188.5	188.8
Ba	0.07	0.10	0.17	0.06	0.07	0.13	0.06	0.08	0.14	0.06	0.08	0.14	0.09	0.08	0.17
Ca	0.12	4.15	4.27	0.10	3.67	3.77	0.09	3.76	3.85	0.07	4.31	4.38	0.08	3.88	3.96
Cd	0.23	17.54	17.77	0.18	17.92	18.1	0.15	18.52	18.67	0.13	18.12	18.25	0.16	18.78	18.94
Cr	0.16	0.35	0.51	0.13	0.39	0.52	0.13	0.40	0.53	0.10	0.38	0.48	0.12	0.39	0.51
Cs	<0.1	6.10	6.10	<0.1	5.80	5.80	<0.1	5.60	5.60	<0.1	5.80	5.80	<0.1	5.80	5.80
Cu	0.01	0.14	0.15	0.01	0.13	0.14	0.01	0.13	0.14	0.01	0.15	0.16	0.01	0.15	0.16
Fe	34.35	4.67	39.02	26.57	4.63	31.2	23.31	4.57	27.88	19.71	4.68	24.39	26.81	5.00	31.81
K	0.10	3.61	3.71	0.08	3.13	3.21	0.04	3.20	3.24	0.05	3.79	3.84	0.08	3.54	3.62
Li	0.81	13.71	14.52	0.60	14.94	15.54	0.36	14.57	14.93	0.18	15.94	16.12	0.23	14.60	14.83
Mg	0.19	4.85	5.04	0.14	4.75	4.89	0.11	4.78	4.89	0.09	5.09	5.18	0.11	4.98	5.09
Mn	0.08	6.41	6.49	0.06	6.43	6.49	0.05	6.17	6.22	0.03	6.29	6.32	0.05	6.18	6.23
Na	1.46	34.70	36.16	1.10	34.30	35.4	0.64	33.90	34.54	0.32	37.99	38.31	0.41	34.81	35.22
Ni	1.59	0.73	2.32	1.27	0.76	2.03	1.09	0.80	1.89	0.91	0.79	1.70	1.15	0.76	1.91
P	0.02	1.10	1.12	0.07	1.31	1.38	0.03	1.41	1.44	<0.01	1.38	1.38	0.15	1.45	1.60
Pb	0.27	2.03	2.30	0.23	2.11	2.34	0.24	2.14	2.38	0.22	2.13	2.35	0.31	2.09	2.40
Sb	0.47	1.37	1.84	0.38	1.32	1.70	0.29	1.32	1.61	0.21	1.26	1.47	0.26	1.21	1.47
Se	99.50	49.16	148.7	136.7	48.99	185.7	110.4	54.29	164.7	122.6	72.53	195.1	140.9	63.81	204.7
Si	19.73	48.05	67.78	13.99	47.27	61.26	8.83	46.22	55.05	5.88	44.39	50.27	7.27	43.99	51.26
Sr	0.21	10.07	10.28	0.18	10.15	10.33	0.16	10.31	10.47	0.16	12.16	12.32	0.19	10.93	11.12
Te	2.23	50.68	52.91	1.69	49.39	51.08	1.51	53.30	54.81	1.33	55.73	57.06	1.43	58.00	59.43
Ti	0.27	0.20	0.47	0.20	0.22	0.42	0.16	0.22	0.38	0.12	0.19	0.31	0.15	0.20	0.35
Zn	0.84	6.05	6.89	0.62	5.95	6.57	0.39	7.95	8.34	0.23	6.61	6.84	0.30	6.70	7.00
Zr	0.37	11.09	11.46	0.27	11.42	11.69	0.19	11.24	11.43	0.12	11.38	11.5	0.12	11.72	11.84
Cl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I	NA	NA	NA	NA	NA	NA	<0.1	NA	NC	<0.1	NA	NC	NA	NA	NA
Nitrate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	NA	NA	NA	NA	NA	NA	<0.1	NA	NC	0.15	NA	NC	NA	NA	NA

* Suspended

Dissolved

NA - Not Analyzed

NC - Not Calculated

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	#7														
I.D.	12N-S-102A			12N-S-104A			12N-S-106A			12N-S-114A			12N-S-117A		
Glass (kg)	22934			23022			23202			23372			23563		
pH	2.27			2.26			2.28			2.24			2.25		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	192	2048	2240	132	1916	2048	352	2240	2592	260	2208	2468	384	2048	2432
Al	0.52	29.79	30.31	0.53	34.91	35.44	2.75	42.95	45.7	2.26	43.11	45.37	3.61	53.30	56.91
As	<0.01	5.62	5.62	<0.01	5.59	5.59	0.09	5.75	5.84	0.09	6.03	6.12	<0.01	5.96	5.96
B	0.11	190.1	190.2	0.13	193.6	193.7	1.40	195.3	196.7	0.90	194.2	195.1	1.37	198.9	200.3
Ba	0.06	0.06	0.12	0.07	0.06	0.13	0.14	0.06	0.20	0.15	0.06	0.21	0.21	0.06	0.27
Ca	0.05	3.40	3.45	0.05	3.66	3.71	0.27	3.54	3.81	0.19	3.70	3.89	0.36	4.25	4.61
Cd	0.08	18.63	18.71	0.09	19.10	19.19	0.37	19.46	19.83	0.27	20.49	20.76	0.58	21.21	21.79
Cr	0.08	0.38	0.46	0.08	0.38	0.46	0.32	0.39	0.71	0.26	0.38	0.64	0.49	0.42	0.91
Cs	<0.1	5.50	5.50	<0.1	5.40	5.40	<0.1	6.00	6.00	<0.1	6.40	6.40	0.10	6.10	6.20
Cu	0.01	0.15	0.16	0.01	0.16	0.17	0.02	0.16	0.18	0.03	0.18	0.21	0.05	0.18	0.23
Fe	14.05	4.95	19.00	13.95	5.00	18.95	57.07	6.06	63.13	47.37	6.05	53.42	83.16	7.04	90.20
K	0.01	2.78	2.79	0.03	2.93	2.96	0.17	3.03	3.20	0.10	3.10	3.20	0.21	3.37	3.58
Li	0.10	14.18	14.28	0.11	14.18	14.29	1.15	16.02	17.17	0.76	14.99	15.75	1.16	16.76	17.92
Mg	0.06	5.27	5.33	<0.01	5.04	5.04	0.35	5.01	5.36	0.26	4.44	4.70	0.53	4.59	5.12
Mn	0.02	6.31	6.33	0.03	6.48	6.51	0.12	7.55	7.67	0.08	7.42	7.50	0.17	9.74	9.91
Na	0.21	38.62	38.83	0.20	41.20	41.40	1.97	47.04	49.01	1.26	45.71	46.97	1.89	51.11	53.00
Ni	0.59	0.73	1.32	0.64	0.73	1.37	3.03	0.91	3.94	2.29	0.88	3.17	4.87	1.26	6.13
P	<0.01	0.95	0.95	0.06	0.92	0.98	0.18	1.07	1.25	<0.01	1.00	1.00	0.16	0.90	1.06
Pb	0.21	1.97	2.18	0.23	2.13	2.36	0.53	2.16	2.69	0.51	2.12	2.63	0.72	2.33	3.05
Sb	0.14	1.36	1.50	0.11	1.40	1.51	0.74	1.53	2.27	0.50	1.45	1.95	1.12	1.31	2.43
Se	155.4	55.75	211.2	88.03	51.22	139.3	145.6	47.75	193.4	101.1	54.22	155.3	113.3	63.27	176.6
Si	2.89	44.98	47.87	3.44	47.38	50.82	27.06	60.29	87.35	22.52	57.65	80.17	33.95	67.32	101.3
Sr	0.11	10.98	11.09	0.12	11.16	11.28	0.58	12.13	12.71	0.57	12.36	12.93	1.17	13.52	14.69
Te	1.23	54.99	56.22	1.10	55.24	56.34	3.66	56.16	59.82	2.34	55.30	57.64	4.85	55.26	60.11
Ti	0.08	0.20	0.28	0.09	0.20	0.29	0.46	0.22	0.68	0.34	0.24	0.58	0.65	0.24	0.89
Zn	0.12	6.75	6.87	0.14	6.68	6.82	1.23	7.15	8.38	0.80	7.56	8.36	1.20	8.65	9.85
Zr	0.06	10.68	10.74	0.06	10.82	10.88	0.56	11.55	12.11	0.39	11.57	11.96	0.63	12.89	13.52
Cl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I	<0.1	NA	NC	NA	NA	NA	<0.1	NA	NC	<0.1	NA	NC	<0.1	NA	NC
Nitrate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	0.15	NA	NC	NA	NA	NA	0.88	NA	NC	<0.1	NA	NC	0.54	NA	NC

* Suspended

Dissolved

NA - Not Analyzed

NC - Not Calculated

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	#7									#8								
I.D.	12N-S-118A			12N-S-126A			12N-S-126B			12N-S-152A			12N-S-153A					
Glass (kg)	23734			23905			24076			24144			24212					
pH	2.22			2.20			2.22			6.98			6.63					
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total			
Total	596	2028	2624	232	2124	2356	448	2120	2568	84	380	464	32	556	588			
Al	5.07	43.96	49.03	1.56	39.79	41.35	3.23	46.33	49.56	2.96	0.71	3.67	0.67	3.51	4.18			
As	<0.01	6.01	6.01	0.03	5.87	5.90	0.39	6.00	6.39	0.22	0.11	0.33	0.07	0.28	0.35			
B	1.95	198.6	200.6	0.47	199.1	199.6	1.08	200.9	202.0	0.34	16.50	16.84	0.07	25.89	25.96			
Ba	0.32	0.06	0.38	0.13	0.06	0.19	0.21	0.06	0.27	0.03	0.10	0.13	0.01	0.14	0.15			
Ca	0.46	4.72	5.18	0.14	4.56	4.70	0.26	4.66	4.92	0.58	39.65	40.23	0.18	42.89	43.07			
Cd	0.77	22.19	22.96	0.22	21.61	21.83	0.48	21.72	22.2	0.30	0.95	1.25	0.14	1.15	1.29			
Cr	0.59	0.41	1.00	0.18	0.40	0.58	0.37	0.41	0.78	0.10	0.03	0.13	0.06	0.03	0.09			
Cs	0.13	6.10	6.23	<0.1	6.10	6.10	0.10	6.30	6.40	<0.1	0.49	0.49	<0.1	0.82	0.82			
Cu	0.07	0.18	0.25	0.02	0.18	0.20	0.03	0.18	0.21	0.02	<0.01	0.02	0.02	0.01	0.03			
Fe	116.5	6.57	123.1	37.67	6.52	44.19	84.88	6.92	91.8	14.28	0.01	14.29	6.51	0.02	6.53			
K	0.24	3.27	3.51	0.06	3.23	3.29	0.21	3.26	3.47	0.06	3.30	3.36	0.03	3.99	4.02			
Li	1.63	15.46	17.09	0.42	15.01	15.43	0.92	15.61	16.53	0.26	3.43	3.69	0.07	7.41	7.48			
Mg	0.61	4.26	4.87	0.17	3.75	3.92	0.38	3.69	4.07	0.12	11.62	11.74	0.05	11.82	11.87			
Mn	0.23	9.15	9.38	0.06	8.98	9.04	0.19	9.65	9.84	0.10	1.37	1.47	0.05	1.28	1.33			
Na	2.69	45.37	48.06	0.65	42.06	42.71	1.54	46.24	47.78	0.47	25.05	25.52	0.12	40.87	40.99			
Ni	5.34	1.03	6.37	1.62	0.90	2.52	3.34	1.03	4.37	0.76	0.14	0.90	0.29	0.23	0.52			
P	<0.01	0.87	0.87	0.08	1.01	1.09	<0.01	1.21	1.21	0.12	<0.07	0.12	0.06	<0.07	0.06			
Pb	1.05	2.34	3.39	0.42	2.32	2.74	0.49	2.36	2.85	0.13	0.08	0.21	0.08	0.13	0.21			
Sb	1.50	1.31	2.81	0.34	1.34	1.68	1.04	1.43	2.47	0.12	0.19	0.31	0.08	0.15	0.23			
Se	258.3	64.98	323.3	121.8	65.84	187.6	266.6	65.43	332.0	16.40	15.57	31.97	6.71	16.68	23.39			
Si	41.27	58.07	99.34	11.06	51.35	62.41	25.49	58.14	83.63	8.00	3.77	11.77	2.89	3.73	6.62			
Sr	1.64	12.98	14.62	0.56	12.99	13.55	1.04	13.13	14.17	0.12	2.78	2.9	0.05	4.47	4.52			
Te	5.71	58.66	64.37	1.58	57.43	59.01	3.70	57.09	60.79	1.80	0.28	2.08	0.87	0.29	1.16			
Ti	0.80	0.26	1.06	0.22	0.27	0.49	0.53	0.27	0.80	0.12	0.01	0.13	0.05	0.01	0.06			
Zn	1.71	8.15	9.86	0.43	7.18	7.61	0.93	7.71	8.64	0.61	0.57	1.18	0.18	1.83	2.01			
Zr	0.88	12.19	13.07	0.24	12.02	12.26	0.49	11.97	12.46	0.96	0.01	0.97	0.54	0.02	0.56			
Cl	NA	NA	NA	NA	NA	NA	NA	116.5	116.5	NA	42.56	42.56	NA	NA	NA			
F	NA	NA	NA	NA	NA	NA	NA	315.4	315.4	NA	28.23	28.23	NA	NA	NA			
I	<0.1	NA	NC	<0.1	NA	NC	NA	323.9	323.9	NA	22.29	22.29	<0.1	NA	NC			
Nitrate	NA	NA	NA	NA	NA	NA	NA	7.83	7.83	NA	4.95	4.95	NA	NA	NA			
Nitrite	NA	NA	NA	NA	NA	NA	NA	<0.1	<0.1	NA	5.08	5.08	NA	NA	NA			
Sulfate	<0.1	NA	NC	<0.1	NA	NC	NA	1045	1045	NA	149.1	149.1	<0.1	NA	NC			

* Suspended

Dissolved

NA - Not Analyzed

NC - Not Calculated

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	#8														
I.D.	12O-S-13A			12O-S-14A			12O-S-22A			12O-S-31A			12O-S-38A		
Glass (kg)	24280			24348			24416			24484			24561		
pH	5.20			4.83			4.95			4.94			4.99		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	24	800	824	16	988	1004	26	1412	1438	24	1624	1648	16	1868	1884
Al	0.32	5.21	5.53	0.20	6.87	7.07	0.36	7.74	8.10	0.28	8.68	8.96	0.19	9.49	9.68
As	0.03	0.32	0.35	<0.01	0.27	0.27	0.02	0.28	0.3	<0.01	0.26	0.26	0.04	0.31	0.35
B	0.03	56.40	56.43	0.02	87.43	87.45	0.03	102.5	102.5	0.02	132.5	132.5	0.01	155.3	155.3
Ba	0.01	0.25	0.26	0.01	0.31	0.32	0.01	0.39	0.4	0.01	0.47	0.48	0.01	0.53	0.54
Ca	0.11	45.10	45.21	0.07	41.36	41.43	0.11	42.14	42.25	0.09	37.59	37.68	0.06	34.27	34.33
Cd	0.06	2.12	2.18	0.04	3.31	3.35	0.07	4.68	4.75	0.07	5.52	5.59	0.05	6.64	6.69
Cr	0.05	0.05	0.1	0.03	0.09	0.12	0.05	0.11	0.16	0.04	0.17	0.21	0.03	0.21	0.24
Cs	<0.1	1.70	1.70	<0.1	3.10	3.10	<0.1	5.50	5.50	<0.1	6.60	6.60	<0.1	7.30	7.30
Cu	0.02	0.02	0.04	0.02	0.03	0.05	0.03	0.03	0.06	0.03	0.05	0.08	0.02	0.05	0.07
Fe	5.02	0.06	5.08	3.34	0.19	3.53	5.61	0.28	5.89	4.98	0.52	5.50	3.39	0.67	4.06
K	0.02	4.84	4.86	0.02	6.83	6.85	0.02	8.51	8.53	0.01	10.92	10.93	0.01	12.78	12.79
Li	0.04	14.16	14.2	0.03	23.76	23.79	0.05	34.82	34.87	0.04	43.28	43.32	0.03	48.77	48.8
Mg	0.03	12.53	12.56	0.03	14.22	14.25	0.04	14.38	14.42	0.04	14.71	14.75	0.03	15.18	15.21
Mn	0.04	1.73	1.77	0.03	2.17	2.20	0.06	2.67	2.73	0.06	3.35	3.41	0.04	3.82	3.86
Na	0.05	72.97	73.02	0.06	93.61	93.67	0.04	125.3	125.3	0.04	163.3	163.3	0.03	189.4	189.4
Ni	0.19	0.37	0.56	0.12	0.51	0.63	0.19	0.62	0.81	0.17	0.71	0.88	0.11	0.78	0.89
P	0.03	0.14	0.17	0.04	0.22	0.26	0.15	<0.07	0.15	0.01	0.48	0.49	0.04	0.56	0.6
Pb	0.02	0.17	0.19	0.03	0.25	0.28	0.08	0.33	0.41	0.12	0.45	0.57	<0.01	0.52	0.52
Sb	0.05	0.22	0.27	<0.03	0.22	0.22	<0.03	0.08	0.08	<0.03	0.12	0.12	<0.03	0.20	0.20
Se	4.56	19.00	23.56	2.24	22.97	25.21	2.85	27.60	30.45	1.53	36.19	37.72	0.79	41.45	42.24
Si	1.71	3.96	5.67	1.17	3.86	5.03	1.83	4.14	5.97	1.67	4.54	6.21	1.07	4.80	5.87
Sr	0.04	7.26	7.3	0.03	11.20	11.23	0.06	13.62	13.68	0.05	16.41	16.46	0.04	18.77	18.81
Te	0.54	0.38	0.92	0.32	0.35	0.67	0.57	0.39	0.96	0.51	0.58	1.09	0.34	0.50	0.84
Ti	0.04	0.01	0.05	0.03	0.01	0.04	0.04	0.02	0.06	0.07	0.02	0.09	0.04	0.02	0.06
Zn	0.08	3.91	3.99	0.06	5.60	5.66	0.12	7.03	7.15	0.10	7.92	8.02	0.07	8.57	8.64
Zr	0.44	0.21	0.65	0.33	0.45	0.78	0.60	0.56	1.16	0.57	0.85	1.42	0.40	1.05	1.45
Cl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

* Suspended

Dissolved

NA - Not Analyzed

The Catholic University of America
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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	#8														
I.D.	12O-S-40A			12O-S-43A			12O-S-43B			12O-S-58A			12O-S-60A		
Glass (kg)	24637			24714			24790			24943			25020		
pH	4.95			5.07			5.02			4.87			4.90		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	24	2064	2088	12	2504	2516	20	2732	2752	8	3040	3048	4	3148	3152
Al	0.29	9.42	9.71	0.17	10.38	10.55	0.29	11.34	11.63	0.11	12.25	12.36	0.05	12.21	12.26
As	0.02	0.17	0.19	0.01	0.24	0.25	0.02	0.25	0.27	0.01	0.24	0.25	<0.01	0.19	0.19
B	0.02	169.7	169.7	0.01	190.8	190.8	0.01	208.2	208.2	0.01	234.7	234.7	<0.01	244.2	244.2
Ba	0.01	0.60	0.61	<0.01	0.66	0.66	0.01	0.71	0.72	<0.01	0.80	0.80	<0.01	0.85	0.85
Ca	0.09	31.95	32.04	0.04	29.25	29.29	0.06	29.24	29.3	0.02	26.78	26.8	0.01	24.93	24.94
Cd	0.09	7.51	7.60	0.04	8.16	8.20	0.07	8.48	8.55	0.03	9.82	9.85	0.02	10.19	10.21
Cr	0.04	0.24	0.28	0.02	0.28	0.30	0.03	0.31	0.34	0.01	0.38	0.39	0.01	0.41	0.42
Cs	<0.1	8.00	8.00	<0.1	8.80	8.80	<0.1	9.10	9.10	<0.1	11.10	11.10	<0.1	11.40	11.40
Cu	0.03	0.05	0.08	0.01	0.06	0.07	0.02	0.07	0.09	0.01	0.08	0.09	<0.01	0.08	0.08
Fe	5.19	0.84	6.03	2.64	1.03	3.67	4.47	1.23	5.70	1.85	1.67	3.52	0.91	1.85	2.76
K	0.02	13.19	13.21	0.01	14.97	14.98	0.01	16.03	16.04	0.01	18.17	18.18	0.01	18.57	18.58
Li	0.05	51.83	51.88	0.03	61.69	61.72	0.04	60.14	60.18	0.02	67.98	68.00	0.01	70.62	70.63
Mg	0.04	14.64	14.68	0.02	15.05	15.07	0.04	15.84	15.88	0.01	16.35	16.36	0.01	15.76	15.77
Mn	0.07	4.31	4.38	0.04	4.99	5.03	0.05	4.98	5.03	0.02	5.78	5.80	0.01	5.92	5.93
Na	0.04	208.4	208.4	0.02	233.4	233.4	0.03	248.7	248.7	0.01	277.3	277.3	0.01	289.8	289.8
Ni	0.17	0.85	1.02	0.09	0.95	1.04	0.15	1.02	1.17	0.06	1.14	1.20	0.03	1.20	1.23
P	0.05	0.41	0.46	0.04	0.64	0.68	0.05	0.47	0.52	0.02	0.61	0.63	0.01	0.88	0.89
Pb	0.12	0.55	0.67	0.06	0.58	0.64	0.11	0.68	0.79	0.04	0.80	0.84	0.02	0.83	0.85
Sb	0.03	0.11	0.14	0.01	<0.03	0.01	<0.01	<0.03	<0.03	<0.01	<0.03	<0.03	<0.01	<0.03	<0.03
Se	1.04	43.82	44.86	0.45	43.68	44.13	0.66	48.53	49.19	0.23	53.10	53.33	0.12	63.00	63.12
Si	1.68	4.94	6.62	0.88	5.41	6.29	1.52	5.83	7.35	0.58	6.32	6.90	0.27	6.21	6.48
Sr	0.06	19.17	19.23	0.03	22.09	22.12	0.06	24.97	25.03	0.02	28.39	28.41	0.01	28.16	28.17
Te	0.45	0.53	0.98	0.23	0.51	0.74	0.38	0.49	0.87	0.13	0.67	0.8	0.07	0.73	0.8
Ti	0.04	0.01	0.05	0.02	0.02	0.04	0.03	0.02	0.05	0.01	0.02	0.03	0.01	0.02	0.03
Zn	0.12	9.08	9.20	0.06	10.49	10.55	0.09	11.85	11.94	0.03	12.93	12.96	0.02	13.58	13.6
Zr	0.62	1.30	1.92	0.33	1.59	1.92	0.54	1.91	2.45	0.22	2.50	2.72	0.11	2.79	2.90
Cl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	22.77	22.77
F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1	<0.1
I	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	115.9	115.9
Nitrate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3913	3913
Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	164.7	164.7
Sulfate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	99.87	99.87

* Suspended

Dissolved

NA - Not Analyzed

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	#9														
I.D.	12O-S-97A			12O-S-107A			12O-S-115A			12O-S-118A			12O-S-125A		
Glass (kg)	25123			25227			25331			25469			25607		
pH	7.83			8.06			8.09			8.00			7.91		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	88	412	500	70	316	386	60	352	412	66	496	562	66	408	474
Al	4.03	0.15	4.18	3.01	0.16	3.17	2.37	0.14	2.51	2.41	0.14	2.55	2.11	0.15	2.26
As	0.11	0.18	0.29	0.11	0.21	0.32	0.12	0.32	0.44	0.16	0.44	0.60	0.19	0.53	0.72
B	0.25	20.50	20.75	0.15	27.83	27.98	0.11	33.91	34.02	0.11	41.56	41.67	0.10	44.13	44.23
Ba	0.02	0.07	0.09	0.02	0.06	0.08	0.02	0.06	0.08	0.02	0.06	0.08	0.01	0.05	0.06
Ca	0.59	38.70	39.29	0.50	34.82	35.32	0.42	31.96	32.38	0.43	33.60	34.03	0.40	28.48	28.88
Cd	0.56	0.20	0.76	1.21	0.20	1.41	1.68	0.22	1.90	2.43	0.22	2.65	3.14	0.15	3.29
Cr	0.10	0.03	0.13	0.09	0.03	0.12	0.08	0.03	0.11	0.09	0.03	0.12	0.09	0.02	0.11
Cs	<0.1	0.45	0.45	<0.1	0.54	0.54	<0.1	0.59	0.59	<0.1	0.67	0.67	<0.1	0.77	0.77
Cu	0.03	0.02	0.05	0.04	0.01	0.05	0.04	<0.01	0.04	0.04	0.02	0.06	0.04	0.01	0.05
Fe	10.50	0.02	10.52	9.53	0.02	9.55	7.98	0.02	8.00	8.72	0.03	8.75	8.07	0.02	8.09
K	0.05	3.65	3.7	0.05	3.12	3.17	0.04	2.88	2.92	0.05	2.77	2.82	0.05	2.61	2.66
Li	0.28	4.40	4.68	0.17	4.51	4.68	0.12	4.71	4.83	0.13	4.74	4.87	0.11	4.95	5.06
Mg	0.19	12.99	13.18	0.22	11.81	12.03	0.22	11.13	11.35	0.25	10.39	10.64	0.27	9.58	9.85
Mn	0.46	0.33	0.79	0.34	0.24	0.58	0.26	0.21	0.47	0.26	0.21	0.47	0.24	0.15	0.39
Na	0.34	31.69	32.03	0.21	30.46	30.67	0.18	29.17	29.35	0.20	28.30	28.5	0.27	27.94	28.21
Ni	0.61	0.13	0.74	0.52	0.10	0.62	0.42	0.09	0.51	0.45	0.09	0.54	0.41	0.10	0.51
P	0.12	0.26	0.38	0.16	0.17	0.33	0.10	<0.07	0.10	0.09	0.31	0.40	0.13	0.54	0.67
Pb	0.26	0.09	0.35	0.30	0.09	0.39	0.29	0.10	0.39	0.31	0.10	0.41	0.36	0.11	0.47
Sb	0.13	0.46	0.59	0.05	0.11	0.16	0.04	0.05	0.09	0.02	0.05	0.07	0.11	0.06	0.17
Se	1.66	20.10	21.76	1.81	37.26	39.07	1.71	53.88	55.59	1.89	59.35	61.24	2.79	73.74	76.53
Si	14.65	2.29	16.94	10.05	2.21	12.26	7.74	2.23	9.97	8.17	2.25	10.42	7.18	2.31	9.49
Sr	0.16	3.20	3.36	0.22	3.18	3.40	0.22	3.19	3.41	0.24	3.14	3.38	0.25	3.20	3.45
Te	1.81	0.36	2.17	3.77	0.95	4.72	4.91	1.93	6.84	7.67	2.79	10.46	8.99	3.81	12.80
Ti	0.09	0.01	0.1	0.07	0.01	0.08	0.05	0.01	0.06	0.06	0.01	0.07	0.05	0.01	0.06
Zn	0.83	0.19	1.02	0.91	0.13	1.04	0.84	0.10	0.94	0.96	0.10	1.06	1.00	0.08	1.08
Zr	1.61	0.02	1.63	1.03	0.01	1.04	0.77	0.01	0.78	0.76	0.01	0.77	0.63	0.01	0.64
Cl	NA	40.73	40.73	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F	NA	12.01	12.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I	NA	15.39	15.39	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate	NA	52.05	52.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	NA	15.75	15.75	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	NA	108.1	108.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

* Suspended

Dissolved

NA - Not Analyzed

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	#9														
I.D.	12O-S-135A			12O-S-145A			12O-S-146A			12O-S-154A			12P-S-14A		
Glass (kg)	25743			25879			25986			26094			26202		
pH	7.86			7.71			7.55			6.62			4.80		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	60	450	510	50	616	666	56	764	820	52	890	942	50	844	894
Al	1.80	0.17	1.97	1.17	0.28	1.45	1.06	0.52	1.58	0.56	1.56	2.12	0.34	2.22	2.56
As	0.18	0.74	0.92	0.22	0.94	1.16	0.32	1.24	1.56	0.32	1.57	1.89	0.21	2.16	2.37
B	0.08	52.90	52.98	0.05	57.17	57.22	0.04	63.74	63.78	0.03	70.95	70.98	0.02	76.08	76.1
Ba	0.01	0.05	0.06	0.01	0.06	0.07	0.01	0.06	0.07	<0.01	0.07	0.07	<0.01	0.07	0.07
Ca	0.33	24.33	24.66	0.23	22.27	22.5	0.21	20.23	20.44	0.08	19.15	19.23	0.04	17.56	17.60
Cd	4.45	0.14	4.59	3.12	0.16	3.28	4.73	0.18	4.91	4.33	0.98	5.31	3.27	6.66	9.93
Cr	0.08	0.02	0.10	0.06	0.01	0.07	0.06	0.01	0.07	0.05	0.01	0.06	0.04	0.01	0.05
Cs	<0.1	0.82	0.82	<0.1	0.93	0.93	<0.1	1.16	1.16	<0.1	1.21	1.21	<0.1	1.33	1.33
Cu	0.03	0.01	0.04	0.03	0.01	0.04	0.03	0.01	0.04	0.02	0.01	0.03	0.02	0.02	0.04
Fe	6.59	0.01	6.60	4.95	<0.01	4.95	4.86	0.01	4.87	3.66	0.02	3.68	3.31	0.03	3.34
K	0.05	2.97	3.02	0.04	2.78	2.82	0.04	2.65	2.69	0.04	2.53	2.57	0.03	2.35	2.38
Li	0.09	4.58	4.67	0.06	4.52	4.58	0.06	4.60	4.66	0.04	4.66	4.70	0.04	4.61	4.65
Mg	0.26	8.00	8.26	0.20	7.50	7.70	0.19	6.92	7.11	0.13	6.58	6.71	0.07	6.32	6.39
Mn	0.17	0.10	0.27	0.13	0.11	0.24	0.12	0.14	0.26	0.08	0.18	0.26	0.06	0.23	0.29
Na	0.21	28.60	28.81	0.17	27.35	27.52	0.22	27.18	27.4	0.21	26.70	26.91	0.19	25.42	25.61
Ni	0.33	0.07	0.40	0.24	0.07	0.31	0.22	0.08	0.30	0.16	0.11	0.27	0.14	0.11	0.25
P	0.08	<0.07	0.08	0.05	<0.07	0.05	0.05	<0.07	0.05	0.04	<0.07	0.04	0.02	0.13	0.15
Pb	0.39	0.10	0.49	0.35	0.11	0.46	0.39	0.13	0.52	0.39	0.15	0.54	0.39	0.20	0.59
Sb	0.16	0.20	0.36	0.08	0.14	0.22	0.04	0.25	0.29	0.05	0.32	0.37	0.03	0.39	0.42
Se	4.50	90.72	95.22	5.67	98.16	103.8	6.64	119.0	125.6	10.85	115.5	126.4	14.15	120.2	134.4
Si	5.62	2.44	8.06	4.06	2.50	6.56	3.84	2.62	6.46	2.67	2.98	5.65	2.28	3.30	5.58
Sr	0.21	3.57	3.78	0.13	3.64	3.77	0.08	3.91	3.99	0.03	4.15	4.18	0.02	4.15	4.17
Te	8.89	5.59	14.48	4.09	6.98	11.07	12.34	7.89	20.23	13.25	3.27	16.52	12.22	2.90	15.12
Ti	0.04	<0.01	0.04	0.03	<0.01	0.03	0.03	0.01	0.04	0.02	0.01	0.03	0.02	0.01	0.03
Zn	0.85	0.05	0.9	0.65	0.09	0.74	0.64	0.12	0.76	0.35	0.74	1.09	0.17	1.38	1.55
Zr	0.47	<0.01	0.47	0.31	0.01	0.32	0.28	0.02	0.30	0.20	0.02	0.22	0.16	0.06	0.22
Cl	NA	40.73	40.73	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F	NA	12.01	12.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I	<0.1	15.39	15.39	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate	NA	52.05	52.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrite	NA	15.75	15.75	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	<0.1	108.1	108.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

* Suspended

Dissolved

NA - Not Analyzed

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Table 4.6. Analytical Results for Samples of SBS Blow-Down Fluids (mg/l), (continued).

Test	#9											
I.D.	12P-S-21A			12P-S-28A			12P-S-34A			12P-S-41A		
Glass (kg)	26333			26464			26595			26726		
pH	6.11			4.10			3.74			3.48		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	96	955	1051	40	898	938	76	1172	1248	72	1144	1216
Al	0.75	1.52	2.27	0.16	2.64	2.80	0.18	3.30	3.48	0.16	4.10	4.26
As	0.56	1.84	2.40	0.10	3.14	3.24	0.08	3.63	3.71	0.17	4.02	4.19
B	0.05	78.93	78.98	0.01	82.19	82.2	0.01	86.93	86.94	0.01	92.30	92.31
Ba	<0.01	0.06	0.06	<0.01	0.07	0.07	<0.01	0.07	0.07	<0.01	0.08	0.08
Ca	0.11	16.14	16.25	0.02	15.17	15.19	0.02	14.03	14.05	0.02	12.70	12.72
Cd	8.39	1.40	9.79	1.57	13.70	15.27	1.44	17.62	19.06	0.85	20.94	21.79
Cr	0.06	0.01	0.07	0.03	0.02	0.05	0.04	0.05	0.09	0.04	0.06	0.10
Cs	<0.1	1.33	1.33	<0.1	1.55	1.55	<0.1	1.72	1.72	<0.1	1.90	1.90
Cu	0.03	0.01	0.04	0.01	0.04	0.05	0.02	0.04	0.06	0.01	0.05	0.06
Fe	4.87	0.02	4.89	2.36	0.08	2.44	3.84	0.36	4.2	3.54	0.58	4.12
K	0.06	2.19	2.25	0.02	2.17	2.19	0.02	2.11	2.13	0.02	2.08	2.10
Li	0.07	4.44	4.51	0.02	4.52	4.54	0.02	4.60	4.62	0.02	4.65	4.67
Mg	0.19	5.79	5.98	0.02	5.71	5.73	0.02	5.44	5.46	0.01	5.09	5.10
Mn	0.09	0.18	0.27	0.03	0.28	0.31	0.02	0.42	0.44	0.01	0.53	0.54
Na	0.38	24.05	24.43	0.11	24.04	24.15	0.10	24.15	24.25	0.06	23.88	23.94
Ni	0.21	0.10	0.31	0.10	0.15	0.25	0.15	0.17	0.32	0.13	0.22	0.35
P	0.08	0.12	0.20	0.01	0.31	0.32	<0.01	0.37	0.37	<0.01	0.50	0.50
Pb	0.67	0.15	0.82	0.26	0.45	0.71	0.28	0.81	1.09	0.18	0.89	1.07
Sb	0.11	0.31	0.42	0.02	0.43	0.45	0.02	0.51	0.53	0.04	0.52	0.56
Se	28.04	111.3	139.3	16.13	125.3	141.4	37.23	96.98	134.2	41.19	88.60	129.8
Si	3.74	2.89	6.63	1.48	3.58	5.06	2.22	4.02	6.24	2.23	4.38	6.61
Sr	0.04	4.12	4.16	0.01	4.23	4.24	0.01	4.32	4.33	0.01	4.45	4.46
Te	24.77	2.94	27.71	9.72	3.25	12.97	15.13	6.64	21.77	12.57	7.97	20.54
Ti	0.03	0.01	0.04	0.02	0.03	0.05	0.02	0.03	0.05	0.02	0.04	0.06
Zn	0.51	0.73	1.24	0.05	1.72	1.77	0.03	2.21	2.24	0.03	2.85	2.88
Zr	0.25	0.03	0.28	0.07	0.30	0.37	0.03	0.57	0.60	0.03	0.85	0.88
Cl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	66.63	66.63
F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	73.36	73.36
I	<0.1	NA	NC	NA	NA	NA	NA	NA	NA	<0.1	332.6	332.6
Nitrate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	21.17	21.17
Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<0.1	<0.1
Sulfate	<0.1	NA	NC	NA	NA	NA	NA	NA	NA	<0.1	782.6	782.6

* Suspended

Dissolved

NA - Not Analyzed

NC - Not Calculated

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Table 4.7. Total Accumulation in SBS from Tests 1 and 2.

	Total in SBS (g)	Total from Target Glass (kg)	% in SBS
Al	103.63	191.60	0.05
As	7.96	1.48	0.54
B	787.79	151.92	0.52
Ba	1.68	1.75	0.10
Ca	106.13	8.74	1.22
Cd	51.09	15.84	0.32
Cr	2.71	1.34	0.20
Cs	11.01	3.69	0.30
Cu	1.06	1.17	0.09
Fe	191.58	355.63	0.05
K	25.35	6.90	0.37
Li	107.56	136.31	0.08
Mg	63.38	33.98 ^s	0.19
Mn	17.30	108.63	0.02
Na	385.28	239.12	0.16
Ni	10.96	20.75	0.05
P	6.07	2.78	0.22
Pb	7.99	6.81	0.11
Sb	3.24	7.73	0.04
Se	1188.22	5.22	22.76
Si	266.30	1041.50	0.03
Sr	88.79	95.94	0.09
Te	135.07	5.47	2.47
Ti	0.91	1.76	0.05
Zn	64.80	78.57	0.08
Zr	14.91	128.89	0.01
Cl	245.31	0.49	50.16
F	239.97	1.96	12.27
I	1314.16	4.89	26.87
Nitrate	278.30	29.40	0.95
Nitrite	65.62	14.18	0.46
Sulfate	1916.42	14.67	13.06
Total	31344*	4895	0.64

*Based on gravimetric analysis for total dissolved and suspended solids, not chemical analysis.

^s Value used is analyzed instead of target.

NA - Not Analyzed

NC - Not Calculated

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Table 4.8. Analytical Results for Samples of WESP Blowdown Fluids (mg/l).

Test	#1												#2		
I.D.	12F-W-41A			12F-W-63A			12F-W-63B			12G-W-80A			12G-W-116A		
Glass (kg).	0			0			0			60			2350		
pH	2.31			2.27			3.20			6.13			3.22		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	334	31836	32170	137	32430	32567	43	753	796	40	116	156	24	1248	1272
Al	1.23	10.06	11.29	0.26	13.00	13.25	0.09	0.47	0.56	0.04	0.05	0.10	0.02	0.81	0.82
As	0.23	62.80	63.03	<0.01	83.92	83.92	<0.01	3.01	3.01	0.07	0.23	0.30	<0.01	4.18	4.18
B	0.45	913.4	913.8	0.12	1321	1321	<0.01	26.15	26.15	0.01	0.75	0.76	2.93	5.46	8.39
Ba	0.03	0.11	0.14	0.01	0.12	0.13	<0.01	0.04	0.05	0.01	0.02	0.03	<0.01	0.07	0.07
Ca	0.52	26.16	26.68	0.05	27.43	27.48	0.05	35.23	35.28	0.30	35.92	36.22	0.02	40.82	40.84
Cd	2.35	130.5	132.7	1.07	148.4	149.4	0.36	5.76	6.12	1.11	0.05	1.16	<0.01	5.70	5.70
Cr	17.67	26.37	44.04	7.44	25.84	33.28	1.37	0.46	1.83	1.07	0.01	1.08	<0.01	0.95	0.95
Cs	<0.1	4.82	4.82	<0.1	2.56	2.56	<0.1	1.73	1.73	<0.1	0.90	0.90	<0.1	16.80	16.80
Cu	0.05	3.72	3.77	0.02	4.30	4.32	0.01	0.21	0.22	0.03	0.01	0.03	<0.01	0.63	0.63
Fe	11.55	0.64	12.19	3.11	0.95	4.06	1.35	0.03	1.38	1.62	0.01	1.63	0.02	0.04	0.07
K	1.46	478.1	479.6	0.54	529.1	529.6	0.06	12.94	13.00	0.03	3.01	3.03	0.01	11.16	11.16
Li	0.12	379.1	379.2	0.07	486.7	486.8	<0.01	16.72	16.72	<0.01	0.19	0.19	<0.01	19.94	19.94
Mg	0.23	6.49	6.71	0.03	7.15	7.18	0.02	7.32	7.33	0.02	7.41	7.43	<0.01	10.34	10.34
Mn	0.06	2.63	2.68	0.01	3.54	3.55	0.01	0.15	0.16	0.02	<0.01	0.02	<0.01	0.20	0.20
Na	1.34	2226	2227	0.65	3206	3207	0.07	85.52	85.59	0.06	10.66	10.72	0.02	94.08	94.10
Ni	0.54	14.05	14.60	0.07	15.44	15.51	0.03	2.37	2.40	0.07	0.05	0.11	0.02	1.03	1.05
P	<0.01	4.59	4.59	<0.01	5.11	5.11	<0.01	<0.07	<0.07	0.04	0.21	0.24	<0.01	<0.07	<0.01
Pb	1.84	1.61	3.45	0.92	1.92	2.84	0.33	0.05	0.37	0.93	<0.02	0.93	<0.01	<0.02	<0.01
Sb	0.76	5.90	6.66	0.40	6.48	6.88	0.29	0.09	0.38	0.81	0.25	1.05	<0.01	0.31	0.31
Se	68.32	11775	11843	29.46	13455	13485	5.14	304.8	309.9	2.04	22.54	24.58	0.02	464.1	464.2
Si	5.77	12.74	18.52	1.06	15.41	16.47	0.63	2.54	3.17	0.46	2.76	3.22	<0.01	2.57	2.63
Sr	0.04	6.88	6.91	0.02	7.44	7.45	<0.01	0.87	0.87	0.01	0.19	0.19	<0.01	0.94	0.94
Te	30.98	466.4	497.4	13.54	546.5	560.0	6.36	18.30	24.66	17.28	9.97	27.25	<0.01	25.36	25.36
Ti	0.28	0.09	0.37	0.07	0.10	0.17	0.02	0.01	0.03	0.02	0.01	0.02	<0.01	<0.01	<0.01
Zn	0.13	46.01	46.14	0.05	54.32	54.37	0.03	1.57	1.60	0.18	0.04	0.22	0.01	2.26	2.27
Zr	0.06	0.04	11.29	0.01	0.02	0.03	<0.01	0.01	0.01	0.01	0.01	0.02	<0.01	<0.01	<0.01
Cl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	26.74	26.74	NA	30.58	30.58
F	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.19	1.19	NA	2.03	2.03
I	<0.1	NA	NC	<0.1	NA	NC	<0.1	NA	NC	NA	5.64	5.64	<0.1	0.65	0.65
Nitrate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.19	6.19	NA	43.62	43.62
Nitrite	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	35.68	35.68	NA	<0.1	<0.1
Sulfate	<0.1	NA	NC	<0.1	NA	NC	<0.1	NA	NC	NA	53.18	53.18	0.29	245.8	246.1

Sus* - Suspended

Dis# - Dissolved

NA - Not Analyzed

NC - Not Calculated

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Table 4.8. Analytical Results for Samples of WESP Blowdown Fluids (mg/l), (continued).

Test	#2														
I.D.	12G-W-128A			12G-W-139A			12G-W-148A			12H-W-11A			12H-W-33A		
Glass (kg).	2561			2827			2930			3120			3360		
pH	4.08			7.61			7.73			7.80			8.03		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	8	1260	1268	2	1288	1290	146	1292	1438	NA	1566	1578	12	1364	1376
Al	NA	0.91	0.91	NA	0.11	0.11	0.05	0.13	0.18	NA	0.13	0.13	<0.01	0.15	0.15
As	NA	5.14	5.14	NA	4.69	4.69	<0.01	5.53	5.53	NA	6.66	6.66	<0.01	8.22	8.22
B	NA	9.08	9.08	NA	11.75	11.75	<0.01	17.26	17.26	NA	22.96	22.96	<0.01	34.43	34.43
Ba	NA	0.07	0.07	NA	0.06	0.06	<0.01	0.06	0.06	NA	0.06	0.06	<0.01	0.06	0.07
Ca	NA	46.42	46.42	NA	49.70	49.70	0.10	54.74	54.84	NA	59.41	59.41	0.01	68.87	68.88
Cd	NA	8.72	8.72	NA	0.49	0.49	0.17	0.58	0.76	NA	0.40	0.40	0.01	0.44	0.45
Cr	NA	0.31	0.31	NA	0.01	0.01	0.01	0.02	0.03	NA	0.02	0.02	<0.01	0.02	0.02
Cs	NA	20.50	20.50	NA	20.00	20.00	<0.1	21.90	21.90	NA	24.60	24.60	<0.1	27.40	27.40
Cu	NA	0.84	0.84	NA	0.13	0.13	0.02	0.14	0.16	NA	0.21	0.21	<0.01	0.35	0.35
Fe	NA	<0.01	<0.01	NA	0.01	0.01	0.05	<0.01	0.05	NA	<0.01	<0.01	<0.01	<0.01	<0.01
K	NA	14.20	14.20	NA	12.87	12.87	<0.01	14.60	14.60	NA	15.32	15.32	<0.01	17.05	17.05
Li	NA	24.26	24.26	NA	22.13	22.13	<0.01	25.20	25.20	NA	25.79	25.79	<0.01	28.08	28.08
Mg	NA	11.66	11.66	NA	12.57	12.57	0.03	14.01	14.05	NA	15.17	15.17	<0.01	18.57	18.57
Mn	NA	0.22	0.22	NA	0.13	0.13	<0.01	0.09	0.09	NA	0.07	0.07	<0.01	0.06	0.06
Na	NA	108.9	108.9	NA	104.6	104.6	0.05	116.1	116.2	NA	120.9	120.9	<0.01	123.3	123.3
Ni	NA	1.19	1.19	NA	0.88	0.88	<0.01	0.99	0.99	NA	0.99	0.99	<0.01	1.00	1.00
P	NA	<0.07	<0.07	NA	<0.07	<0.07	0.17	<0.07	0.17	NA	<0.01	<0.01	0.02	<0.07	0.02
Pb	NA	0.03	0.03	NA	0.04	0.04	<0.01	0.05	0.05	NA	0.08	0.08	<0.01	0.11	0.11
Sb	NA	0.25	0.25	NA	0.27	0.27	<0.01	0.31	0.31	NA	0.41	0.41	<0.01	0.47	0.47
Se	NA	558.4	558.4	NA	504.4	504.4	<0.01	482.8	482.8	NA	558.0	558.0	0.01	589.7	589.7
Si	NA	2.96	2.96	NA	3.15	3.15	0.38	3.65	4.03	NA	4.08	4.08	0.01	4.89	4.90
Sr	NA	1.15	1.15	NA	1.06	1.06	<0.01	1.18	1.18	NA	1.22	1.22	<0.01	1.29	1.29
Te	NA	25.77	25.77	NA	17.89	17.89	<0.01	20.39	20.39	NA	21.94	21.94	<0.01	22.95	22.95
Ti	NA	<0.01	<0.01	NA	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	NA	2.61	2.61	NA	0.10	0.10	0.02	0.12	0.13	NA	0.04	0.04	<0.01	0.03	0.03
Zr	NA	<0.01	<0.01	NA	0.01	0.01	<0.01	<0.01	<0.01	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Cl	NA	38.63	38.63	NA	42.19	42.19	NA	47.95	47.95	NA	53.53	53.53	NA	70.51	70.51
F	NA	3.45	3.45	NA	4.56	4.56	NA	6.53	6.53	NA	9.38	9.38	NA	14.04	14.04
I	NA	2.37	2.37	NA	10.23	10.23	<0.1	22.24	22.24	NA	36.40	36.40	<0.1	87.44	87.44
Nitrate	NA	45.80	45.80	NA	42.66	42.66	NA	45.90	45.90	NA	47.59	47.59	NA	44.72	44.72
Nitrite	NA	<0.1	<0.1	NA	1.96	1.96	NA	3.85	3.85	NA	5.88	5.88	NA	7.91	7.91
Sulfate	NA	319.7	319.7	NA	292.0	292.0	0.35	342.4	342.8	NA	355.0	355.0	0.01	377.7	377.7

Sus* - Suspended

Dis# - Dissolved

NA - Not Analyzed

*Note: If TSS is very small and Sus. concentrations were not analyzed, Dis. concentrations were used for the totals.

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Table 4.8. Analytical Results for Samples of WESP Blowdown Fluids (mg/l), (continued).

Test	#2														
I.D.	12H-W-40A			12H-W-43A			12I-W-13A			12I-W-22A			12I-W-26A		
Glass (kg).	3452			3452			3540			3699			3840		
pH	7.97			7.89			7.95			7.89			7.92		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	2	1580	1582	574	1556	2130	2	1408	1410	0	1420	1420	8	1308	1316
Al	<0.01	0.16	0.16	2.76	0.15	2.91	NA	0.16	0.16	NA	0.16	0.16	NA	0.17	0.17
As	<0.01	8.61	8.61	3.23	8.52	11.75	NA	9.20	9.20	NA	8.47	8.47	NA	8.76	8.76
B	<0.01	37.94	37.94	0.30	39.43	39.72	NA	42.34	42.34	NA	44.67	44.67	NA	46.29	46.29
Ba	<0.01	0.07	0.07	0.21	0.06	0.26	NA	0.07	0.07	NA	0.08	0.08	NA	0.08	0.08
Ca	<0.01	74.57	74.57	7.10	74.29	81.39	NA	78.05	78.05	NA	77.71	77.71	NA	83.34	83.34
Cd	<0.01	0.44	0.44	48.34	0.30	48.64	NA	0.43	0.43	NA	0.41	0.41	NA	0.28	0.28
Cr	<0.01	0.03	0.03	11.66	0.04	11.69	NA	0.04	0.04	NA	0.04	0.04	NA	0.05	0.05
Cs	<0.1	28.80	28.80	0.46	26.00	26.46	NA	26.40	26.40	NA	27.10	27.10	NA	26.70	26.70
Cu	<0.01	0.42	0.42	2.52	0.45	2.97	NA	0.47	0.47	NA	0.49	0.49	NA	0.45	0.45
Fe	<0.01	<0.01	<0.01	17.88	<0.01	17.88	NA	<0.01	<0.01	NA	0.01	0.01	NA	<0.01	<0.01
K	<0.01	17.16	17.16	0.29	19.46	19.75	NA	17.64	17.64	NA	18.09	18.09	NA	18.98	18.98
Li	<0.01	27.70	27.70	0.29	26.84	27.13	NA	27.56	27.56	NA	27.77	27.77	NA	28.62	28.62
Mg	<0.01	19.55	19.55	0.41	20.18	20.59	NA	21.11	21.11	NA	22.43	22.43	NA	24.15	24.15
Mn	<0.01	0.06	0.06	0.64	0.04	0.68	NA	0.06	0.06	NA	0.05	0.05	NA	0.04	0.04
Na	<0.01	124.3	124.3	1.95	123.1	125.0	NA	125.0	125.0	NA	125.9	125.9	NA	130.2	130.2
Ni	<0.01	0.99	0.99	1.02	0.90	1.91	NA	0.99	0.99	NA	0.96	0.96	NA	0.95	0.95
P	<0.01	<0.07	<0.07	<0.01	<0.07	<0.07	NA	<0.01	<0.01	NA	<0.01	<0.01	NA	<0.01	<0.01
Pb	<0.01	0.11	0.11	8.92	0.12	9.04	NA	0.12	0.12	NA	0.16	0.16	NA	0.15	0.15
Sb	<0.01	0.43	0.43	5.27	0.54	5.81	NA	0.40	0.40	NA	0.46	0.46	NA	0.54	0.54
Se	<0.01	628.9	628.9	42.52	768.8	811.3	NA	662.0	662.0	NA	607.4	607.4	NA	655.0	655.0
Si	0.01	5.51	5.52	6.29	5.54	11.83	NA	5.66	5.66	NA	6.07	6.07	NA	6.51	6.51
Sr	<0.01	1.32	1.32	0.25	1.31	1.56	NA	1.36	1.36	NA	1.37	1.37	NA	1.43	1.43
Te	<0.01	23.91	23.91	177.1	23.85	200.9	NA	24.98	24.98	NA	24.24	24.24	NA	23.21	23.21
Ti	<0.01	<0.01	<0.01	0.48	<0.01	0.48	NA	<0.01	<0.01	NA	<0.01	<0.01	NA	<0.01	<0.01
Zn	<0.01	0.04	0.04	6.88	0.04	6.91	NA	0.03	0.03	NA	0.03	0.03	NA	0.02	0.02
Zr	<0.01	<0.01	<0.01	0.33	<0.01	0.33	NA	0.01	0.01	NA	<0.01	<0.01	NA	0.01	0.01
Cl	NA	74.44	74.44	NA	80.99	80.99	NA	82.03	82.03	NA	80.45	80.45	NA	88.42	88.42
F	NA	15.37	15.37	NA	16.85	16.85	NA	17.69	17.69	NA	14.09	14.09	NA	18.46	18.46
I	<0.1	100.9	100.9	<0.01	116.4	116.4	NA	122.3	122.3	NA	128.8	128.8	NA	143.5	143.5
Nitrate	NA	46.63	46.63	NA	56.95	56.95	NA	45.68	45.68	NA	43.30	43.30	NA	43.35	43.35
Nitrite	NA	8.69	8.69	NA	8.56	8.56	NA	9.85	9.85	NA	10.93	10.93	NA	14.36	14.36
Sulfate	0.02	395.7	395.7	0.35	384.5	384.8	NA	529.2	529.2	NA	386.8	386.8	NA	423.5	423.5

Sus* - Suspended
Dis# - Dissolved
NA - Not Analyzed

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Table 4.8. Analytical Results for Samples of WESP Blowdown Fluids (mg/l), (continued).

Test	#2														
I.D.	12I-W-33A			12I-W-42A			12I-W-51A			12I-W-61A			12I-W-68A		
Glass (kg).	3981			4122			4250			4507			4635		
pH	8.01			7.92			7.92			7.91			7.89		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	6	1456	1462	12	1544	1556	2	1696	1698	2	1976	1978	6	1904	1910
Al	<0.01	0.17	0.17	NA	0.17	0.17	NA	0.17	0.17	<0.01	0.18	0.18	NA	0.18	0.18
As	<0.01	9.04	9.04	NA	9.64	9.64	NA	10.43	10.43	<0.01	11.29	11.29	NA	10.59	10.59
B	<0.01	47.20	47.20	NA	50.97	50.97	NA	52.84	52.84	<0.01	58.29	58.29	NA	55.16	55.16
Ba	<0.01	0.08	0.08	NA	0.09	0.09	NA	0.09	0.09	<0.01	0.09	0.09	NA	0.09	0.09
Ca	<0.01	87.61	87.61	NA	95.04	95.04	NA	92.96	92.96	<0.01	99.70	99.70	NA	95.81	95.81
Cd	<0.01	0.28	0.28	NA	0.22	0.22	NA	0.28	0.28	<0.01	0.28	0.28	NA	0.28	0.28
Cr	<0.01	0.05	0.05	NA	0.06	0.06	NA	0.07	0.07	<0.01	0.07	0.07	NA	0.07	0.07
Cs	<0.1	26.50	26.50	NA	22.14	22.14	NA	29.90	29.90	<0.1	31.50	31.50	NA	29.20	29.20
Cu	<0.01	0.45	0.45	NA	0.43	0.43	NA	0.48	0.48	<0.01	0.48	0.48	NA	0.45	0.45
Fe	<0.01	<0.01	<0.01	NA	0.02	0.02	NA	0.02	0.02	<0.01	0.03	0.03	NA	0.03	0.03
K	<0.01	18.47	18.47	NA	19.61	19.61	NA	20.02	20.02	<0.01	20.61	20.61	NA	20.16	20.16
Li	<0.01	27.61	27.61	NA	28.83	28.83	NA	28.88	28.88	<0.01	29.11	29.11	NA	28.41	28.41
Mg	<0.01	24.77	24.77	NA	26.41	26.41	NA	28.25	28.25	<0.01	29.37	29.37	NA	28.65	28.65
Mn	<0.01	0.05	0.05	NA	0.06	0.06	NA	0.05	0.05	<0.01	0.04	0.04	NA	0.06	0.06
Na	<0.01	127.0	127.0	NA	134.0	134.0	NA	136.0	136.0	<0.01	140.5	140.5	NA	136.8	136.8
Ni	<0.01	0.90	0.90	NA	0.88	0.88	NA	0.84	0.84	<0.01	0.82	0.82	NA	0.82	0.82
P	<0.01	<0.01	<0.01	NA	0.08	0.08	NA	0.08	0.08	<0.01	0.29	0.29	NA	0.32	0.32
Pb	<0.01	0.16	0.16	NA	0.17	0.17	NA	0.18	0.18	<0.01	0.18	0.18	NA	0.18	0.18
Sb	<0.01	0.52	0.52	NA	0.61	0.61	NA	0.65	0.65	<0.01	0.58	0.58	NA	0.59	0.59
Se	<0.01	676.8	676.8	NA	698.1	698.1	NA	704.8	704.8	<0.01	723.4	723.4	NA	725.8	725.8
Si	<0.01	6.48	6.48	NA	7.10	7.10	NA	7.19	7.19	<0.01	7.58	7.59	NA	7.44	7.44
Sr	<0.01	1.40	1.40	NA	1.42	1.42	NA	1.46	1.46	<0.01	1.49	1.49	NA	1.43	1.43
Te	<0.01	24.47	24.47	NA	24.54	24.54	NA	27.05	27.05	<0.01	29.69	29.69	NA	26.19	26.19
Ti	<0.01	<0.01	<0.01	NA	0.01	0.01	NA	0.01	0.01	<0.01	0.01	0.01	NA	0.01	0.01
Zn	<0.01	0.02	0.02	NA	0.02	0.02	NA	0.02	0.02	<0.01	0.02	0.02	NA	0.03	0.03
Zr	<0.01	0.01	0.01	NA	0.02	0.02	NA	0.02	0.02	<0.01	0.02	0.02	NA	0.02	0.02
Cl	NA	94.40	94.40	NA	90.73	90.73	NA	105.7	105.7	NA	113.0	113.0	NA	116.4	116.4
F	NA	19.31	19.31	NA	20.38	20.38	NA	22.86	22.86	NA	26.34	26.34	NA	24.80	24.80
I	<0.1	156.0	156.0	NA	153.4	153.4	NA	171.1	171.1	<0.1	198.9	198.9	NA	192.6	192.6
Nitrate	NA	45.57	45.57	NA	45.60	45.60	NA	45.99	45.99	NA	47.84	47.84	NA	45.27	45.27
Nitrite	NA	16.27	16.27	NA	18.06	18.06	NA	20.82	20.82	NA	23.70	23.70	NA	21.70	21.70
Sulfate	<0.1	470.4	470.4	NA	439.2	439.2	NA	478.4	478.4	<0.1	494.7	494.7	NA	464.0	464.0

Sus* - Suspended

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Table 4.8. Analytical Results for Samples of WESP Blowdown Fluids (mg/l), (continued).

Test	#2									#3					
I.D.	12I-W-73A			12J-W-12A			12J-W-13A			12J-W-65A			12J-W-86A		
Glass (kg).	4765			4765			4900			6657			7711		
pH	7.90			7.82			6.99			3.08			3.00		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	8	2080	2088	50	2088	2138	288	604	892	0	2508	2508	6	3800	3806
Al	NA	0.18	0.18	0.11	0.18	0.29	0.12	0.07	0.19	NA	1.28	1.28	NA	2.28	2.28
As	NA	11.99	11.99	0.41	13.26	13.67	2.43	9.86	12.30	NA	19.53	19.53	NA	25.15	25.15
B	NA	61.57	61.57	<0.01	72.29	72.29	<0.01	14.28	14.28	NA	71.29	71.29	NA	115.0	115.0
Ba	NA	0.10	0.10	0.01	0.10	0.11	0.04	0.03	0.07	NA	0.14	0.14	NA	0.19	0.19
Ca	NA	74.86	74.86	0.53	82.87	83.40	0.92	38.01	38.93	NA	60.81	60.81	NA	65.84	65.84
Cd	NA	0.26	0.26	6.37	0.28	6.65	42.62	0.32	42.94	NA	64.82	64.82	NA	76.31	76.31
Cr	NA	0.08	0.08	0.34	0.10	0.44	1.61	0.03	1.64	NA	0.22	0.22	NA	0.40	0.40
Cs	NA	31.30	31.30	0.10	34.30	34.40	0.64	11.50	12.14	NA	56.26	56.26	NA	81.22	81.22
Cu	NA	0.48	0.48	0.08	0.24	0.32	0.13	0.02	0.14	NA	1.61	1.61	NA	2.17	2.17
Fe	NA	0.03	0.03	1.20	0.03	1.23	2.25	0.02	2.26	NA	0.04	0.04	NA	0.06	0.06
K	NA	21.63	21.63	0.03	23.36	23.39	0.20	7.10	7.31	NA	23.89	23.89	NA	36.65	36.65
Li	NA	25.29	25.29	0.04	27.42	27.47	0.23	7.57	7.81	NA	53.76	53.76	NA	84.75	84.75
Mg	NA	28.93	28.93	0.03	32.72	32.75	0.05	12.28	12.32	NA	17.80	17.80	NA	19.62	19.62
Mn	NA	0.05	0.05	0.13	0.05	0.18	0.04	0.03	0.07	NA	0.49	0.49	NA	0.79	0.79
Na	NA	107.3	107.3	0.32	116.4	116.4	2.02	48.38	50.39	NA	293.2	293.2	NA	429.0	429.0
Ni	NA	0.77	0.77	0.08	0.70	0.78	0.17	0.29	0.46	NA	1.12	1.12	NA	1.55	1.55
P	NA	0.27	0.27	<0.01	0.24	0.24	<0.01	0.11	0.11	NA	0.60	0.60	NA	0.65	0.65
Pb	NA	0.20	0.20	0.97	0.23	1.21	5.94	<0.01	5.94	NA	0.96	0.96	NA	1.18	1.18
Sb	NA	0.62	0.62	0.24	0.73	0.96	1.37	0.37	1.74	NA	0.33	0.33	NA	0.25	0.25
Se	NA	898.4	898.4	2.38	1008	1011	12.85	414.9	427.8	NA	899.2	899.2	NA	913.6	913.6
Si	NA	8.07	8.07	0.69	9.00	9.69	0.79	2.57	3.36	NA	4.61	4.61	NA	5.94	5.94
Sr	NA	1.54	1.54	0.02	1.75	1.77	0.03	0.36	0.39	NA	1.66	1.66	NA	2.51	2.51
Te	NA	27.72	27.72	20.15	34.04	54.18	115.7	15.30	131.0	NA	48.09	48.09	NA	63.16	63.16
Ti	NA	0.01	0.01	0.01	0.01	0.03	0.02	<0.01	0.02	NA	0.01	0.01	NA	0.03	0.03
Zn	NA	0.02	0.02	0.13	0.02	0.15	0.41	0.01	0.42	NA	4.75	4.75	NA	6.88	6.88
Zr	NA	0.01	0.01	0.06	0.03	0.08	0.02	0.01	0.03	NA	0.02	0.02	NA	0.04	0.04
Cl	NA	128.9	128.9	NA	154.1	154.1	NA	82.03	82.03	NA	83.40	83.40	NA	102.2	102.2
F	NA	27.23	27.23	NA	31.00	31.00	NA	17.69	17.69	NA	7.92	7.92	NA	8.74	8.74
I	NA	214.2	214.2	<0.1	274.1	274.1	<0.1	122.3	122.3	NA	6.13	6.13	NA	1.56	1.56
Nitrate	NA	48.19	48.19	NA	52.86	52.86	NA	45.68	45.68	NA	28.55	28.55	NA	44.59	44.59
Nitrite	NA	24.19	24.19	NA	35.75	35.75	NA	9.85	9.85	NA	<0.1	<0.1	NA	<0.1	<0.1
Sulfate	NA	517.5	517.5	0.04	559.4	559.5	<0.1	429.2	429.2	NA	1140	1140	NA	1492	1492

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Table 4.8. Analytical Results for Samples of WESP Blowdown Fluids (mg/l), (continued).

Test	#3									#5								
I.D.	12J-W-130A			12K-W-6A			12K-W-6C			12L-W-20A			12L-W-30A					
Glass (kg).	9645			9645			11100			14746			14849					
pH	7.07			2.75			2.5			2.00			1.27					
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total			
Total	333	428	761	26	9492	2518	92	2060	2152	0	592	592	0	1612	1612			
Al	NA	3.71	3.71	0.02	4.94	4.96	0.56	0.88	1.44	NA	0.53	0.53	NA	2.61	2.61			
As	NA	49.79	49.79	0.10	60.56	60.66	0.32	9.94	10.25	NA	1.88	1.88	NA	3.88	3.88			
B	NA	212.7	212.7	0.31	281.7	282.0	0.09	22.17	22.26	NA	15.53	15.53	NA	47.31	47.31			
Ba	NA	0.25	0.25	<0.01	0.30	0.30	0.01	0.07	0.07	NA	0.07	0.07	NA	0.15	0.15			
Ca	NA	91.27	91.27	0.02	77.34	77.36	0.06	39.48	39.54	NA	43.40	43.40	NA	54.10	54.10			
Cd	NA	99.70	99.70	1.76	117.0	119.2	2.27	46.58	48.85	NA	14.75	14.75	NA	51.84	51.84			
Cr	NA	0.64	0.64	0.18	1.35	1.52	2.80	2.90	5.70	NA	4.88	4.88	NA	24.84	24.84			
Cs	NA	163.7	163.7	<0.1	200.6	200.6	<0.1	23.56	23.56	NA	5.15	5.15	NA	10.49	10.49			
Cu	NA	5.57	5.57	0.01	8.43	8.44	0.02	0.65	0.67	NA	2.40	2.40	NA	5.24	5.24			
Fe	NA	0.08	0.08	0.64	0.12	0.76	4.51	0.20	4.71	NA	0.89	0.89	NA	9.91	9.91			
K	NA	74.88	74.88	0.11	100.4	100.5	0.02	12.92	12.94	NA	5.15	5.15	NA	8.14	8.14			
Li	NA	141.4	141.4	0.01	185.8	185.8	0.01	24.71	24.72	NA	6.03	6.03	NA	13.08	13.08			
Mg	NA	28.95	28.95	0.02	29.89	29.91	0.07	10.26	10.32	NA	13.27	13.27	NA	15.90	15.90			
Mn	NA	1.36	1.36	0.13	1.75	1.88	0.51	0.66	1.16	NA	0.24	0.24	NA	0.86	0.86			
Na	NA	787.7	787.7	0.11	982.3	982.4	0.18	113.8	114.0	NA	41.78	41.78	NA	70.83	70.83			
Ni	NA	2.45	2.45	0.01	2.90	2.91	0.11	2.92	3.03	NA	0.31	0.31	NA	1.33	1.33			
P	NA	1.32	1.32	0.04	1.65	1.69	0.29	0.38	0.67	NA	0.26	0.26	NA	0.52	0.52			
Pb	NA	1.29	1.29	0.51	1.40	1.90	1.41	0.11	1.53	NA	2.48	2.48	NA	14.09	14.09			
Sb	NA	0.27	0.27	0.18	0.45	0.63	1.12	0.23	1.35	NA	0.06	0.06	NA	0.48	0.48			
Se	NA	2538	2538	1.01	3432	3433	13.86	1338	1352	NA	134.0	134.0	NA	291.4	291.4			
Si	NA	10.09	10.09	0.44	12.39	12.83	4.93	2.91	7.83	NA	2.61	2.61	NA	3.37	3.37			
Sr	NA	4.94	4.94	<0.01	4.29	4.29	0.01	0.85	0.86	NA	0.59	0.59	NA	1.13	1.13			
Te	NA	102.7	102.7	13.19	117.9	131.1	22.38	46.96	69.34	NA	75.70	75.70	NA	280.1	280.1			
Ti	NA	0.04	0.04	0.01	0.05	0.06	0.04	0.01	0.05	NA	0.01	0.01	NA	0.05	0.05			
Zn	NA	11.34	11.34	0.03	14.44	14.46	0.14	2.89	3.03	NA	1.00	1.00	NA	3.44	3.44			
Zr	NA	0.04	0.04	0.03	0.05	0.08	0.83	0.01	0.84	NA	<0.01	<0.01	NA	0.05	0.05			
Cl	NA	160.4	160.4	NA	196.8	196.8	NA	35.53	35.53	NA	43.05	43.05	NA	47.33	47.33			
F	NA	10.31	10.31	NA	10.72	10.72	NA	1.17	1.17	NA	2.14	2.14	NA	6.18	6.18			
I	NA	0.70	0.70	NA	12.13	12.13	NA	16.34	16.34	NA	1.20	1.20	NA	2.68	2.68			
Nitrate	NA	94.01	94.01	NA	149.3	149.3	NA	47.68	47.68	NA	1130	1130	NA	5633	5633			
Nitrite	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1			
Sulfate	NA	2967	2967	NA	3817	3817	NA	401.7	401.7	NA	142.6	142.6	NA	179.0	179.0			

Sus* - Suspended

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Table 4.8. Analytical Results for Samples of WESP Blowdown Fluids (mg/l), (continued).

Test	#5														
I.D.	12L-W-41A			12L-W-50A			12L-W-70A			12L-W-80A			12L-W-95A		
Glass (kg).	15056			15230			15641			15704			15829		
pH	1.08			0.91			0.71			0.64			0.57		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	4	2232	2236	20	2880	2900	86	3664	3750	54	3964	4018	36	4056	4092
Al	NA	6.40	6.40	NA	6.39	6.39	NA	8.23	8.23	NA	9.92	9.92	NA	11.07	11.07
As	NA	5.28	5.28	NA	5.78	5.78	NA	7.66	7.66	NA	8.16	8.16	NA	7.50	7.50
B	NA	79.63	79.63	NA	104.4	104.4	NA	164.8	164.8	NA	196.8	196.8	NA	247.1	247.1
Ba	NA	0.19	0.19	NA	0.22	0.22	NA	0.29	0.29	NA	0.31	0.31	NA	0.38	0.38
Ca	NA	60.95	60.95	NA	64.57	64.57	NA	80.05	80.05	NA	87.62	87.62	NA	94.31	94.31
Cd	NA	66.17	66.17	NA	74.22	74.22	NA	86.61	86.61	NA	87.52	87.52	NA	89.95	89.95
Cr	NA	36.23	36.23	NA	41.32	41.32	NA	53.09	53.09	NA	54.51	54.51	NA	55.35	55.35
Cs	NA	14.13	14.13	NA	15.96	15.96	NA	20.25	20.25	NA	21.95	21.95	NA	25.71	25.71
Cu	NA	7.22	7.22	NA	9.26	9.26	NA	13.24	13.24	NA	14.61	14.61	NA	17.46	17.46
Fe	NA	23.02	23.02	NA	34.51	34.51	NA	67.54	67.54	NA	84.40	84.40	NA	101.6	101.6
K	NA	10.52	10.52	NA	11.61	11.61	NA	14.95	14.95	NA	17.19	17.19	NA	21.33	21.33
Li	NA	19.02	19.02	NA	22.60	22.60	NA	27.17	27.17	NA	32.78	32.78	NA	44.47	44.47
Mg	NA	19.40	19.40	NA	20.06	20.06	NA	24.10	24.10	NA	26.77	26.77	NA	29.26	29.26
Mn	NA	1.49	1.49	NA	1.97	1.97	NA	2.98	2.98	NA	4.17	4.17	NA	5.01	5.01
Na	NA	89.02	89.02	NA	99.24	99.24	NA	118.9	118.9	NA	134.1	134.1	NA	189.6	189.6
Ni	NA	2.13	2.13	NA	2.73	2.73	NA	3.84	3.84	NA	4.48	4.48	NA	5.09	5.09
P	NA	0.57	0.57	NA	0.81	0.81	NA	1.00	1.00	NA	1.15	1.15	NA	1.30	1.30
Pb	NA	22.52	22.52	NA	28.26	28.26	NA	37.63	37.63	NA	39.19	39.19	NA	42.15	42.15
Sb	NA	1.01	1.01	NA	1.59	1.59	NA	2.56	2.56	NA	3.87	3.87	NA	5.18	5.18
Se	NA	384.4	384.4	NA	410.5	410.5	NA	403.3	403.3	NA	528.0	528.0	NA	625.7	625.7
Si	NA	4.13	4.13	NA	4.42	4.42	NA	5.47	5.47	NA	6.09	6.09	NA	6.54	6.54
Sr	NA	1.70	1.70	NA	2.22	2.22	NA	3.30	3.30	NA	4.81	4.81	NA	4.81	4.81
Te	NA	571.6	571.6	NA	670.5	670.5	NA	713.1	713.1	NA	726.6	726.6	NA	776.4	776.4
Ti	NA	0.07	0.07	NA	0.09	0.09	NA	0.14	0.14	NA	0.16	0.16	NA	0.18	0.18
Zn	NA	5.75	5.75	NA	7.03	7.03	NA	8.80	8.80	NA	9.80	9.80	NA	11.12	11.12
Zr	NA	0.11	0.11	NA	0.19	0.19	NA	0.41	0.41	NA	0.69	0.69	NA	0.98	0.98
Cl	NA	52.99	52.99	NA	58.51	58.51	NA	65.55	65.55	NA	69.75	69.75	NA	69.21	69.21
F	NA	9.60	9.60	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1
I	NA	3.61	3.61	NA	4.60	4.60	NA	6.13	6.13	NA	6.79	6.79	NA	4.70	4.70
Nitrate	NA	10027	10027	NA	13353	13353	NA	21305	21305	NA	27111	27111	NA	33113	33113
Nitrite	NA	<0.1	<0.1	NA	3.75	3.75	NA	4.96	4.96	NA	7.87	7.87	NA	19.88	19.88
Sulfate	NA	206.5	206.5	NA	234.0	234.0	NA	268.3	268.3	NA	292.7	292.7	NA	295.2	295.2

Sus* - Suspended

Dis# - Dissolved

NA - Not Analyzed

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Table 4.8. Analytical Results for Samples of WESP Blowdown Fluids (mg/l), (continued).

Test	#5						#6								
I.D.	12L-W-107A			12L-W-124A			12M-W-10A			12M-W-24A			12M-W-40A		
Glass (kg).	15892			16200			16621			16809			17118		
pH	0.50			0.42			2.15			2.20			2.45		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	140	4448	4588	50	5860	5910	6	752	758	5	888	893	0	824	824
Al	NA	10.73	10.73	NA	13.64	13.64	NA	2.38	2.38	NA	2.47	2.47	NA	2.20	2.20
As	NA	8.22	8.22	NA	9.15	9.15	NA	3.70	3.70	NA	5.20	5.20	NA	6.35	6.35
B	NA	297.0	297.0	NA	402.8	402.8	NA	36.96	36.96	NA	43.04	43.04	NA	49.37	49.37
Ba	NA	0.43	0.43	NA	0.56	0.56	NA	0.09	0.09	NA	0.10	0.10	NA	0.10	0.10
Ca	NA	100.2	100.2	NA	119.8	119.8	NA	59.54	59.54	NA	64.77	64.77	NA	69.80	69.80
Cd	NA	99.69	99.69	NA	112.6	112.6	NA	11.05	11.05	NA	14.44	14.44	NA	16.80	16.80
Cr	NA	54.07	54.07	NA	61.73	61.73	NA	2.52	2.52	NA	2.43	2.43	NA	2.05	2.05
Cs	NA	26.86	26.86	NA	34.19	34.19	NA	4.80	4.80	NA	6.90	6.90	NA	7.90	7.90
Cu	NA	19.59	19.59	NA	23.00	23.00	NA	14.27	14.27	NA	14.19	14.19	NA	12.68	12.68
Fe	NA	110.1	110.1	NA	149.7	149.7	NA	8.54	8.54	NA	7.97	7.97	NA	6.40	6.40
K	NA	22.31	22.31	NA	25.94	25.94	NA	6.54	6.54	NA	7.51	7.51	NA	8.66	8.66
Li	NA	50.38	50.38	NA	71.95	71.95	NA	7.48	7.48	NA	9.46	9.46	NA	11.80	11.80
Mg	NA	28.20	28.20	NA	31.43	31.43	NA	13.15	13.15	NA	14.40	14.40	NA	16.06	16.06
Mn	NA	4.12	4.12	NA	5.39	5.39	NA	0.82	0.82	NA	0.80	0.80	NA	0.74	0.74
Na	NA	238.2	238.2	NA	334.0	334.0	NA	45.90	45.90	NA	54.72	54.72	NA	61.86	61.86
Ni	NA	4.59	4.59	NA	5.77	5.77	NA	0.85	0.85	NA	0.87	0.87	NA	0.80	0.80
P	NA	1.55	1.55	NA	1.94	1.94	NA	0.17	0.17	NA	0.15	0.15	NA	0.37	0.37
Pb	NA	41.79	41.79	NA	46.34	46.34	NA	1.37	1.37	NA	1.36	1.36	NA	1.07	1.07
Sb	NA	5.51	5.51	NA	8.03	8.03	NA	0.78	0.78	NA	0.89	0.89	NA	0.85	0.85
Se	NA	676.1	676.1	NA	792.5	792.5	NA	167.4	167.4	NA	241.8	241.8	NA	278.6	278.6
Si	NA	6.22	6.22	NA	7.81	7.81	NA	2.76	2.76	NA	3.06	3.06	NA	3.37	3.37
Sr	NA	5.33	5.33	NA	7.89	7.89	NA	0.97	0.97	NA	1.03	1.03	NA	1.03	1.03
Te	NA	839.9	839.9	NA	952.6	952.6	NA	17.46	17.46	NA	18.70	18.70	NA	14.17	14.17
Ti	NA	0.18	0.18	NA	0.22	0.22	NA	0.01	0.01	NA	0.01	0.01	NA	0.01	0.01
Zn	NA	12.15	12.15	NA	15.34	15.34	NA	3.48	3.48	NA	3.93	3.93	NA	3.94	3.94
Zr	NA	1.06	1.06	NA	1.78	1.78	NA	0.08	0.08	NA	0.07	0.07	NA	0.07	0.07
Cl	NA	73.07	73.07	NA	78.42	78.42	NA	72.56	72.56	NA	94.46	94.46	NA	115.1	115.1
F	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	4.49	4.49	NA	6.45	6.45	NA	11.02	11.02
I	NA	4.15	4.15	NA	4.63	4.63	NA	1.41	1.41	NA	1.73	1.73	NA	1.41	1.41
Nitrate	NA	42164	42164	NA	39004	39004	NA	1103	1103	NA	1097	1097	NA	1011	1011
Nitrite	NA	28.10	28.10	NA	30.48	30.48	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1
Sulfate	NA	312.9	312.9	NA	397.8	397.8	NA	97.91	97.91	NA	112.2	112.2	NA	122.3	122.3

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Table 4.8. Analytical Results for Samples of WESP Blowdown Fluids (mg/l), (continued).

Test	#6														
I.D.	12M-W-61A			12M-W-72A			12M-W-82A			12M-W-91A			12M-W-109A		
Glass (kg).	17421			17620			17720			17820			18020		
pH	NA			2.65			2.68			2.69			2.73		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	0	1168	1168	1396	6	1402	1504	10	1514	1708	10	1718	12	2280	2292
Al	NA	2.37	2.37	NA	2.27	NC	NA	2.34	NC	NA	2.64	NC	NA	2.82	2.82
As	NA	8.71	8.71	NA	9.80	NC	NA	11.03	NC	NA	14.00	NC	NA	16.71	16.71
B	NA	66.74	66.74	NA	71.42	NC	NA	81.11	NC	NA	94.99	NC	NA	117.0	117.0
Ba	NA	0.12	0.12	NA	0.12	NC	NA	0.12	NC	NA	0.14	NC	NA	0.16	0.16
Ca	NA	82.16	82.16	NA	84.43	NC	NA	90.38	NC	NA	101.5	NC	NA	124.8	124.8
Cd	NA	24.11	24.11	NA	25.95	NC	NA	29.31	NC	NA	35.79	NC	NA	44.34	44.34
Cr	NA	2.02	2.02	NA	1.73	NC	NA	1.74	NC	NA	1.87	NC	NA	1.89	1.89
Cs	NA	12.30	12.30	NA	12.70	NC	NA	14.90	NC	NA	16.70	NC	NA	19.60	19.60
Cu	NA	14.40	14.40	NA	12.58	NC	NA	14.78	NC	NA	15.96	NC	NA	16.56	16.56
Fe	NA	3.63	3.63	NA	1.91	NC	NA	2.03	NC	NA	1.92	NC	NA	1.57	1.57
K	NA	11.03	11.03	NA	11.40	NC	NA	12.20	NC	NA	14.03	NC	NA	16.57	16.57
Li	NA	17.03	17.03	NA	17.50	NC	NA	19.50	NC	NA	23.24	NC	NA	27.86	27.86
Mg	NA	19.25	19.25	NA	19.91	NC	NA	21.40	NC	NA	24.19	NC	NA	27.72	27.72
Mn	NA	0.83	0.83	NA	0.78	NC	NA	0.78	NC	NA	0.90	NC	NA	0.96	0.96
Na	NA	82.69	82.69	NA	85.41	NC	NA	94.57	NC	NA	112.8	NC	NA	134.4	134.4
Ni	NA	0.93	0.93	NA	0.85	NC	NA	0.92	NC	NA	1.04	NC	NA	1.10	1.10
P	NA	0.39	0.39	NA	0.22	NC	NA	0.21	NC	NA	0.43	NC	NA	0.55	0.55
Pb	NA	0.23	0.23	NA	0.19	NC	NA	0.22	NC	NA	0.27	NC	NA	0.33	0.33
Sb	NA	0.99	0.99	NA	0.94	NC	NA	1.07	NC	NA	1.10	NC	NA	1.22	1.22
Se	NA	488.9	488.9	NA	543.1	NC	NA	848.1	NC	NA	593.6	NC	NA	812.7	812.7
Si	NA	4.29	4.29	NA	4.50	NC	NA	5.16	NC	NA	6.06	NC	NA	7.19	7.19
Sr	NA	1.23	1.23	NA	1.21	NC	NA	1.28	NC	NA	1.47	NC	NA	1.62	1.62
Te	NA	11.28	11.28	NA	24.53	NC	NA	25.73	NC	NA	29.87	NC	NA	29.46	29.46
Ti	NA	0.01	0.01	NA	0.01	NC	NA	0.02	NC	NA	0.02	NC	NA	0.03	0.03
Zn	NA	4.76	4.76	NA	4.46	NC	NA	4.79	NC	NA	5.45	NC	NA	5.81	5.81
Zr	NA	0.08	0.08	NA	0.08	NC	NA	0.08	NC	NA	0.10	NC	NA	0.10	0.10
Cl	NA	157.1	157.1	NA	170.2	NC	NA	186.9	NC	NA	228.3	NC	NA	250.4	250.4
F	NA	17.59	17.59	NA	21.45	NC	NA	23.19	NC	NA	25.91	NC	NA	33.78	33.78
I	NA	2.51	2.51	NA	1.83	NC	NA	2.44	NC	NA	3.64	NC	NA	4.31	4.31
Nitrate	NA	1131	1131	NA	999.5	NC	NA	1045	NC	NA	1168	NC	NA	1201	1201
Nitrite	NA	<0.1	<0.1	NA	<0.1	NC	NA	<0.1	NC	NA	<0.1	NC	NA	<0.1	<0.1
Sulfate	NA	143.04	143.04	NA	170.5	NC	NA	175.8	NC	NA	200.8	NC	NA	223.1	223.1

Sus* - Suspended
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NC - Not Calculated

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Table 4.8. Analytical Results for Samples of WESP Blowdown Fluids (mg/l), (continued).

Test	#6						#7								
I.D.	12M-W-117A			12M-W-117B			12N-W-115A			12N-W-132A			12N-W-132B		
Glass (kg).	18020			18100			23372			24076			24100		
pH	2.86			3.82			2.47			2.47			2.68		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	38	2092	2130	88	536	624	0	7392	7392	40	7072	7112	80	1452	1532
Al	NA	3.16	3.16	0.05	0.58	0.64	NA	6.94	6.94	NA	7.62	7.62	0.02	0.76	0.78
As	NA	16.42	16.42	0.44	5.14	5.59	NA	110.7	110.7	NA	129.2	129.2	0.23	28.60	28.82
B	NA	120.6	120.6	0.04	13.98	14.02	NA	380.1	380.1	NA	411.4	411.4	0.03	68.36	68.39
Ba	NA	0.16	0.16	0.01	0.05	0.06	NA	0.08	0.08	NA	0.09	0.09	<0.01	0.05	0.05
Ca	NA	131.2	131.2	0.06	50.70	50.75	NA	42.87	42.87	NA	41.12	41.12	0.01	46.95	46.96
Cd	NA	46.96	46.96	2.57	22.94	25.51	NA	351.1	351.1	NA	449.0	449.0	0.65	85.13	85.78
Cr	NA	1.89	1.89	1.24	0.31	1.55	NA	1.42	1.42	NA	1.34	1.34	0.22	0.86	1.07
Cs	NA	21.00	21.00	<0.1	5.40	5.40	NA	93.20	93.20	NA	105.6	105.6	<0.1	17.70	17.70
Cu	NA	15.91	15.91	0.08	0.95	1.03	NA	2.67	2.67	NA	2.89	2.89	0.01	0.49	0.50
Fe	NA	1.54	1.54	6.47	0.03	6.51	NA	2.10	2.10	NA	2.10	2.10	1.20	1.98	3.19
K	NA	17.42	17.42	0.05	5.51	5.56	NA	43.63	43.63	NA	45.39	45.39	0.01	11.18	11.19
Li	NA	29.24	29.24	0.01	6.59	6.61	NA	121.4	121.4	NA	129.8	129.8	0.01	25.17	25.19
Mg	NA	27.84	27.84	0.08	12.53	12.60	NA	12.92	12.92	NA	12.66	12.66	0.01	12.57	12.59
Mn	NA	1.01	1.01	0.04	0.13	0.17	NA	1.64	1.64	NA	1.79	1.79	<0.01	0.26	0.26
Na	NA	140.3	140.3	0.05	42.46	42.51	NA	443.1	443.1	NA	458.1	458.1	0.05	94.57	94.62
Ni	NA	1.12	1.12	0.05	2.08	2.12	NA	1.98	1.98	NA	2.09	2.09	0.01	1.06	1.07
P	NA	0.52	0.52	<0.01	<0.07	<0.07	NA	1.63	1.63	NA	1.69	1.69	0.02	0.33	0.35
Pb	NA	0.37	0.37	1.53	<0.02	1.53	NA	3.68	3.68	NA	3.81	3.81	0.88	0.43	1.31
Sb	NA	1.33	1.33	0.98	0.23	1.21	NA	5.24	5.24	NA	5.90	5.90	0.54	1.50	2.04
Se	NA	844.6	844.6	14.47	365.7	380.1	NA	3764	3764	NA	4018	4018	14.31	1169	1183
Si	NA	8.43	8.43	0.63	1.47	2.10	NA	16.61	16.61	NA	19.52	19.52	0.36	3.46	3.82
Sr	NA	2.13	2.13	<0.01	0.36	0.37	NA	1.04	1.04	NA	1.24	1.24	<0.01	0.37	0.37
Te	NA	27.55	27.55	31.04	13.38	44.42	NA	104.5	104.5	NA	116.9	116.9	11.11	46.97	58.07
Ti	NA	0.02	0.02	0.02	<0.01	0.02	NA	0.07	0.07	NA	0.08	0.08	0.01	0.01	0.02
Zn	NA	6.26	6.26	0.06	1.23	1.29	NA	12.41	12.41	NA	13.55	13.55	0.03	2.96	2.98
Zr	NA	0.23	0.23	0.04	0.01	0.05	NA	1.13	1.13	NA	1.24	1.24	0.02	0.07	0.09
Cl	NA	292.7	292.7	NA	87.15	87.15	NA	737.8	737.8	NA	870.8	870.8	NA	143.3	143.3
F	NA	37.19	37.19	NA	9.67	9.67	NA	389.9	389.9	NA	470.0	470.0	NA	91.04	91.04
I	NA	3.82	3.82	NA	<0.1	<0.1	NA	71.99	71.99	NA	83.71	83.71	NA	4.53	4.53
Nitrate	NA	1107	1107	NA	143.1	143.1	NA	125.2	125.2	NA	126.3	126.3	NA	35.75	35.75
Nitrite	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1	NA	<0.1	<0.1
Sulfate	NA	281.0	281.0	NA	105.9	105.9	NA	2770	2770	NA	3001	3001	NA	549.3	549.3

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Table 4.8. Analytical Results for Samples of WESP Blowdown Fluids (mg/l), (continued).

Test	#8			#9					
I.D.	12O-W-75B			12P-W-47A			12P-W-47B		
Glass (kg)	25020			26725			26725		
pH	2.68			7.52			3.91		
	Sus*	Dis.#	Total	Sus*	Dis.#	Total	Sus*	Dis.#	Total
Total	100	1916	2016	2	606	608	1074	1890	2964
Al	<0.01	NA	NC	NA	0.16	0.16	0.33	0.11	0.44
As	0.36	NA	NC	NA	1.31	1.31	3.13	39.17	42.30
B	0.07	NA	NC	NA	26.12	26.12	0.12	114.8	115.0
Ba	0.01	NA	NC	NA	0.05	0.05	0.02	0.05	0.07
Ca	0.04	NA	NC	NA	55.18	55.18	11.32	29.77	41.08
Cd	0.19	NA	NC	NA	0.30	0.30	56.19	158.1	214.3
Cr	0.11	NA	NC	NA	0.04	0.04	0.59	0.05	0.64
Cs	<0.1	NA	NC	NA	1.90	1.90	<0.1	3.00	3.00
Cu	0.05	NA	NC	NA	0.65	0.65	0.14	0.37	0.51
Fe	16.54	NA	NC	NA	<0.01	<0.01	2.53	0.02	2.55
K	0.02	NA	NC	NA	6.07	6.07	0.22	9.14	9.36
Li	0.01	NA	NC	NA	5.03	5.03	0.27	13.83	14.10
Mg	0.02	NA	NC	NA	14.56	14.56	0.21	13.39	13.60
Mn	0.01	NA	NC	NA	0.10	0.10	<0.01	0.11	0.11
Na	0.08	NA	NC	NA	53.92	53.92	2.89	77.44	80.33
Ni	0.02	NA	NC	NA	0.12	0.12	0.04	0.53	0.56
P	0.05	NA	NC	NA	<0.07	<0.07	0.02	0.25	0.27
Pb	1.00	NA	NC	NA	<0.02	<0.02	10.26	0.53	10.79
Sb	0.37	NA	NC	NA	0.15	0.15	1.92	0.94	2.85
Se	19.31	NA	NC	NA	65.60	65.60	325.1	1171	1496
Si	0.14	NA	NC	NA	1.11	1.11	0.75	1.57	2.32
Sr	<0.01	NA	NC	NA	1.00	1.00	0.03	0.47	0.50
Te	16.36	NA	NC	NA	3.45	3.45	441.4	6.94	448.3
Ti	0.01	NA	NC	NA	<0.01	<0.01	0.03	0.01	0.04
Zn	0.01	NA	NC	NA	0.09	0.09	0.18	3.12	3.29
Zr	0.06	NA	NC	NA	<0.01	<0.01	0.05	0.01	0.06
Cl	NA	NA	NA	NA	59.88	59.88	NA	245.4	245.4
F	NA	NA	NA	NA	6.75	6.75	NA	91.54	91.54
I	NA	NA	NA	NA	17.20	17.20	NA	178.7	178.7
Nitrate	NA	NA	NA	NA	238.9	238.9	NA	125.4	125.4
Nitrite	NA	NA	NA	NA	5.54	5.54	NA	<0.1	<0.1
Sulfate	NA	NA	NA	NA	89.52	89.52	NA	283.2	283.2

Sus* - Suspended
Dis# - Dissolved
NA - Not Analyzed
NC - Not Calculated

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Test #	Sampling Date	Sample I.D.	Analysis Performed	Measured Mass (kg)	Cumulative Mass (kg)
1	06/27/01	12F-G-84A	XRF, DCP	520.0	520.0
		12F-G-84B			
		12F-G-87A			
		12F-G-93A			
		12F-G-93B			
		12F-G-94A			
		12F-G-97A			
		12F-G-103A			
		12F-G-105A			
		12F-G-107A			
	06/28/01	12F-G-109A	XRF, DCP, AA	458.0	978.0
		12F-G-115A			
		12F-G-116A			
		12F-G-118A			
		12F-G-119A			
		12F-G-127A			
		12F-G-130A			
		12F-G-137A			
	06/30/01	12F-G-139A	XRF, DCP, AA	505.0	1483.0
		12F-G-140A			
		12F-G-141A			
		12F-G-141B			
		12F-G-146A			
		12F-G-149A			
		12G-G-6A			
		12G-G-17A			
		12G-G-20A			
		12G-G-23A			
	07/01/01	12G-G-25A	XRF, DCP, AA	496.5	1979.5
		12G-G-31A			
		12G-G-32A			
		12G-G-33A			
		12G-G-41A			
		12G-G-45A			
		12G-G-45B			
		12G-G-46A			
		12G-G-53A			
		12G-G-56A			
	07/03/01	12G-G-57A	XRF, DCP, AA, Fe ⁺⁺	321.5	2301.0
		12G-G-57B			
		12G-G-58A			
		12G-G-64A			
		12G-G-70A			
		12G-G-78A			
		12G-G-79A			

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Table 5.1. Discharged Glass Samples and Analyses Performed, (continued).

Test #	Sampling Date	Sample I.D.	Analysis Performed	Measured Mass (kg)	Cumulative Mass (kg)
2	07/24/01	12G-G-124A	XRF, Fe ⁺⁺	260.0	2561.0
		12G-G-125A			
		12G-G-126A			
		12G-G-126B			
		12G-G-128A			
	07/24/01	12G-G-130A	XRF, Fe ⁺⁺	266.0	2827.0
		12G-G-135A			
		12G-G-135B			
		12G-G-136A			
		12G-G-138A			
	07/25/01	12G-G-139A	XRF, Fe ⁺⁺	208.0	3035.0
		12G-G-145A			
		12G-G-146A			
		12G-G-150A			
	07/26/01	12G-G-151A	XRF, Fe ⁺⁺	262.5	3297.5
		12G-G-151B			
		12H-G-11A			
		12H-G-12A			
		12H-G-22A			
	07/26/01	12H-G-23A	XRF, Fe ⁺⁺	154.5	3452.0
		12H-G-24A			
		12H-G-26A			
	07/27/01	12H-G-33A	XRF, Fe ⁺⁺	247.0	3699.0
		12H-G-40A			
		12H-G-40B			
		12H-G-40C			
	07/29/01	12I-G-13A	XRF, Fe ⁺⁺	422.5	4121.5
		12I-G-14A			
		12I-G-22A			
		12I-G-22B			
		12I-G-24A			
		12I-G-24B			
		12I-G-31A			
		12I-G-33A			
		12I-G-35A			
	07/31/01	12I-G-40A	XRF, DCP, AA	513.5	4635.0
		12I-G-43A			
		12I-G-49A			
		12I-G-50A			
		12I-G-51A			
		12I-G-57A			
		12I-G-58A			
		12I-G-61A			
		12I-G-66A			
		12I-G-66B			

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Table 5.1. Discharged Glass Samples and Analyses Performed, (continued).

Test #	Sampling Date	Sample I.D.	Analysis Performed	Measured Mass (kg)	Cumulative Mass (kg)
2	08/02/01	12I-G-74A	XRF, DCP, AA	260.0	4895.0
		12I-G-82A			
		12I-G-82B			
		12I-G-88A			
		12J-G-7A			
3	08/06/01	12J-G-37A	XRF, DCP, AA	109.0	5004.0
		12J-G-37B			
	08/07/01	12J-G-39A	XRF, DCP, AA	510.5	5514.5
		12J-G-39B			
		12J-G-40A			
		12J-G-40B			
		12J-G-42A			
		12J-G-43A			
		12J-G-43B			
		12J-G-43C			
		12J-G-44A			
	08/07/01	12J-G-45A	XRF, DCP, AA	496.5	6011.0
		12J-G-45B			
		12J-G-51A			
		12J-G-51B			
		12J-G-51C			
		12J-G-52A			
	08/07/01	12J-G-52B	XRF, DCP, AA	477.5	6488.5
		12J-G-52C			
		12J-G-53A			
		12J-G-53B			
		12J-G-55A			
		12J-G-56A			
		12J-G-56B			
		12J-G-56C			
	08/08/01	12J-G-56D	XRF, DCP, AA	504.5	6993.0
		12J-G-62A			
		12J-G-62B			
		12J-G-64A			
		12J-G-65A			
		12J-G-65B			
		12J-G-65C			
		12J-G-68A			
		12J-G-68B			
		12J-G-69A			
		12J-G-69B			

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Test #	Sampling Date	Sample I.D.	Analysis Performed	Measured Mass (kg)	Cumulative Mass (kg)
3	08/08/01	12J-G-70A	XRF, DCP, AA	454.0	7447.0
		12J-G-70B			
		12J-G-75A			
		12J-G-75B			
		12J-G-76A			
		12J-G-76B			
		12J-G-76C			
		12J-G-76D			
		12J-G-78A			
	08/09/01	12J-G-82A	XRF	527.0	7974.0
		12J-G-82B			
		12J-G-84A			
		12J-G-84B			
		12J-G-86A			
		12J-G-86B			
		12J-G-91A			
		12J-G-94A			
		12J-G-94B			
	08/09/01	12J-G-94C	XRF, DCP, AA	494.0	8468.0
		12J-G-94D			
		12J-G-96A			
		12J-G-96B			
		12J-G-97A			
		12J-G-100A			
		12J-G-100B			
		12J-G-100C			
	08/09/01	12J-G-106A	XRF, DCP, AA	515.5	8983.5
		12J-G-107A			
		12J-G-108A			
		12J-G-108B			
		12J-G-109A			
		12J-G-109B			
		12J-G-111A			
		12J-G-111B			
	08/10/01	12J-G-112A	XRF, DCP, AA	520.0	9503.5
		12J-G-112B			
		12J-G-113A			
		12J-G-115A			
		12J-G-120A			
		12J-G-120B			
		12J-G-123A			
		12J-G-125A			

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Table 5.1. Discharged Glass Samples and Analyses Performed, (continued).

Test #	Sampling Date	Sample I.D.	Analysis Performed	Measured Mass (kg)	Cumulative Mass (kg)
3	08/10/01	12J-G-125B	XRF, DCP, AA	283.0	9786.5
		12J-G-126A			
		12J-G-126B			
		12J-G-129A			
	08/10/01	12J-G-129B	XRF, DCP, AA	348.5	10135.0
		12J-G-130A			
		12J-G-130B			
		12J-G-131A			
		12J-G-136A			
	08/11/01	12J-G-136B	XRF, DCP, AA	423.5	10558.5
		12J-G-138A			
		12J-G-138B			
		12J-G-138C			
		12J-G-139A			
		12J-G-139B			
		12J-G-139C			
	08/11/01	12J-G-141A	XRF, DCP, AA, Fe ⁺⁺	516.0	11074.5
		12J-G-142A			
		12J-G-147A			
		12J-G-148A			
		12J-G-149A			
		12J-G-150A			
		12J-G-152A			
4	08/20/01	12K-G-37A	XRF, DCP, AA	348.5	11423.0
		12K-G-38A			
		12K-G-39A			
		12K-G-40A			
		12K-G-42A			
	08/21/01	12K-G-46A	XRF	465.0	11888.0
		12K-G-51A			
		12K-G-53A			
		12K-G-53B			
		12K-G-54A			
		12K-G-63A			
	08/22/01	12K-G-64A	XRF	521.0	12409.0
		12K-G-65A			
		12K-G-66A			
		12K-G-66B			
		12K-G-67A			
		12K-G-70A			
		12K-G-71A			
		12K-G-76A			
		12K-G-76B			
		12K-G-78A			
		12K-G-78B			

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Table 5.1. Discharged Glass Samples and Analyses Performed, (continued).

Test #	Sampling Date	Sample I.D.	Analysis Performed	Measured Mass (kg)	Cumulative Mass (kg)
4	08/23/01	12K-G-80A	XRF	528.5	12937.5
		12K-G-80B			
		12K-G-83A			
		12K-G-84A			
		12K-G-84B			
		12K-G-86A			
		12K-G-86B			
		12K-G-92A			
		12K-G-92B			
		12K-G-93A			
		12K-G-96A			
	08/24/01	12K-G-96B	XRF	523.0	13460.5
		12K-G-101A			
		12K-G-101B			
		12K-G-102A			
		12K-G-104A			
		12K-G-104B			
		12K-G-105A			
		12K-G-110A			
	08/24/01	12K-G-110B	XRF, DCP, AA	471.0	13931.5
		12K-G-112A			
		12K-G-112B			
		12K-G-113A			
		12K-G-114A			
		12K-G-115A			
		12K-G-121A			
		12K-G-123A			
	08/25/01	12K-G-125A	XRF, DCP, AA	517.5	14449.0
		12K-G-125B			
		12K-G-126A			
		12K-G-129A			
		12K-G-134A			
		12K-G-134B			
		12K-G-135A			
		12K-G-135B			
	08/25/01	12K-G-136A	XRF, DCP, AA, Fe ⁺⁺	90.5	14539.5
		12K-G-136B			
5	09/27/01	12L-G-16A			
		12L-G-17A			
		12L-G-21A			
		12L-G-28A			
		12L-G-28B			
		12L-G-28C			

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Table 5.1. Discharged Glass Samples and Analyses Performed, (continued).

Test #	Sampling Date	Sample I.D.	Analysis Performed	Measured Mass (kg)	Cumulative Mass (kg)
5		12L-G-29A	XRF, Fe ⁺⁺	516.0	15055.5
		12L-G-30A			
		12L-G-39A			
		12L-G-41A			
		12L-G-46A			
	09/29/01	12L-G-47A	XRF, DCP, AA, Fe ⁺⁺	522.5	15578.0
		12L-G-49A			
		12L-G-50A			
		12L-G-59A			
		12L-G-61A			
		12L-G-68A			
		12L-G-68B			
		12L-G-73A			
		12L-G-79A			
		12L-G-80A			
	09/30/01	12L-G-83A	XRF, Fe ⁺⁺	314.0	15892.0
		12L-G-88A			
		12L-G-90A			
		12L-G-95A			
		12L-G-99A			
	10/01/01	12L-G-101A	XRF, DCP, AA, Fe ⁺⁺	306.5	16198.5
		12L-G-108A			
		12L-G-109A			
		12L-G-116A			
		12L-G-116B			
6	10/12/01	12L-G-118A	XRF, Fe ⁺⁺	507.0	16705.5
		12L-G-119A			
		12L-G-147A			
		12L-G-148A			
		12L-G-150A			
		12L-G-150B			
		12L-G-155A			
		12M-G-6A			
		12M-G-9A			
	10/14/01	12M-G-10A	XRF, Fe ⁺⁺	516.0	17221.5
		12M-G-19A			
		12M-G-20A			
		12M-G-21A			
		12M-G-24A			
		12M-G-30A			
		12M-G-32A			
		12M-G-40A			
		12M-G-48A			
		12M-G-50A			

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Test #	Sampling Date	Sample I.D.	Analysis Performed	Measured Mass (kg)	Cumulative Mass (kg)
6	10/15/01	12M-G-54A	XRF, DCP, AA, Fe ⁺⁺	257.0	17478.5
		12M-G-55A			
		12M-G-62A			
		12M-G-63A			
		12M-G-70A			
	10/16/01	12M-G-72A	XRF	541.0	18019.5
		12M-G-79A			
		12M-G-80A			
		12M-G-87A			
		12M-G-109A			
		12M-G-111A			
	10/18/01	12M-G-117A	XRF, DCP, AA	80.0	18099.5
7	10/23/01	12M-G-140A	XRF	532.0	18631.5
		12M-G-141A			
		12M-G-143A			
		12M-G-143B			
		12M-G-145A			
		12M-G-146A			
		12M-G-146B			
		12M-G-148A			
		12M-G-148B			
		12M-G-149A			
	10/23/01	12M-G-150A	XRF	513.0	19144.5
		12M-G-155A			
		12M-G-155B			
		12N-G-11A			
		12N-G-11B			
		12N-G-12A			
		12N-G-12B			
		12N-G-12C			
	10/24/01	12N-G-16A	XRF	508.0	19652.5
		12N-G-16B			
		12N-G-19A			
		12N-G-19B			
		12N-G-19C			
		12N-G-20A			
		12N-G-21A			
		12N-G-21B			
		12N-G-21C			
	10/24/01	12N-G-27A	XRF, Fe ⁺⁺	364.5	20017.0
		12N-G-27B			
		12N-G-36A			
		12N-G-36B			
		12N-G-38A			
		12N-G-38B			
		12N-G-38C			

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Table 5.1. Discharged Glass Samples and Analyses Performed, (continued).

Test #	Sampling Date	Sample I.D.	Analysis Performed	Measured Mass (kg)	Cumulative Mass (kg)
7	10/25/01	12N-G-39A	XRF, Fe ⁺⁺	520.5	20537.5
		12N-G-40A			
		12N-G-46A			
		12N-G-46B			
		12N-G-48A			
		12N-G-48B			
		12N-G-50A			
		12N-G-51A			
		12N-G-51B			
		12N-G-51C			
	10/25/01	12N-G-53A	XRF, DCP, AA, Fe ⁺⁺	500.5	21038.0
		12N-G-53B			
		12N-G-54A			
		12N-G-54B			
		12N-G-54C			
		12N-G-62A			
	10/26/01	12N-G-63A	XRF, Fe ⁺⁺	475.5	21513.5
		12N-G-64A			
		12N-G-64B			
		12N-G-66A			
		12N-G-67A			
		12N-G-68A			
		12N-G-70A			
	10/26/01	12N-G-70B	XRF, Fe ⁺⁺	515.0	22028.5
		12N-G-71A			
		12N-G-72A			
		12N-G-72B			
		12N-G-73A			
		12N-G-79A			
		12N-G-80A			
		12N-G-81A			
		12N-G-81B			
		12N-G-81C			
	10/26/01	12N-G-84A	XRF, Fe ⁺⁺	463.5	22492.0
		12N-G-85A			
		12N-G-86A			
		12N-G-86B			
		12N-G-87A			
		12N-G-88A			
	10/26/01	12N-G-88B			
		12N-G-88C			
		12N-G-88D			
		12N-G-94A			
		12N-G-97A			
	10/26/01	12N-G-99A			
		12N-G-101A			
		12N-G-101B			

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Test #	Sampling Date	Sample I.D.	Analysis Performed	Measured Mass (kg)	Cumulative Mass (kg)
7	10/26/01	12N-G-102A	XRF	530.0	23022.0
		12N-G-103A			
		12N-G-103B			
	10/27/01	12N-G-104A	XRF	540.5	23562.5
		12N-G-104B			
		12N-G-106A			
		12N-G-113A			
		12N-G-114A			
		12N-G-115A			
	10/27/01	12N-G-115B	XRF, DCP, AA	513.0	24075.5
		12N-G-117A			
		12N-G-117B			
		12N-G-118A			
		12N-G-119A			
		12N-G-119B			
		12N-G-126A			
8	10/31/01	12N-G-126B	XRF, Fe ⁺⁺	408.5	24484.0
		12N-G-153A			
		12N-G-154A			
		12O-G-13A			
		12O-G-14A			
		12O-G-16A			
		12O-G-22A			
	11/02/01	12O-G-24A	XRF, DCP, AA, Fe ⁺⁺	535.5	25019.5
		12O-G-31A			
		12O-G-32A			
		12O-G-38A			
		12O-G-40A			
		12O-G-43A			
		12O-G-49A			
		12O-G-51A			
9	11/06/01	12O-G-58A	XRF, Fe ⁺⁺	311.0	25330.5
		12O-G-60A			
		12O-G-66A			
		12O-G-68A			
		12O-G-95A			
		12O-G-96A			
	11/07/01	12O-G-97A	XRF, DCP, AA, Fe ⁺⁺	276.5	25607.0
		12O-G-99A			
		12O-G-106A			
		12O-G-107A			
		12O-G-108A			
		12O-G-116A			
		12O-G-118A			
		12O-G-124A			
		12O-G-125A			

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Table 5.1. Discharged Glass Samples and Analyses Performed, (continued).

Test #	Sampling Date	Sample I.D.	Analysis Performed	Measured Mass(kg)	Cumulative Mass (kg)
9	11/08/01	12O-G-126A	XRF, Fe ⁺⁺	271.5	25878.5
		12O-G-134A			
		12O-G-135A			
		12O-G-136A			
		12O-G-144A			
	11/09/01	12O-G-146A	XRF, Fe ⁺⁺	323.0	26201.5
		12O-G-146B			
		12O-G-153A			
		12O-G-154A			
		12O-G-155A			
	11/10/01	12P-G-12A	XRF, DCP, AA, Fe ⁺⁺	524.0	26725.5
		12P-G-15A			
		12P-G-15B			
		12P-G-21A			
		12P-G-28A			
		12P-G-31A			
		12P-G-32A			
		12P-G-34A			
		12P-G-41A			
		12P-G-42A			

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Table 5.2. XRF Analyzed Compositions for Discharged Glasses (wt%).

Test #		1					2					
Glass (kg)		520	978	1483	1979	2301	2561	2827	3035	3297	3452	3699
Sample I.D.	Target	12F-G-107A	12F-G-139A	12G-G-25A	12G-G-57A	12G-G-79A	12G-G-128A	12G-G-138A	12G-G-150A	12H-G-22A	12H-G-26A	12H-G-40C
Al ₂ O ₃	7.40	7.69	7.55	7.64	7.48	7.76	7.42	7.45	7.47	7.53	7.49	7.47
As ₂ O ₃	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
B ₂ O ₃ *	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
BaO	0.04	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
CaO	0.25	0.37	0.37	0.33	0.32	0.31	0.32	0.32	0.31	0.31	0.30	0.30
CdO	0.37	0.43	0.42	0.40	0.38	0.35	0.37	0.41	0.38	0.38	0.34	0.38
CeO ₂	0.08	0.07	0.07	0.08	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.06
Cl	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cr ₂ O ₃	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.05	0.05	0.05
Cs ₂ O	0.08	0.09	0.08	0.08	0.08	0.07	0.08	0.09	0.08	0.08	0.07	0.08
CuO	0.03	0.04	0.04	0.03	0.03	0.03	0.04	0.03	0.04	0.03	0.03	0.03
F	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.00
Fe ₂ O ₃	10.39	9.98	10.25	9.93	9.98	9.98	10.20	10.11	10.09	9.99	10.06	10.03
K ₂ O	0.17	0.25	0.26	0.24	0.24	0.26	0.26	0.24	0.25	0.25	0.25	0.25
La ₂ O ₃	0.32	0.15	0.13	0.12	0.11	0.11	0.12	0.12	0.12	0.11	0.10	0.12
Li ₂ O*	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
MgO	0.06	0.31	0.41	0.62	0.79	0.86	0.83	0.92	0.96	0.96	0.95	0.96
MnO	3.03	3.14	3.17	3.08	3.06	3.04	3.12	3.09	3.09	3.07	3.07	3.04
Na ₂ O	6.59	6.93	6.83	7.15	7.18	6.92	6.68	6.72	6.95	6.94	6.87	6.82
NiO	0.54	0.49	0.50	0.48	0.47	0.47	0.47	0.46	0.46	0.45	0.45	0.45
P ₂ O ₅	0.13	0.21	0.25	0.26	0.29	0.28	0.30	0.30	0.29	0.30	0.30	0.34
PbO	0.15	0.14	0.13	0.13	0.13	0.13	0.12	0.13	0.13	0.13	0.13	0.13
Sb ₂ O ₃	0.21	0.19	0.19	0.17	0.18	0.17	0.16	0.19	0.17	0.18	0.15	0.18
SeO ₂	0.15	0.02	0.03	0.04	0.05	0.06	0.02	0.03	0.03	0.03	0.03	0.04
SiO ₂	45.54	45.01	44.69	44.99	45.00	44.91	45.02	44.98	44.83	45.00	45.28	45.07
SO ₃	0.25	0.14	0.17	0.20	0.23	0.25	0.21	0.21	0.22	0.21	0.22	0.24
SrO	2.32	2.13	2.14	2.02	2.00	2.02	2.07	2.05	2.04	2.02	1.99	2.03
TeO ₂	0.14	0.11	0.12	0.12	0.13	0.11	0.11	0.13	0.12	0.12	0.10	0.11
TiO ₂	0.06	0.07	0.07	0.07	0.07	0.08	0.08	0.07	0.07	0.07	0.07	0.07
ZnO	2.00	1.89	1.92	1.83	1.80	1.82	1.88	1.84	1.84	1.81	1.84	1.81
ZrO ₂	3.56	4.09	4.15	3.94	3.89	3.89	3.99	3.99	3.95	3.91	3.78	3.93
Sum	99.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

* Target values. NA: Not Analyzed.

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Table 5.2. XRF Analyzed Compositions for Discharged Glasses (wt%) (continued).

Test #		2			3							
Glass (kg)		4121.5	4635	4895	5004	5514.5	6011	6488.5	6993	7447	7974	8468
Sample I.D.	Target	12I-G-35A	12I-G-66B	12J-G-7A	12J-G-37B	12J-G-44A	12J-G-52B	12J-G-62A	12J-G-69A	12J-G-78A	12J-G-94B	12J-G-100C
Al ₂ O ₃	7.40	7.58	7.37	7.60	7.51	8.00	7.25	7.32	7.21	7.19	7.38	7.36
As ₂ O ₃	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
B ₂ O ₃ *	10.00	0.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
BaO	0.04	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
CaO	0.25	0.31	0.31	0.31	0.30	0.30	0.30	0.29	0.30	0.30	0.29	0.29
CdO	0.37	0.36	0.38	0.35	0.36	0.36	0.45	0.47	0.42	0.46	0.46	0.44
CeO ₂	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.07	0.08	0.07
Cl	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cr ₂ O ₃	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Cs ₂ O	0.08	0.09	0.08	0.07	0.08	0.08	0.09	0.08	0.06	0.08	0.09	0.08
CuO	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
F	0.04	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fe ₂ O ₃	10.39	10.18	10.10	10.21	10.16	9.83	10.29	10.26	10.51	10.46	10.23	10.18
K ₂ O	0.17	0.27	0.24	0.27	0.26	0.28	0.24	0.24	0.25	0.26	0.24	0.25
La ₂ O ₃	0.32	0.10	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.12
Li ₂ O*	6.00	0.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
MgO	0.06	0.99	1.08	1.05	1.07	1.10	1.14	1.07	1.09	1.18	1.12	1.13
MnO	3.03	3.08	3.06	3.10	3.04	2.93	3.07	3.10	3.15	3.14	3.07	3.05
Na ₂ O	6.59	6.13	7.07	6.72	6.55	7.15	7.14	6.92	6.82	6.71	6.82	7.04
NiO	0.54	0.47	0.46	0.46	0.46	0.44	0.48	0.49	0.50	0.50	0.49	0.48
P ₂ O ₅	0.13	0.32	0.33	0.32	0.43	0.33	0.37	0.38	0.33	0.34	0.32	0.35
PbO	0.15	0.13	0.13	0.13	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.12
Sb ₂ O ₃	0.21	0.18	0.18	0.16	0.17	0.17	0.19	0.18	0.16	0.18	0.19	0.19
SeO ₂	0.15	0.05	0.05	0.05	0.04	0.03	0.03	0.02	0.03	0.02	0.03	0.02
SiO ₂	45.54	45.34	44.68	44.63	44.94	44.58	44.22	44.49	44.39	44.31	44.60	44.68
SO ₃	0.25	0.24	0.26	0.25	0.25	0.21	0.23	0.22	0.22	0.21	0.21	0.21
SrO	2.32	2.04	2.02	2.04	2.04	2.01	2.09	2.09	2.11	2.13	2.07	2.01
TeO ₂	0.14	0.11	0.12	0.10	0.11	0.11	0.12	0.12	0.11	0.12	0.13	0.13
TiO ₂	0.06	0.08	0.07	0.07	0.07	0.09	0.07	0.07	0.08	0.08	0.08	0.08
ZnO	2.00	1.85	1.82	1.87	1.83	1.80	1.85	1.85	1.92	1.90	1.84	1.81
ZrO ₂	3.56	3.95	3.93	3.95	3.93	3.81	3.99	3.95	3.94	4.02	3.91	3.83
Sum	99.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

* Target values. NA: Not Analyzed.

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Table 5.2. XRF Analyzed Compositions for Discharged Glasses (wt%) (continued).

Test #		3					4					
Glass (kg)		8983.5	9503.5	9787	10135	10559	11423	11888	12409	12938	13461	13932
Sample I.D.	Target	12J-G-112A	12J-G-125A	12J-G-129A	12J-G-136A	12J-G-141A	12K-G-42A	12K-G-64A	12K-G-78B	12K-G-96A	12K-G-110B	12K-G-125A
Al ₂ O ₃	7.40	6.67	7.31	7.25	7.37	7.23	7.71	7.29	7.17	7.27	7.51	7.49
As ₂ O ₃	0.04	0.05	0.04	0.04	0.04	0.03	0.04	0.04	0.04	0.04	0.04	0.03
B ₂ O ₃ *	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
BaO	0.04	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
CaO	0.25	0.30	0.30	0.29	0.29	0.29	0.28	0.30	0.29	0.29	0.29	0.29
CdO	0.37	0.46	0.40	0.39	0.42	0.37	0.43	0.46	0.41	0.44	0.35	0.41
CeO ₂	0.08	0.07	0.06	0.08	0.06	0.07	0.07	0.06	0.07	0.06	0.08	0.06
Cl	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cr ₂ O ₃	0.04	0.24	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Cs ₂ O	0.08	0.08	0.07	0.07	0.08	0.07	0.08	0.08	0.07	0.08	0.07	0.07
CuO	0.03	0.04	0.03	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.04	0.04
F	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fe ₂ O ₃	10.39	11.28	10.28	10.41	10.31	10.38	9.82	10.30	10.50	10.26	10.47	10.31
K ₂ O	0.17	0.23	0.24	0.25	0.26	0.24	0.24	0.23	0.23	0.24	0.25	0.23
La ₂ O ₃	0.32	0.13	0.13	0.13	0.12	0.11	0.11	0.12	0.13	0.13	0.13	0.12
Li ₂ O*	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
MgO	0.06	1.15	1.13	1.14	1.09	1.19	1.12	1.18	1.15	1.20	1.23	1.28
MnO	3.03	3.25	3.09	3.14	3.10	3.13	2.99	3.09	3.16	3.07	3.14	3.08
Na ₂ O	6.59	6.63	6.94	6.70	6.55	6.98	7.08	6.94	6.89	6.69	7.10	6.96
NiO	0.54	0.60	0.49	0.50	0.49	0.51	0.45	0.49	0.50	0.49	0.51	0.48
P ₂ O ₅	0.13	0.31	0.33	0.33	0.33	0.32	0.33	0.33	0.33	0.33	0.35	0.32
PbO	0.15	0.14	0.13	0.13	0.13	0.13	0.12	0.13	0.13	0.13	0.14	0.12
Sb ₂ O ₃	0.21	0.19	0.16	0.15	0.17	0.15	0.17	0.18	0.16	0.19	0.14	0.17
SeO ₂	0.15	0.03	0.02	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.03
SiO ₂	45.54	43.31	44.65	44.75	44.86	44.53	45.24	44.54	44.52	45.06	45.97	45.36
SO ₃	0.25	0.21	0.22	0.23	0.22	0.23	0.21	0.22	0.22	0.22	0.23	0.23
SrO	2.32	2.22	2.06	2.06	2.07	2.05	1.89	2.01	2.01	1.93	1.94	1.91
TeO ₂	0.14	0.14	0.12	0.10	0.12	0.11	0.12	0.13	0.12	0.13	0.07	0.12
TiO ₂	0.06	0.08	0.07	0.08	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08
ZnO	2.00	1.99	1.86	1.87	1.86	1.88	1.74	1.84	1.87	1.81	1.93	1.83
ZrO ₂	3.56	4.22	3.86	3.84	3.90	3.84	3.63	3.89	3.87	3.79	1.93	2.98
Sum	99.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

* Target values. NA: Not Analyzed.

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Table 5.2. XRF Analyzed Compositions for Discharged Glasses (wt%) (continued).

Test #		4		5				6				
Glass (kg)		14449	14540	15056	15578	15892	16199	16706	17222	17479	18020	18100
Sample I.D.	Target	12K-G-136B	12K-G-138A	12L-G-46A	12L-G-80A	12L-G-101A	12L-G-119A	12M-G-19A	12M-G-50A	12M-G-70A	12M-G-111A	12M-G-117A
Al ₂ O ₃	7.40	7.22	7.16	7.40	7.47	7.30	7.26	7.28	7.26	7.08	7.43	7.37
As ₂ O ₃	0.04	0.04	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
B ₂ O ₃ *	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
BaO	0.04	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
CaO	0.25	0.29	0.29	0.29	0.29	0.29	0.30	0.37	0.45	0.47	0.51	0.51
CdO	0.37	0.41	0.39	0.38	0.31	0.41	0.32	0.41	0.38	0.41	0.40	0.39
CeO ₂	0.08	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08
Cl	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.01
Cr ₂ O ₃	0.04	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Cs ₂ O	0.08	0.07	0.07	0.07	0.05	0.07	0.05	0.08	0.07	0.08	0.08	0.08
CuO	0.03	0.03	0.03	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03
F	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fe ₂ O ₃	10.39	10.52	10.63	10.19	10.04	10.04	9.99	9.86	10.12	10.27	10.20	10.26
K ₂ O	0.17	0.25	0.24	0.25	0.26	0.25	0.26	0.25	0.24	0.25	0.26	0.26
La ₂ O ₃	0.32	0.14	0.13	0.12	0.13	0.13	0.12	0.13	0.11	0.12	0.11	0.12
Li ₂ O*	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
MgO	0.06	1.19	1.14	1.18	1.16	1.16	1.21	1.15	1.25	1.15	1.02	1.04
MnO	3.03	3.14	3.13	3.06	2.98	2.96	3.00	2.97	2.95	3.00	2.93	2.99
Na ₂ O	6.59	6.64	6.93	6.62	6.87	6.85	7.09	6.82	7.02	6.41	6.43	6.32
NiO	0.54	0.50	0.50	0.44	0.45	0.45	0.45	0.44	0.46	0.47	0.47	0.48
P ₂ O ₅	0.13	0.32	0.32	0.33	0.32	0.32	0.31	0.31	0.31	0.31	0.30	0.30
PbO	0.15	0.13	0.13	0.12	0.12	0.12	0.12	0.13	0.12	0.13	0.12	0.13
Sb ₂ O ₃	0.21	0.17	0.16	0.15	0.13	0.17	0.13	0.16	0.16	0.17	0.17	0.16
SeO ₂	0.15	0.03	0.04	0.02	0.04	0.04	0.04	0.05	0.06	0.06	0.06	0.07
SiO ₂	45.54	44.65	44.34	45.29	45.73	45.42	45.59	45.51	45.30	44.94	44.99	44.90
SO ₃	0.25	0.23	0.25	0.16	0.19	0.21	0.22	0.23	0.24	0.24	0.25	0.24
SrO	2.32	1.98	2.00	1.95	1.82	1.89	1.83	1.90	1.95	2.04	2.00	2.01
TeO ₂	0.14	0.12	0.12	0.10	0.08	0.11	0.09	0.12	0.12	0.12	0.13	0.12
TiO ₂	0.06	0.09	0.09	0.10	0.09	0.10	0.10	0.12	0.14	0.14	0.16	0.17
ZnO	2.00	1.86	1.87	1.83	1.82	1.80	1.82	1.82	1.90	1.96	1.96	1.98
ZrO ₂	3.56	3.89	3.91	3.80	3.49	3.75	3.55	3.74	3.25	4.03	3.85	3.94
Sum	99.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

* Target values. NA: Not Analyzed.

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Table 5.2. XRF Analyzed Compositions for Discharged Glasses (wt%) (continued).

Test #		7										
Glass (kg)		18632	19653	20017	20538	21038	21514	22029	22492	23022	23563	24076
Sample I.D.	Target	12M-G-149A	12N-G-21C	12N-G-38C	12N-G-51C	12N-G-63A	12N-G-71A	12N-G-85A	12N-G-88D	12N-G-103B	12N-G-115B	12N-G-126B
Al ₂ O ₃	7.40	7.68	7.96	8.03	7.96	8.02	8.22	8.05	8.16	8.22	7.94	8.17
As ₂ O ₃	0.04	0.04	0.03	0.03	0.03	0.04	0.04	0.03	0.04	0.03	0.03	0.04
B ₂ O ₃ *	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
BaO	0.04	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
CaO	0.25	0.54	0.56	0.56	0.58	0.56	0.56	0.56	0.57	0.56	0.59	0.59
CdO	0.37	0.38	0.36	0.37	0.41	0.36	0.38	0.41	0.35	0.35	0.37	0.37
CeO ₂	0.08	0.08	0.08	0.08	0.09	0.08	0.07	0.08	0.08	0.10	0.08	0.08
Cl	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Cr ₂ O ₃	0.04	0.04	0.04	0.04	0.04	0.05	0.04	0.05	0.04	0.05	0.05	0.05
Cs ₂ O	0.08	0.07	0.06	0.07	0.08	0.07	0.08	0.08	0.07	0.07	0.06	0.06
CuO	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03
F	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fe ₂ O ₃	10.39	9.97	10.04	10.08	10.34	10.20	9.90	10.32	10.11	9.98	10.24	10.17
K ₂ O	0.17	0.28	0.29	0.29	0.27	0.26	0.27	0.26	0.27	0.27	0.25	0.27
La ₂ O ₃	0.32	0.11	0.12	0.12	0.12	0.12	0.11	0.11	0.12	0.11	0.11	0.12
Li ₂ O*	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
MgO	0.06	0.95	0.71	0.68	0.67	0.69	0.82	0.81	0.87	0.85	0.69	0.59
MnO	3.03	2.93	2.95	3.00	2.99	3.03	2.91	3.01	3.03	2.90	3.07	3.09
Na ₂ O	6.59	6.78	6.56	6.52	6.46	6.74	6.92	6.42	6.89	7.04	6.77	6.88
NiO	0.54	0.46	0.48	0.48	0.49	0.48	0.48	0.49	0.49	0.48	0.49	0.48
P ₂ O ₅	0.13	0.29	0.26	0.23	0.23	0.25	0.25	0.27	0.25	0.27	0.25	0.25
PbO	0.15	0.12	0.12	0.12	0.12	0.13	0.12	0.13	0.12	0.13	0.12	0.13
Sb ₂ O ₃	0.21	0.16	0.15	0.16	0.19	0.15	0.17	0.18	0.15	0.14	0.15	0.15
SeO ₂	0.15	0.04	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.03	0.03
SiO ₂	45.54	44.89	45.57	44.88	44.30	44.45	44.53	44.10	44.17	44.36	44.41	44.20
SO ₃	0.25	0.22	0.17	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.15
SrO	2.32	1.95	1.94	1.96	2.05	1.99	1.94	2.07	1.99	1.95	2.01	2.00
TeO ₂	0.14	0.12	0.11	0.12	0.13	0.10	0.11	0.12	0.10	0.10	0.10	0.10
TiO ₂	0.06	0.19	0.19	0.20	0.22	0.21	0.21	0.21	0.20	0.20	0.20	0.21
ZnO	2.00	1.92	1.94	1.96	2.03	1.97	1.89	1.99	1.95	1.91	2.01	2.01
ZrO ₂	3.56	3.79	3.29	3.82	4.01	3.85	3.78	4.06	3.80	3.74	3.84	3.81
Sum	99.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.0	100.00	100.00	100.00

* Target values. NA: Not Analyzed.

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Table 5.2. XRF Analyzed Compositions for Discharged Glasses (wt%) (continued).

Test #		8		9					Overall Avg.
Glass (kg)		24484	25020	25331	25607	26155	26478	27002	
Sample I.D.	Target	12O-G- 31A	12O-G- 68A	12O-G- 107A	12O-G- 125A	12O-G- 144A	12P-G- 12A	12P-G- 42A	
Al ₂ O ₃	7.40	8.10	7.88	7.66	7.64	7.87	7.45	7.46	7.54
As ₂ O ₃	0.04	0.03	0.04	0.04	0.04	0.03	0.04	0.03	0.04
B ₂ O ₃ *	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
BaO	0.04	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
CaO	0.25	0.54	0.49	0.46	0.44	0.42	0.41	0.37	0.38
CdO	0.37	0.38	0.37	0.38	0.36	0.40	0.36	0.36	0.39
CeO ₂	0.08	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.07
Cl	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00
Cr ₂ O ₃	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05
Cs ₂ O	0.08	0.07	0.07	0.07	0.07	0.08	0.07	0.07	0.07
CuO	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
F	0.04	NA	NA	NA	NA	NA	NA	NA	NA
Fe ₂ O ₃	10.39	10.15	10.06	10.16	10.23	9.86	10.23	10.12	10.19
K ₂ O	0.17	0.29	0.28	0.26	0.26	0.26	0.26	0.25	0.25
La ₂ O ₃	0.32	0.11	0.12	0.12	0.12	0.11	0.12	0.11	0.12
Li ₂ O*	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
MgO	0.06	0.68	0.79	0.79	0.88	0.96	1.03	1.01	0.98
MnO	3.03	2.98	2.87	2.91	2.97	2.89	3.03	3.07	3.04
Na ₂ O	6.59	6.50	6.47	6.63	6.43	6.52	6.89	6.96	6.79
NiO	0.54	0.49	0.48	0.48	0.48	0.46	0.48	0.48	0.48
P ₂ O ₅	0.13	0.26	0.26	0.27	0.28	0.28	0.29	0.29	0.30
PbO	0.15	0.13	0.12	0.12	0.12	0.12	0.13	0.12	0.13
Sb ₂ O ₃	0.21	0.16	0.16	0.15	0.15	0.17	0.16	0.16	0.17
SeO ₂	0.15	0.05	0.06	0.06	0.07	0.05	0.04	0.04	0.04
SiO ₂	45.54	44.50	45.05	44.96	44.97	45.32	44.59	44.85	44.83
SO ₃	0.25	0.20	0.22	0.24	0.24	0.23	0.22	0.21	0.21
SrO	2.32	2.03	1.98	2.00	2.01	1.94	2.00	1.97	2.00
TeO ₂	0.14	0.11	0.11	0.11	0.11	0.12	0.10	0.10	0.11
TiO ₂	0.06	0.20	0.18	0.16	0.15	0.14	0.13	0.12	0.11
ZnO	2.00	1.99	1.94	1.96	1.95	1.85	1.94	1.87	1.88
ZrO ₂	3.56	3.91	3.86	3.89	3.90	3.80	3.90	3.85	3.82
Sum	99.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	

* - Target values.

NA - Not Analyzed.

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Table 5.3. DCP Analyzed Composition of Discharged Glass Samples (wt%).

Test#		1				2		
Glass (kg)		978	1483	1979	2301	4635	4895	5004
Oxide	Target	12F-G-139A	12G-G-25A	12G-G-57A	12G-G-79A	12I-G-66B	12J-G-7A	12J-G-37B
Al ₂ O ₃	7.40	7.55	7.84	7.45	7.67	7.60	8.07	7.84
As ₂ O ₃	0.04	0.05	NA	NA	NA	NA	NA	NA
B ₂ O ₃	10.00	9.80	11.03	11.16	10.84	10.65	10.81	10.70
BaO	0.04	0.05	0.05	0.05	0.06	0.05	0.05	0.06
CaO	0.25	0.31	0.32	0.32	0.34	0.29	0.31	0.31
CdO	0.37	0.31	NA	NA	NA	NA	NA	NA
CeO ₂	0.08	NA	NA	NA	NA	NA	NA	NA
Cl	0.01	NA	NA	NA	NA	NA	NA	NA
Cr ₂ O ₃	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05
Cs ₂ O*	0.08	0.07	0.09	0.10	0.10	0.07	0.08	0.09
CuO	0.03	0.03	NA	NA	NA	NA	NA	NA
F	0.04	NA	NA	NA	NA	NA	NA	NA
Fe ₂ O ₃	10.39	8.82	9.36	9.22	9.33	9.57	9.39	9.44
K ₂ O	0.17	0.19	0.19	0.19	0.22	0.18	0.20	0.20
La ₂ O ₃	0.32	NA	NA	NA	NA	NA	NA	NA
Li ₂ O	6.00	5.38	5.29	5.12	5.22	5.29	5.46	5.34
MgO	0.06	0.52	0.69	0.81	0.96	1.13	1.18	1.19
MnO	3.03	2.62	2.89	2.76	2.82	2.65	2.81	2.73
Na ₂ O	6.59	6.44	6.71	6.42	6.55	6.56	6.76	6.65
NiO	0.54	0.46	0.46	0.46	0.50	0.45	0.48	0.51
P ₂ O ₅	0.13	0.38	0.21	0.17	0.32	0.38	0.34	0.38
PbO	0.15	0.19	NA	NA	NA	NA	NA	NA
Sb ₂ O ₃	0.21	0.20	NA	NA	NA	NA	NA	NA
SeO ₂	0.15	0.02	NA	NA	NA	NA	NA	NA
SiO ₂	45.54	41.51	44.83	44.42	40.42	44.77	43.89	44.31
SO ₃	0.25	NA	NA	NA	NA	NA	NA	NA
SrO	2.32	2.02	2.03	1.93	1.99	1.97	2.04	2.02
TeO ₂	0.14	0.12	NA	NA	NA	NA	NA	NA
TiO ₂	0.06	0.10	0.09	0.09	0.11	0.10	0.11	0.10
ZnO	2.00	1.86	NA	NA	NA	NA	NA	NA
ZrO ₂	3.56	3.87	3.71	3.47	3.51	3.71	3.89	3.81
SUM	99.99	92.89	95.85	94.20	90.99	95.46	95.92	95.73

* Analyzed by AA. NA: Not Analyzed.

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Table 5.3. DCP Analyzed Composition of Discharged Glass Samples (wt%) (continued).

Test#		3										
Glass (kg)		6011		6489	6993	7447	8468	8984	9504	9787	10135	
Oxide	Target	12J-G-52B1	12J-G-52B2	12J-G-62A	12J-G-69B	12J-G-78A	12J-G-100C	12J-G-112A	12J-G-125A	12J-G-129A	12J-G-136A1	12J-G-136A2
Al ₂ O ₃	7.40	7.74	7.69	7.38	7.50	7.48	7.88	7.60	7.99	7.88	8.07	7.91
As ₂ O ₃	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B ₂ O ₃	10.00	10.99	10.85	10.53	10.89	10.72	10.73	10.52	10.61	10.62	11.15	10.94
BaO	0.04	0.06	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.05
CaO	0.25	0.31	0.28	0.31	0.27	0.27	0.27	0.28	0.28	0.29	0.30	0.28
CdO	0.37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
CeO ₂	0.08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cl	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cr ₂ O ₃	0.04	0.05	0.06	0.05	0.05	0.05	0.05	0.21	0.05	0.05	0.05	0.05
Cs ₂ O*	0.08	0.07	0.04	0.10	0.08	0.09	0.10	0.08	0.08	0.09	0.08	0.05
CuO	0.03	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fe ₂ O ₃	10.39	9.51	9.99	9.39	9.54	9.53	9.44	9.94	9.43	9.46	9.49	10.10
K ₂ O	0.17	0.19	0.17	0.21	0.18	0.18	0.19	0.18	0.19	0.20	0.21	0.17
La ₂ O ₃	0.32	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Li ₂ O	6.00	5.50	5.44	5.27	5.33	5.29	5.51	5.48	5.62	5.58	5.66	5.51
MgO	0.06	1.22	1.14	1.28	1.20	1.18	1.25	1.27	1.28	1.30	1.28	1.21
MnO	3.03	2.82	2.70	2.77	2.82	2.77	2.81	2.78	2.81	2.81	2.80	2.84
Na ₂ O	6.59	6.72	6.73	6.39	6.53	6.48	6.75	6.73	6.85	6.78	6.90	6.78
NiO	0.54	0.50	0.48	0.49	0.47	0.46	0.47	0.56	0.49	0.52	0.52	0.48
P ₂ O ₅	0.13	0.41	0.57	0.28	0.43	0.33	0.41	0.35	0.40	0.33	0.34	0.50
PbO	0.15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sb ₂ O ₃	0.21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SeO ₂	0.15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SiO ₂	45.54	44.48	44.45	44.91	44.50	44.44	44.64	43.66	44.33	37.87	44.18	45.18
SO ₃	0.25	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SrO	2.32	2.04	2.02	1.95	2.02	1.97	2.06	2.02	2.06	2.05	2.08	2.08
TeO ₂	0.14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TiO ₂	0.06	0.10	0.09	0.10	0.09	0.09	0.10	0.10	0.10	0.10	0.11	0.10
ZnO	2.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ZrO ₂	3.56	3.79	3.69	3.35	3.44	3.45	3.76	3.72	3.75	3.76	3.77	3.84
SUM	99.99	96.48	96.45	94.80	95.39	94.82	96.50	95.54	96.38	89.75	97.04	98.05

*Analyzed by AA.

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Table 5.3. DCP Analyzed Composition of Discharged Glass Samples (wt%) (continued).

Test#		3			4				5		6	
Glass (kg)		10559	11075		13932	14449	14540		15578	16199	17479	18100
Oxide	Target	12J-G-141A	12J-G-152B1	12J-G-152B2	12K-G-125A	12K-G-136B	12K-G-138A1	12K-G-138A2	12L-G-80A	12L-G-119A	12M-G-70A	12M-G-117A
Al ₂ O ₃	7.40	7.32	7.48	7.50	7.21	7.14	7.22	6.91	7.37	6.87	6.90	6.96
As ₂ O ₃	0.04	NA	NA	NA	0.02	0.04	0.01	0.00	0.02	0.00	0.02	0.00
B ₂ O ₃	10.00	10.68	10.73	11.32	10.13	10.20	10.21	9.97	10.26	9.75	9.63	9.46
BaO	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
CaO	0.25	0.28	0.27	0.28	0.27	0.27	0.28	0.26	0.28	0.27	0.45	0.50
CdO	0.37	NA	NA	NA	0.36	0.35	0.33	0.36	0.33	0.33	0.34	0.34
CeO ₂	0.08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cl	0.01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cr ₂ O ₃	0.04	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.04
Cs ₂ O**	0.08	0.08	0.09	0.04	0.08	0.08	0.08	0.05	0.07	0.07	0.07	0.07
CuO	0.03	NA	NA	NA	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03
F	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fe ₂ O ₃	10.39	9.62	9.60	9.97	9.33	9.21	9.28	9.37	9.56	9.26	9.85	9.94
K ₂ O	0.17	0.18	0.18	0.17	0.19	0.19	0.20	0.19	0.20	0.19	0.19	0.21
La ₂ O ₃	0.32	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Li ₂ O	6.00	5.23	5.22	5.25	5.18	5.09	5.16	4.93	5.19	4.87	4.78	4.69
MgO	0.06	1.27	1.24	1.22	1.29	1.29	1.32	1.21	1.30	1.25	1.26	1.15
MnO	3.03	2.65	2.68	2.71	2.49	2.51	2.52	2.47	3.09	2.94	2.99	2.91
Na ₂ O	6.59	6.38	6.47	6.51	6.25	6.15	6.25	6.00	6.33	5.94	5.88	5.78
NiO	0.54	0.48	0.47	0.50	0.46	0.46	0.47	0.45	0.43	0.43	0.45	0.45
P ₂ O ₅	0.13	0.43	0.42	0.48	0.35	0.32	0.34	0.39	0.38	0.33	0.29	0.36
PbO	0.15	NA	NA	NA	0.18	0.18	0.18	0.18	0.17	0.16	0.17	0.16
Sb ₂ O ₃	0.21	NA	NA	NA	0.18	0.14	0.11	0.05	0.18	0.18	0.19	0.18
SeO ₂	0.15	NA	NA	NA	0.04	0.01	0.03	0.00	0.01	0.07	0.05	0.04
SiO ₂	45.54	40.72	44.33	45.65	43.01	38.99	43.71	42.96	43.35	44.64	44.56	44.61
SO ₃ ***	0.25	NA	NA	NA	0.18	0.21	0.31	0.16	NA	NA	NA	NA
SrO	2.32	1.97	1.99	1.99	1.81	1.82	1.82	1.94	1.85	1.73	1.81	1.81
TeO ₂	0.14	NA	NA	NA	0.08	0.09	0.05	0.00	0.17	0.15	0.17	0.13
TiO ₂	0.06	0.10	0.10	0.10	0.11	0.11	0.12	0.11	0.13	0.13	0.17	0.19
ZnO	2.00	NA	NA	NA	1.75	1.75	1.73	1.73	1.80	1.77	1.92	1.95
ZrO ₂	3.56	3.66	3.69	3.75	3.43	3.48	3.48	3.41	3.52	3.34	3.48	3.53
SUM	99.99	91.16	95.06	97.57	94.51	90.22	95.32	93.23	96.13	94.78	95.76	95.54

** Analyzed by AA.

*** Analyzed by IC.

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Table 5.3. DCP Analyzed Composition of Discharged Glass Samples (wt%) (continued).

Test#		7		8	9			Overall Avg.
Glass (kg)	Target	21038	24076	25020	25607	26726		
Oxide		12N-G-63A	12N-G-126B	12O-G-68A	12O-G-125A	12P-G-42A1	12P-G-42A2	
Al ₂ O ₃	7.40	7.50	7.74	7.22	7.06	7.11	7.14	7.49
As ₂ O ₃	0.04	0.01	0.02	0.03	0.03	0.00	0.02	0.03
B ₂ O ₃	10.00	9.39	9.31	9.47	9.51	9.84	9.75	10.37
BaO	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05
CaO	0.25	0.56	0.57	0.46	0.42	0.36	0.33	0.33
CdO	0.37	0.33	0.32	0.34	0.33	0.30	0.29	0.33
CeO ₂	0.08	NA	NA	NA	NA	NA	NA	NC
Cl	0.01	NA	NA	NA	NA	NA	NA	NC
Cr ₂ O ₃	0.04	0.05	0.05	0.04	0.04	0.04	0.04	0.05
Cs ₂ O**	0.08	0.07	0.07	0.07	0.07	NA	NA	0.08
CuO	0.03	0.03	0.02	0.02	0.03	0.03	0.02	0.03
F	0.04	NA	NA	NA	NA	NA	NA	NC
Fe ₂ O ₃	10.39	9.94	9.64	9.84	9.52	9.72	9.25	9.51
K ₂ O	0.17	0.21	0.21	0.20	0.20	0.20	0.18	0.19
La ₂ O ₃	0.32	NA	NA	NA	NA	NA	NA	NC
Li ₂ O	6.00	4.71	4.79	4.69	4.73	4.87	4.82	5.20
MgO	0.06	0.81	0.65	0.86	0.97	1.12	1.04	1.11
MnO	3.03	3.02	3.14	2.87	2.87	3.08	3.10	2.79
Na ₂ O	6.59	5.78	5.84	5.68	5.74	5.93	5.97	6.37
NiO	0.54	0.48	0.46	0.44	0.44	0.46	0.46	0.47
P ₂ O ₅	0.13	0.23	0.19	0.32	0.29	0.33	0.16	0.34
PbO	0.15	0.17	0.16	0.16	0.16	0.16	0.14	0.17
Sb ₂ O ₃	0.21	0.19	0.19	0.18	0.19	0.18	0.20	0.17
SeO ₂	0.15	0.01	0.02	0.05	0.03	0.01	0.00	0.03
SiO ₂	45.54	45.22	43.71	45.08	44.25	44.88	45.07	43.30
SO ₃	0.25	NA	NA	NA	NA	NA	NA	NC
SrO	2.32	1.86	1.88	1.79	1.78	1.81	1.93	1.95
TeO ₂	0.14	0.11	0.13	0.13	0.14	0.10	0.19	0.12
TiO ₂	0.06	0.24	0.23	0.20	0.18	0.15	0.16	0.12
ZnO	2.00	2.00	1.98	1.90	1.91	1.89	1.91	1.86
ZrO ₂	3.56	3.55	3.52	3.48	3.43	3.46	3.47	3.61
SUM	99.99	96.51	94.89	95.56	94.36	96.08	95.68	94.51

** Analyzed by AA.

NC: Not Calculated.

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Table 5.4. Measured Iron Redox of Discharged Glasses.

Test #	Discharge Date	Sample I.D.	Cumulative Mass (kg)	Fe ²⁺ /Fe _{tot} (%)
1	07/03/01	12G-G-79A	2301.0	1.9
2	07/24/01	12G-G-128A	2561.0	3.0
	07/24/01	12G-G-138A	2827.0	6.3
	07/25/01	12G-G-150A	3035.0	9.1
	07/26/01	12H-G-22A	3297.5	11.3
	07/26/01	12H-G-26A	3452.0	12.7
	07/27/01	12H-G-40C	3699.0	13.7
	07/29/01	12I-G-35A	4121.5	9.4
3	08/11/01	12J-G-152B	11074.5	1.6
4	08/25/01	12K-G-138A	14539.5	2.1
5	09/27/01	12L-G-46A	15055.5	<0.4
	09/29/01	12L-G-80A	15578.0	<0.4
	09/30/01	12L-G-101A	15892.0	<0.4
	10/01/01	12L-G-119A	16198.5	<0.4
6	10/12/01	12M-G-19A	16705.5	1.7
	10/14/01	12M-G-50A	17221.5	3.5
	10/15/01	12M-G-70A	17478.5	4.5
7	10/24/01	12N-G-38C	20017.0	5.1
	10/25/01	12N-G-51C	20537.5	6.5
	10/25/01	12N-G-63A	21038.0	5.8
	10/26/01	12N-G-71A	21513.5	6.0
	10/26/01	12N-G-85A	22028.5	5.8
	10/26/01	12N-G-88D	22492.0	4.8
8	10/31/01	12O-G-31A	24484.0	2.0
	11/02/01	12O-G-68A	25019.5	1.2
9	11/06/01	12O-G-107A	25330.5	2.9
	11/07/01	12O-G-125A	25607.0	8.6
	11/08/01	12O-G-144A	25878.5	11.1
	11/09/01	12P-G-12A	26201.5	17.5
	11/10/01	12P-G-42A	26725.5	11.9

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Table 6.1. Summary of Off-Gas Particulate Sampling Results During DM 1200 AZ-101 Tests.

Test #	Date	Location	Total PM (grams)	Meter Volume (dscf)	Concentration (mg/dscf)	Flow Rate (dscfm)	Particulate Emission Rate (mg/min)	Moisture (% vol.)	% Isokinetic
1	6/29/01	Melter Outlet	0.0929	60.670	1.5311	158.68	243.0	13.00	104
	6/29/01	Scrubber Outlet	0.0046	79.768	0.0580	197.30	11.5	2.99	102
	6/29/01	WESP Outlet	0.0022	101.724	0.0218	160.66	3.51	2.75	102
	6/29/01	Melter Outlet	0.0537	53.850	0.9980	142.39	142.1	13.84	103
	6/29/01	Scrubber Outlet	0.0081	64.561	0.1255	161.35	20.2	2.86	101
	6/29/01	WESP Outlet	0.0033	110.421	0.0295	180.73	5.34	2.90	99
	6/30/01	Melter Outlet	0.0296	54.083	0.5475	147.59	80.8	9.22	100
	6/30/01	Scrubber Outlet	0.0047	69.519	0.0672	171.88	11.5	2.53	102
	6/30/01	WESP Outlet	0.0036	104.712	0.0345	169.62	5.85	2.63	100
2	7/29/01	Melter Outlet	0.0745	48.815	1.5252	160.77	245.2	9.16	87
	7/29/01	Scrubber Outlet	0.0633	204.385	0.3097	187.80	58.2	2.50	109
	7/29-31/01	WESP Outlet	0.0023	1862.443	0.0012	214.48	0.27	2.7	97
	7/30/01	Melter Outlet	0.0507	46.429	1.0913	154.71	168.8	9.59	86
	7/30/01	Scrubber Outlet	0.0456	221.418	0.2059	212.22	43.7	2.17	105
	7/31/01	Melter Outlet	0.0596	49.837	1.1964	160.39	191.9	8.43	85
	7/30/01	Scrubber Outlet	0.0248	146.001	0.1698	214.40	36.4	2.36	105
3	8/8/01	Melter Outlet	0.7240	34.847	20.7765	163.33	3393.4	29.32	59
	8/8/01	Scrubber Outlet	0.1388	151.39	0.9168	210.12	192.6	8.13	102
	8/9/01	Melter Outlet	1.4912	34.433	43.3069	132.85	5753.3	40.03	111
	8/9/01	Scrubber Outlet	0.0986	98.818	0.9974	195.49	195.0	12.24	108
	8/10/01	Melter Outlet	0.7026	18.24	38.5173	102.39	3943.8	41.16	114
	8/10/01	Scrubber Outlet	0.1269	183.744	0.6906	189.49	130.9	7.55	97
	8/8-10/01	WESP Outlet	0.0083	1632.622	0.0051	207.216	1.06	8.14	102
	8/10/01	Melter Outlet	0.5403	18.079	29.8872	129.28	3863.8	33.49	102
4	8/22/01	Melter Outlet	0.4105	35.058	11.71	151.14	1770	23.8	99
	8/22/01	Scrubber Outlet	0.0602	97.783	0.6208	200.10	124.2	5.25	98
	8/23/01	Melter Outlet	0.2631	23.701	11.10	149.85	1664	25.2	101
	8/23/01	Scrubber Outlet	0.0476	72.412	0.6573	195.61	128.6	5.27	99
	8/24/01	Melter Outlet	0.4159	35.163	11.83	153.00	1810	25.4	98
	8/24/01	Scrubber Outlet	0.0508	94.582	0.5371	193.42	103.9	5.14	98
	8/22-24/01	WESP Outlet	0.0060	1752.331	0.0034	192.59	0.66	5.46	102

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**Table 6.1. Summary of Off-Gas Particulate Sampling Results
During DM 1200 AZ-101 Tests (continued).**

Test	Date	Location	Total PM (g)	Meter Volume (dscf)	Concentration (mg/dscf)	Flow Rate (dscfm)	Particulate Emission Rate (mg/min)	Moisture (% vol.)	% Isokinetic
5	9/28/01	Melter Outlet	0.2223	54.496	4.097	178	730	8.14	96
	9/28/01	Scrubber Outlet	0.0351	156.7	0.224	209	46.8	2.45	100
	9/29/01	Melter Outlet	0.2427	43.943	5.524	174	958	9.79	100
	9/29/01	Scrubber Outlet	0.0346	70.374	0.491	208	102	3.73	102
	9/30/01	Melter Outlet	0.2700	40.915	6.598	175	1161	9.42	98
	9/30/01	Scrubber Outlet	0.0163	57.389	0.491	211	59.9	2.64	109
	9/28-30/01	WESP Outlet	0.0076	1989.5	0.0038	212	0.81	3.43	104
6	10/15/01	Melter Outlet	0.1066	88.28	1.2075	189	228.2	6.16	91
	10/15/01	Scrubber Outlet	0.0286	214	0.1336	218	29.2	2.11	98
	10/16/01	Melter Outlet	0.1029	75.631	1.3606	168	229.0	9.27	94
	10/16/01	Scrubber Outlet	0.0272	73.319	0.3710	207	77.0	2.73	94
	10/17/01	Melter Outlet	0.0735	77.913	0.9434	172	162.0	7.1	95
	10/17/01	Scrubber Outlet	0.0134	105.971	0.1264	199.8	25.3	2.18	98
	10/15-17/01	WESP Outlet	0.0071	2083	0.0034	227	0.77	2.5	103
7	10/23/01	Melter Outlet	0.4596	35.823	12.83	179	2294	26.08	120
	10/23/01	Scrubber Outlet	0.0762	39.672	1.921	271	320	6.54	103
	10/24/01	Melter Outlet	0.4522	33.568	13.471	163	2206	30.96	144
	10/24/01	Scrubber Outlet	0.0713	33.792	2.11	269	568	7.42	88
	10/25/01	Melter Outlet	0.4070	33.352	12.203	175	2135	32.85	134
	10/25/01	Scrubber Outlet	0.0749	43.417	1.725	287	496	7.63	106
	10/23-25/01	WESP Outlet	0.0134	1875	0.0071	215	1.53	6.0	106
8	10/30/01	Melter Outlet	0.3402	40.326	8.436	160.5	1354	11.05	101
	10/30/01	Scrubber Outlet	0.1065	94.384	1.128	193.9	218.8	3.43	98
	10/31/01	Melter Outlet	0.2536	40.420	6.274	170	1066.4	8.67	95
	10/31/01	Scrubber Outlet	0.0332	35.312	0.9402	194.2	182.6	3.26	87
	11/1/01	Melter Outlet	0.2902	34.405	8.435	172.3	1453.4	10.58	96
	11/1/01	Scrubber Outlet	0.0466	43.622	1.068	199.7	213.3	2.85	88
	10/30-11/1/01	WESP Outlet	0.0104	1927.4	0.0054	203	1.09	2.75	106
9a	11/7/01	Melter Outlet	0.1185	56.838	2.085	169.86	354.1	9.36	101
	11/7/01	Scrubber Outlet	0.0581	97.648	0.595	200.39	119.2	2.5	98
9a-b	11/8/01	Scrubber Outlet	0.0553	56.574	0.9775	199.18	194.7	2.59	98
	11/7-9/01	WESP Outlet	0.0163	1856.4	0.0088	196	1.72	2.09	105
9b	11/8/01	Melter Outlet	0.1524	40.874	3.729	150.19	560	11.39	109
	11/9/01	Melter Outlet	0.1719	53.308	3.225	215.01	693.3	8.41	99
	11/9/01	Scrubber Outlet	0.1335	97.838	1.365	196.6	268.3	2.52	100

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Table 6.2. Average Carryover and DF Values from Melter, SBS, and WESP.

Test	Solids Feed Flux* (g/min)	Melter			SBS			WESP			Cumulative DF across Melter, SBS and WESP
		Outlet Flux (mg/min)	DF	% emitted	Outlet Flux (mg/min)	DF	% emitted	Outlet Flux (mg/min)	DF	% emitted	
1	317.2	155	2042	0.05	14.4	11.0	9.3	NC	NC	NC	NC
2	232.2	202	1149	0.09	46.1	4.0	22.8	0.27	171	0.58	859878
3	1036.3	4520	229	0.44	172.8	26.0	3.8	1.06	163	0.61	977673
4	536.7	1748	307	0.33	118.9	14.7	6.8	0.66	180	0.56	813132
5	275.3	950	290	0.34	69.6	13.6	7.3	0.81	85.9	1.2	344166
6	160.3	206	777	0.13	43.8	4.7	21.3	0.77	56.9	1.8	208225
7	957.7	2212	433	0.23	461.3	4.8	20.9	1.53	302	0.33	625926
8	285.2	1291	221	0.45	204.9	6.3	15.9	1.09	188	0.53	259243
9ab	281.8	536	526	0.19	194.1	2.8	36.2	1.72	113	0.89	165784

* - Calculated from average feed rate during sampling periods only (as opposed to the entire test) and the percent solids after drying at 110°C.

NC – Not Calculated due to insufficient sampling time.

Table 6.3. Melter Emission Rates for DM 1200 AZ101 Test 1.

		Average Feed Flux (mg/min)	Run 1 (mg/min)	Run 2 (mg/min)	Run 3 (mg/min)	Average (mg/min)	DF Across Melter
Particles	Total ^s	317167	243.0	142.1	80.8	155.3	2042
	Al	12425	7.38	0.69	1.05	3.04	4090
	As	96	0.84	0.30	< 0.09	< 0.41	> 234
	B	9843	6.28	0.22	84.10	30.20	326
	Ba	114	0.12	< 0.09	< 0.09	< 0.10	> 1140
	Ca	567	2.06	< 0.09	11.24	< 4.46	>127
	Cd	1051	1.18	0.68	0.15	0.67	1572
	Cr	87	0.15	0.15	< 0.09	< 0.13	> 669
	Cs	239	0.55	0.50	0.14	0.40	599
	Cu	76	0.31	0.21	0.36	0.29	258
	Fe	23043	14.89	1.87	2.40	6.38	3609
	I	317	< 0.09	< 0.09	< 0.09	< 0.09	> 5286
	K	448	0.61	0.21	0.64	0.48	925
	Li	8840	3.36	0.63	0.48	1.49	5932
	Mg [#]	2208	2.78	0.39	0.37	1.18	1871
	Mn	7443	1.92	0.22	0.20	0.78	9587
	Na	15507	17.42	2.68	3.02	7.71	2012
	Ni	1346	0.69	< 0.09	0.13	< 0.30	> 4487
	P	180	4.30	< 0.09	0.17	< 1.52	> 118
	Pb	442	0.48	0.30	0.36	0.38	1156
	S	318	0.68	1.53	35.46	12.56	25
	Sb	501	0.64	< 0.09	0.17	< 0.30	> 1670
	Se	339	44.41	14.54	253.80	104.25	3
	Si	67505	20.85	1.38	7.09	9.78	6906
	Sr	6222	5.70	0.94	0.48	2.37	2624
	Te	355	2.79	3.09	1.82	2.56	138
	Ti	114	< 0.09	< 0.09	< 0.09	< 0.09	> 1901
	Zn	5096	7.80	1.58	1.28	3.55	1434
	Zr	8359	1.78	< 0.09	0.15	< 0.67	> 12476
Gas	B	9843	23.41	33.25	0.32	18.99	518
	Cl	32	4.58	7.58	< 0.17	< 4.05	> 8
	F	127	4.37	8.64	< 0.17	< 4.33	> 29
	I	317	189.70	208.54	249.85	216.03	1
	S	318	13.02	18.46	< 0.17	< 10.49	> 30
	Se	339	26.66	22.97	0.55	16.73	20

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

- The analyzed MgO concentration of 1.15 wt% instead of the target value of 0.06 wt% was used to calculate the feed flux

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Table 6.4. SBS Emission Rates for DM 1200 AZ101 Test 1.

		Average Melter Emissions Flux (mg/min)	Run 1 (mg/min)	Run 2 (mg/min)	Run 3 (mg/min)	Average (mg/min)	DF Across SBS
Particles	Total ^s	155.3	11.5	20.2	11.5	14.4	11
	Al	3.04	0.45	< 0.09	0.21	0.22	14
	As	0.38	< 0.09	0.10	< 0.09	< 0.09	> 6
	B	30.20	0.41	0.20	0.14	0.25	121
	Ba	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	NC
	Ca	4.43	0.60	0.44	0.67	0.57	8
	Cd	0.67	0.10	0.24	< 0.09	< 0.14	> 5
	Cr	0.10	< 0.09	< 0.09	< 0.09	< 0.09	> 2
	Cs	0.40	0.10	0.21	< 0.09	< 0.13	> 3
	Cu	0.29	0.10	0.10	0.13	0.11	3
	Fe	6.38	0.12	< 0.09	< 0.09	< 0.10	> 64
	I	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	NC
	K	0.48	0.26	0.54	0.41	0.40	1
	Li	1.49	0.09	0.25	< 0.09	< 0.14	> 11
	Mg	1.18	< 0.09	< 0.09	0.09	0.03	20
	Mn	0.78	< 0.09	< 0.09	< 0.09	< 0.09	> 13
	Na	7.71	2.30	1.64	1.42	1.79	4
	Ni	0.27	< 0.09	< 0.09	< 0.09	< 0.09	> 5
	P	1.49	0.79	1.14	0.57	0.83	2
	Pb	0.38	0.12	0.13	0.17	0.14	3
	S	12.56	0.33	0.55	< 0.09	< 0.32	> 43
	Sb	0.27	0.54	< 0.09	< 0.09	< 0.24	> 1
	Se	104.25	1.24	3.47	1.00	1.90	55
	Si	9.78	0.29	0.21	0.85	0.45	22
	Sr	2.37	< 0.09	< 0.09	< 0.09	< 0.09	> 40
	Te	2.56	0.70	1.64	0.21	0.85	3
	Ti	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	NC
	Zn	3.55	0.18	0.10	< 0.09	< 0.12	> 30
	Zr	0.64	< 0.09	< 0.09	< 0.09	< 0.09	> 11
Gas	B	18.99	0.39	0.70	0.41	0.50	38
	Cl	4.05	< 0.17	< 0.17	< 0.17	< 0.17	> 68
	F	4.33	< 0.17	< 0.17	< 0.17	< 0.17	> 72
	I	216.03	208.36	178.99	422.54	269.96	1
	S	10.49	< 0.17	< 0.17	< 0.17	< 0.17	> 175
	Se	16.73	2.33	5.61	6.84	4.93	3

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

Table 6.5. WESP Emission Rates for DM 1200 AZ101 Test 1.

		Average SBS Emissions Flux (mg/min)	Run 1 (mg/min)	Run 2 (mg/min)	Run 3 (mg/min)	Average (mg/min)	DF Across WESP
Particles	Total [§]	14.4	3.51	5.34	5.85	4.9	3
	Al	0.22	< 0.09	< 0.09	< 0.09	< 0.09	> 2.4
	As	< 0.09	0.44	< 0.09	< 0.09	< 0.15	NC
	B	0.25	< 0.09	< 0.09	< 0.09	< 0.09	> 2.8
	Ba	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	NC
	Ca	0.57	0.19	0.15	1.11	0.48	2
	Cd	0.11	< 0.09	< 0.09	< 0.09	< 0.09	> 1.2
	Cr	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	NC
	Cs	0.11	< 0.09	< 0.09	< 0.09	< 0.09	> 1.2
	Cu	0.11	< 0.09	0.09	0.14	0.08	1
	Fe	0.04	< 0.09	< 0.09	0.10	< 0.09	>0.4
	I	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	NC
	K	0.40	0.22	0.37	0.19	0.26	2
	Li	0.12	< 0.09	< 0.09	< 0.09	< 0.09	> 1.3
	Mg	0.03	< 0.09	< 0.09	< 0.09	< 0.09	> 0.3
	Mn	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	NC
	Na	1.79	0.35	0.51	3.31	1.39	3
	Ni	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	NC
	P	0.83	0.79	0.10	< 0.09	0.30	3
	Pb	0.14	0.16	0.15	0.17	0.16	1
	S	0.30	0.37	< 0.09	< 0.09	< 0.12	> 1
	Sb	0.18	0.19	0.42	< 0.09	< 0.20	> 1
	Se	1.90	< 0.09	< 0.09	< 0.09	< 0.09	>21.1
	Si	0.45	0.31	0.14	0.39	0.28	2
	Sr	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	NC
	Te	0.85	0.25	0.37	0.43	0.35	3
	Ti	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	NC
	Zn	0.10	< 0.09	< 0.09	0.09	< 0.09	>1
	Zr	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	NC
Gas	B	0.50	0.44	0.65	0.54	0.55	1
	Cl	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	NC
	F	< 0.17	< 0.17	0.33	< 0.17	< 0.17	NC
	I	269.96	144.07	360.80	227.81	244.23	1
	S	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	NC
	Se	4.93	< 0.17	0.25	0.22	< 0.17	14

NC – Not Calculated

[§] - From gravimetric analysis of filters and rinse dry-downs

Table 6.6. Melter Emission Rates for DM 1200 AZ101 Test 2.

		Average Feed Flux (mg/min)	Run 1 (mg/min)	Run 2 (mg/min)	Run 3 (mg/min)	Average (mg/min)	DF Across Melter
Particles	Total ^s	232167	245.2	168.8	191.9	202	1149
	Al	9095	4.88	7.83	4.75	5.82	1563
	As	70	2.78	0.87	1.09	1.58	45
	B	7205	4.15	9.39	4.67	6.07	1187
	Ba	83	< 0.06	0.11	0.13	< 0.10	> 830
	Ca	415	0.83	0.84	0.51	0.72	573
	Cd	769	23.02	2.97	14.38	13.45	57
	Cr	64	0.11	0.14	0.13	0.13	503
	Cs	175	0.64	0.44	0.31	0.46	380
	Cu	56	0.50	0.10	0.12	0.24	232
	Fe	16867	9.09	13.18	8.53	10.27	1643
	I	232	< 0.06	< 0.06	< 0.06	< 0.06	> 3869
	K	328	0.67	0.55	0.48	0.57	578
	Li	6471	1.78	3.22	2.04	2.35	2755
	Mg [#]	1613	1.25	2.25	1.58	1.69	954
	Mn	5448	0.90	2.89	1.39	1.72	3159
	Na	11351	7.09	8.64	6.76	7.50	1514
	Ni	985	0.42	0.53	0.54	0.50	1976
	P	132	0.18	0.11	0.67	0.32	412
	Pb	323	2.98	0.46	1.70	1.71	189
	S	233	1.32	0.83	0.48	0.88	265
	Sb	367	0.20	0.82	0.63	0.55	665
	Se	248	34.38	30.06	24.48	29.64	8
	Si	49414	12.48	22.26	11.39	15.38	3213
	Sr	4555	2.48	4.82	3.64	3.64	1250
	Te	260	62.65	5.61	44.72	37.66	7
	Ti	84	0.10	0.07	< 0.06	< 0.08	> 1050
	Zn	3730	3.14	4.77	3.73	3.88	961
	Zr	6119	0.72	1.18	0.69	0.86	7074
Gas	B	7205	38.42	17.29	17.87	24.53	294
	Cl	23	6.60	6.05	3.30	5.31	4
	F	93	5.71	7.69	2.23	5.21	18
	I	232	47.60	78.72	64.65	63.66	4
	S	233	38.87	9.99	20.11	22.99	10
	Se	248	9.10	42.67	15.03	22.27	11

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

- The analyzed MgO concentration of 1.15 wt% instead of the target value of 0.06 wt% was used to calculate the feed flux

Table 6.7. SBS Emission Rates for DM 1200 AZ101 Test 2.

		Average Melter Emissions Flux (mg/min)	Run 1 (mg/min)	Run 2 (mg/min)	Run 3 (mg/min)	Average (mg/min)	DF Across SBS
Particles	Total ^s	202	58.2	43.7	36.4	46.1	4
	Al	5.82	< 0.06	< 0.06	< 0.06	< 0.06	> 97
	As	1.58	0.89	0.44	0.41	0.58	3
	B	6.07	< 0.06	< 0.06	< 0.06	< 0.06	> 101
	Ba	0.08	< 0.06	< 0.06	< 0.06	< 0.06	> 1
	Ca	0.72	< 0.06	0.07	0.09	< 0.06	> 12
	Cd	13.45	9.78	4.03	4.03	5.95	2
	Cr	0.13	< 0.06	< 0.06	< 0.06	< 0.06	> 2
	Cs	0.46	0.28	0.26	0.16	0.23	2
	Cu	0.24	< 0.06	< 0.06	< 0.06	< 0.06	> 4
	Fe	10.27	< 0.06	< 0.06	< 0.06	< 0.06	> 171
	I	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	NC
	K	0.57	0.13	0.15	0.11	0.13	4
	Li	2.35	0.15	0.17	0.11	0.14	16
	Mg	1.69	< 0.06	< 0.06	< 0.06	< 0.06	> 28
	Mn	1.72	< 0.06	< 0.06	< 0.06	< 0.06	> 29
	Na	7.50	0.97	1.09	0.69	0.92	8
	Ni	0.50	< 0.06	< 0.06	< 0.06	< 0.06	> 8
	P	0.32	0.18	< 0.06	0.27	< 0.17	> 2
	Pb	1.71	1.18	0.39	0.42	0.66	3
	S	0.88	0.92	NA	0.23	0.58	2
	Sb	0.55	0.09	0.17	0.07	0.11	5
	Se	29.64	3.92	5.51	3.20	4.21	7
	Si	15.38	0.15	0.10	0.17	0.14	108
	Sr	3.64	< 0.06	< 0.06	< 0.06	< 0.06	> 61
	Te	37.66	25.12	13.51	18.24	18.96	2
	Ti	0.06	< 0.06	< 0.06	< 0.06	< 0.06	> 1
	Zn	3.88	< 0.06	< 0.06	0.07	< 0.06	> 65
	Zr	0.86	< 0.06	< 0.06	< 0.06	< 0.06	> 14
Gas	B	24.53	1.27	1.78	0.45	1.17	21
	Cl	5.31	0.63	0.93	< 0.07	< 0.54	> 10
	F	5.21	< 0.07	< 0.07	< 0.07	< 0.06	> 87
	I	63.66	4.53	11.26	2.12	5.97	11
	S	22.99	< 0.07	< 0.07	< 0.07	< 0.06	> 383
	Se	22.27	4.37	14.54	1.68	6.86	3

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

NA – Not Analyzed

Table 6.8. WESP Emission Rates for DM 1200 AZ101 Test 2.

		Average Feed Flux (mg/min)	Average Melter Emissions Flux (mg/min)	Average SBS Emissions Flux (mg/min)	WESP Emissions Flux (mg/min)	DF Across WESP	DF Across SBS, WESP	Cumulative DF Across Melter, SBS, WESP
Particles	Total ^s	232167	202	46.1	0.27	171	673	773890
	Al	9095	5.82	< 0.06	< 0.06	NC	> 97	> 151591
	As	70	1.58	0.58	< 0.06	> 9.1	> 26	> 1172
	B	7205	6.07	< 0.06	< 0.06	NC	> 101	> 120086
	Ba	83	0.08	< 0.06	< 0.06	NC	> 1	> 1386
	Ca	415	0.72	< 0.06	< 0.06	> 0.9	> 12	> 6915
	Cd	769	13.45	5.95	< 0.06	> 92.9	> 224	> 12820
	Cr	64	0.13	< 0.06	< 0.06	NC	> 2	> 1059
	Cs	175	0.46	0.23	< 0.06	> 3.7	> 8	> 2920
	Cu	56	0.24	< 0.06	< 0.06	NC	> 4	> 927
	Fe	16867	10.27	< 0.06	< 0.06	NC	> 171	> 281122
	I	232	< 0.06	< 0.06	< 0.06	NC	NC	> 3869
	K	328	0.57	0.13	< 0.06	> 2.0	> 9	> 5461
	Li	6471	2.35	0.14	< 0.06	> 2.2	> 39	> 107847
	Mg#	1613	1.69	< 0.06	< 0.06	NC	> 28	> 26933
	Mn	5448	1.72	< 0.06	< 0.06	NC	> 29	> 90801
	Na	11351	7.50	0.92	< 0.06	> 14.3	> 125	> 189191
	Ni	985	0.50	< 0.06	< 0.06	NC	> 8	> 16419
	P	132	0.32	0.15	< 0.06	> 2.3	> 5	> 2196
	Pb	323	1.71	0.66	< 0.06	> 10.3	> 29	> 5388
	S	233	0.88	0.58	< 0.06	> 9.6	> 15	> 3877
	Sb	367	0.55	0.11	< 0.06	> 1.7	> 9	> 6117
	Se	248	29.64	4.21	< 0.06	> 65.8	> 494	> 4130
	Si	49414	15.38	0.14	< 0.06	> 2.2	> 256	> 823561
	Sr	4555	3.64	< 0.06	< 0.06	NC	> 61	> 75910
	Te	260	37.66	18.96	< 0.06	> 296.2	> 628	> 4331
	Ti	84	0.06	< 0.06	< 0.06	NC	> 1	> 1392
	Zn	3730	3.88	0.02	< 0.06	> 0.3	> 65	> 62174
	Zr	6119	0.86	< 0.06	< 0.06	NC	> 14	> 101978
Gas	B	7205	24.53	1.17	0.10	12	251	73797
	Cl	23	5.31	0.52	< 0.07	> 7.4	> 89	> 387
	F	93	5.21	< 0.06	< 0.07	NC	> 87	> 1548
	I	232	63.66	5.97	< 0.07	> 85.3	> 1061	> 3869
	S	233	22.99	< 0.06	< 0.07	NC	> 383	> 3877
	Se	248	22.27	6.86	< 0.07	> 98.1	> 371	> 4130

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

- The analyzed MgO concentration of 1.15 wt% instead of the target value of 0.06 wt% was used to calculate the feed flux

Table 6.9. Melter Emission Rates for DM 1200 AZ101 Test 3.

		Average Feed Flux (mg/min)	Run 1 (mg/min)	Run 2 (mg/min)	Run 3 (mg/min)	Average (mg/min)	DF Across Melter
Particles	Total ^s	1036333	5753	3944	3864	4520	229
	Al	40600	226.23	164.76	117.46	169.48	240
	As	314	7.72	4.93	4.85	5.83	54
	B	32162	220.74	121.33	79.40	140.49	229
	Ba	371	2.08	1.18	1.10	1.46	255
	Ca	1852	12.27	8.21	6.75	9.08	204
	Cd	3433	27.28	20.20	16.32	21.27	161
	Cr	284	6.76	4.45	3.03	4.75	60
	Cs	782	22.48	14.20	13.16	16.61	47
	Cu	248	1.24	0.92	0.74	0.97	257
	Fe	75292	452.63	294.49	191.32	312.81	241
	I	1036	< 0.06	< 0.06	< 0.06	< 0.06	> 17272
	K	1463	15.79	8.87	< 0.06	11.55	127
	Li	28884	93.35	66.62	53.72	71.23	405
	Mg [#]	7200	49.75	35.86	24.90	36.84	195
	Mn	24319	35.88	24.80	37.46	32.71	743
	Na	50670	314.32	193.73	161.33	223.13	227
	Ni	4398	25.92	18.50	12.01	18.81	234
	P	588	9.26	4.56	4.80	6.21	95
	Pb	1443	9.22	6.09	6.38	7.23	200
	S	1038	112.15	87.00	108.27	102.47	10
	Sb	1638	8.73	4.92	4.68	6.11	268
	Se	1106	300.38	431.85	723.54	485.26	2
	Si	220570	600.12	408.96	368.81	459.30	480
	Sr	20330	92.44	69.25	50.50	70.73	287
	Te	1160	113.04	71.25	61.36	81.88	14
	Ti	373	1.59	0.94	0.98	1.17	319
	Zn	16652	90.96	66.60	46.20	67.92	245
	Zr	27312	53.46	25.72	33.60	37.59	727
Gas	B	32162	361.41	303.03	334.82	333.09	97
	Cl	104	26.73	58.38	136.21	73.78	1
	F	415	90.69	99.35	204.56	131.53	3
	I	1036	435.05	508.64	582.72	508.80	2
	S	1038	149.33	124.73	220.70	164.92	6
	Se	1106	2.07	7.09	139.77	49.64	22

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs[#] - The analyzed MgO concentration of 1.15 wt% instead of the target value of 0.06 wt% was used to calculate the feed flux

Table 6.10. SBS Emission Rates for DM 1200 AZ101 Test 3.

		Average Melter Emissions Flux (mg/min)	Run 1 (mg/min)	Run 2 (mg/min)	Run 3 (mg/min)	Average (mg/min)	DF Across SBS
Particles	Total ^s	4520	192.6	195.0	130.9	172.8	26.2
	Al	169.48	0.37	0.41	0.32	0.37	462
	As	5.83	1.31	1.72	0.73	1.25	5
	B	140.49	0.14	0.17	0.11	0.14	995
	Ba	1.46	< 0.06	< 0.06	< 0.06	< 0.06	> 24
	Ca	9.08	< 0.06	0.07	< 0.06	< 0.06	> 151
	Cd	21.27	1.43	1.79	0.66	1.29	16
	Cr	4.75	0.62	0.61	0.30	0.51	9
	Cs	16.61	5.34	5.07	2.92	4.44	4
	Cu	0.97	< 0.06	< 0.06	< 0.06	< 0.06	> 16
	Fe	312.81	0.47	0.66	0.49	0.54	581
	I	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	NC
	K	11.55	2.00	1.99	1.18	1.72	7
	Li	71.23	4.83	4.67	2.97	4.16	17
	Mg	36.84	0.12	0.17	0.11	0.14	273
	Mn	32.71	0.09	0.11	0.15	0.12	279
	Na	223.13	22.87	24.17	14.85	20.63	11
	Ni	18.81	0.07	0.09	< 0.06	< 0.07	> 269
	P	6.21	< 0.06	< 0.06	< 0.06	< 0.06	> 103
	Pb	7.23	0.42	0.32	0.26	0.33	22
	S	102.47	31.36	31.79	20.75	27.97	4
	Sb	6.11	0.46	0.55	0.22	0.41	15
	Se	485.26	25.33	17.94	18.40	20.56	24
	Si	459.30	0.54	0.97	0.83	0.78	590
	Sr	70.73	0.18	0.15	0.16	0.16	429
	Te	81.88	5.44	5.79	2.71	4.64	18
	Ti	1.17	< 0.06	< 0.06	< 0.06	< 0.06	> 19
	Zn	67.92	0.44	0.49	0.31	0.41	165
	Zr	37.59	< 0.06	< 0.06	< 0.06	< 0.06	> 627
Gas	B	333.09	8.42	7.50	9.57	8.50	39
	Cl	73.78	1.90	1.02	1.98	1.63	45
	F	131.53	0.54	0.83	0.53	0.63	209
	I	508.80	8.26	3.76	4.76	5.59	91
	S	164.92	13.30	32.96	19.11	21.79	8
	Se	49.64	67.03	17.61	74.09	52.91	1

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

Table 6.11. WESP Emission Rates for DM 1200 AZ101 Test 3.

		Average Feed Flux (mg/min)	Average Melter Emissions Flux (mg/min)	Average SBS Emissions Flux (mg/min)	WESP Emissions Flux (mg/min)	DF Across WESP	DF Across SBS, WESP	Cumulative DF Across Melter, SBS, WESP
Particles	Total ^s	1036333	4520	172.8	1.06	163	4264	977673
	Al	40600	169.48	0.37	< 0.06	> 5.7	> 2825	> 676665
	As	314	5.83	1.25	< 0.06	> 19.6	> 97	> 5232
	B	32162	140.49	0.14	< 0.06	> 2.2	> 2342	> 536034
	Ba	371	1.46	< 0.06	< 0.06	NC	> 24	> 6188
	Ca	1852	9.08	0.02	< 0.06	> 0.4	> 151	> 30865
	Cd	3433	21.27	1.29	< 0.06	> 20.2	> 354	> 57224
	Cr	284	4.75	0.51	< 0.06	> 8.0	> 79	> 4727
	Cs	782	16.61	4.44	< 0.06	> 69.4	> 277	> 13034
	Cu	248	0.97	< 0.06	< 0.06	NC	> 16	> 4139
	Fe	75292	312.81	0.54	< 0.06	> 8.4	> 5214	> 1254859
	I	1036	< 0.06	< 0.06	< 0.06	NC	NC	> 17272
	K	1463	11.55	1.72	< 0.06	> 26.9	> 193	> 24375
	Li	28884	71.23	4.16	< 0.06	> 65.0	> 1187	> 481402
	Mg [#]	7200	36.84	0.14	< 0.06	> 2.1	> 614	> 120000
	Mn	24319	32.71	0.12	< 0.06	> 1.8	> 545	> 405311
	Na	50670	223.13	20.63	0.06	319	3447	782786
	Ni	4398	18.81	0.05	< 0.06	> 0.8	> 314	> 73292
	P	588	6.21	< 0.06	< 0.06	NC	> 103	> 9804
	Pb	1443	7.23	0.33	< 0.06	> 5.2	> 121	> 24051
	S	1038	102.47	27.97	< 0.06	> 437.0	> 1708	> 17305
	Sb	1638	6.11	0.41	< 0.06	> 6.4	> 102	> 27305
	Se	1106	485.26	20.56	< 0.06	> 321.2	> 8088	> 18437
	Si	220570	459.30	0.78	< 0.06	> 12.2	> 7655	> 3676168
	Sr	20330	70.73	0.16	< 0.06	> 2.6	> 1179	> 338841
	Te	1160	81.88	4.64	< 0.06	> 72.6	> 1365	> 19333
	Ti	373	1.17	< 0.06	< 0.06	NC	> 19	> 6213
	Zn	16652	67.92	0.41	< 0.06	> 6.4	> 1132	> 277527
	Zr	27312	37.59	< 0.06	< 0.06	NC	> 627	> 455205
Gas	B	32162	333.09	8.50	0.53	16	626	60443
	Cl	104	73.78	1.63	< 0.07	> 23.3	> 1230	> 1727
	F	415	131.53	0.63	0.44	1	299	941
	I	1036	508.80	5.59	6.25	1	81	166
	S	1038	164.92	21.79	2.85	8	58	364
	Se	1106	49.64	52.91	0.15	356	334	7436

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

- The analyzed MgO concentration of 1.15 wt% instead of the target value of 0.06 wt% was used to calculate the feed flux

Table 6.12. Melter Emission Rates for DM 1200 AZ101 Test 4.

		Average Feed Flux (mg/min)	Run 1 (mg/min)	Run 2 (mg/min)	Run 3 (mg/min)	Average (mg/min)	DF Across Melter
Particles	Total ^s	536667	1770	1664	1810	1748	307.4
	Al	21025	74.14	78.56	76.40	76.37	275
	As	163	1.77	1.39	1.52	1.56	104
	B	16655	49.19	52.86	45.75	49.26	338
	Ba	192	0.64	0.60	0.67	0.64	300
	Ca	959	3.55	3.58	3.90	3.68	261
	Cd	1778	9.34	8.38	7.85	8.53	209
	Cr	147	2.07	2.17	2.05	2.10	70
	Cs	405	8.41	7.87	8.68	8.32	49
	Cu	129	0.50	0.47	0.49	0.49	263
	Fe	38990	118.41	116.88	124.22	119.84	325
	I	537	< 0.06	< 0.06	< 0.06	< 0.06	> 8944
	K	757	4.40	6.16	5.82	5.46	139
	Li	14958	32.70	32.37	33.49	32.85	455
	Mg [#]	3725	15.13	15.76	16.15	15.68	238
	Mn	12593	16.80	11.41	14.09	14.10	893
	Na	26240	89.75	92.95	96.65	93.11	282
	Ni	2277	7.38	7.73	7.51	7.54	302
	P	305	1.64	1.23	1.77	1.54	197
	Pb	747	3.36	2.94	2.88	3.06	244
	S	538	33.46	35.20	34.35	34.34	16
	Sb	848	1.99	1.67	2.22	1.96	433
	Se	573	308.93	265.95	259.47	278.12	2
	Si	114223	173.00	153.20	189.47	171.89	664
	Sr	10528	30.26	30.62	33.01	31.30	336
	Te	601	44.75	44.10	37.37	42.07	14
	Ti	193	1.33	1.73	0.98	1.35	143
	Zn	8623	30.23	29.80	30.74	30.26	285
	Zr	14144	14.09	9.38	14.49	12.65	1118
Gas	B	16655	136.38	152.31	151.04	146.58	114
	Cl	54	72.91	68.99	58.23	66.71	1
	F	215	63.91	63.67	57.24	61.61	3
	I	537	500.39	407.69	437.61	448.56	1
	S	538	100.72	93.55	89.98	94.75	6
	Se	573	37.28	41.17	33.22	37.22	15

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs[#] - The analyzed MgO concentration of 1.15 wt% instead of the target value of 0.06 wt% was used to calculate the feed flux

Table 6.13. SBS Emission Rates for DM 1200 AZ101 Test 4.

		Average Melter Emissions Flux (mg/min)	Run 1 (mg/min)	Run 2 (mg/min)	Run 3 (mg/min)	Average (mg/min)	DF Across SBS
Particles	Total ^s	1748	124.2	128.6	103.9	118.9	14.7
	Al	76.37	0.19	0.34	0.10	0.21	361
	As	1.56	0.48	0.42	0.27	0.39	4
	B	49.26	0.37	0.38	0.14	0.29	167
	Ba	0.64	< 0.06	< 0.06	< 0.06	< 0.06	> 11
	Ca	3.68	0.14	0.21	0.13	0.16	23
	Cd	8.53	1.12	1.13	0.77	1.01	8
	Cr	2.10	0.46	0.45	0.35	0.42	5
	Cs	8.32	2.28	2.45	1.95	2.23	4
	Cu	0.49	< 0.06	< 0.06	< 0.06	< 0.06	> 8
	Fe	119.84	0.17	0.24	0.18	0.20	610
	I	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	NC
	K	5.46	0.91	1.38	0.93	1.07	5
	Li	32.85	2.27	2.65	2.09	2.33	14
	Mg	15.68	0.08	0.12	< 0.06	< 0.09	> 174
	Mn	14.10	< 0.06	0.21	< 0.06	0.07	200
	Na	93.11	9.64	11.28	8.80	9.90	-9
	Ni	7.54	< 0.06	0.08	0.07	0.05	126
	P	1.54	< 0.06	0.08	< 0.06	< 0.07	> 22
	Pb	3.06	0.25	0.25	0.20	0.23	13
	S	34.34	10.88	11.97	9.70	10.85	3
	Sb	1.96	0.23	0.29	0.17	0.23	8
	Se	278.12	20.46	21.87	15.21	19.18	14
	Si	171.89	0.48	0.53	0.30	0.43	396
	Sr	31.30	0.09	0.27	< 0.06	< 0.15	> 209
	Te	42.07	9.31	9.04	6.46	8.27	5
	Ti	1.35	0.38	0.11	0.08	0.19	7
	Zn	30.26	0.28	0.52	0.15	0.32	96
	Zr	12.65	< 0.06	< 0.06	< 0.06	< 0.06	> 211
Gas	B	146.58	4.17	5.20	4.77	4.72	31
	Cl	66.71	0.93	1.28	0.88	1.03	65
	F	61.61	0.41	0.54	0.58	0.51	121
	I	448.56	77.00	352.47	203.04	210.84	2
	S	94.75	< 0.07	< 0.07	< 0.07	< 0.07	> 1579
	Se	37.22	17.27	24.13	26.93	22.78	2

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

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Vitreous State Laboratory

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Table 6.14. WESP Emission Rates for DM 1200 AZ101 Test 4.

		Average Feed Flux (mg/min)	Average Melter Emissions Flux (mg/min)	Average SBS Emissions Flux (mg/min)	WESP Emissions Flux (mg/min)	DF Across WESP	DF Across SBS, WESP	Cumulative DF Across Melter, SBS, WESP
Particles	Total ^s	536667	1748	118.9	0.66	180	2648	813132
	Al	21025	76.37	0.21	< 0.06	> 3.3	> 1273	> 350412
	As	163	1.56	0.39	< 0.06	> 6.1	> 26	> 2710
	B	16655	49.26	0.29	< 0.06	> 4.6	> 821	> 277586
	Ba	192	0.64	< 0.06	< 0.06	NC	> 11	> 3204
	Ca	959	3.68	0.16	< 0.06	> 2.5	> 61	> 15984
	Cd	1778	8.53	1.01	< 0.06	> 15.7	> 142	> 29634
	Cr	147	2.10	0.42	< 0.06	> 6.6	> 35	> 2448
	Cs	405	8.32	2.23	< 0.06	> 34.8	> 139	> 6750
	Cu	129	0.49	< 0.06	< 0.06	NC	> 8	> 2144
	Fe	38990	119.84	0.20	< 0.06	> 3.1	> 1997	> 649831
	I	537	< 0.06	< 0.06	< 0.06	NC	NC	> 8944
	K	757	5.46	1.07	< 0.06	> 16.7	> 91	> 12623
	Li	14958	32.85	2.33	< 0.06	> 36.5	> 548	> 249295
	Mg#	3725	15.68	0.07	< 0.06	> 1.0	> 261	> 62083
	Mn	12593	14.10	0.07	< 0.06	> 1.1	> 235	> 209891
	Na	26240	93.11	9.90	< 0.06	> 154.7	> 1552	> 437326
	Ni	2277	7.54	0.05	< 0.06	> 0.8	> 126	> 37955
	P	305	1.54	< 0.06	< 0.06	NC	> 26	> 5077
	Pb	747	3.06	0.23	< 0.06	> 3.7	> 51	> 12455
	S	538	34.34	10.85	< 0.06	> 169.5	> 572	> 8961
	Sb	848	1.96	0.23	< 0.06	> 3.6	> 33	> 14140
	Se	573	278.12	19.18	< 0.06	> 299.7	> 4635	> 9547
	Si	114223	171.89	0.43	< 0.06	> 6.8	> 2865	> 1903709
	Sr	10528	31.30	0.12	< 0.06	> 1.9	> 522	> 175469
	Te	601	42.07	8.27	< 0.06	> 129.2	> 701	> 10012
	Ti	193	1.35	0.19	< 0.06	> 3.0	> 22	> 3217
	Zn	8623	30.26	0.32	< 0.06	> 4.9	> 504	> 143718
	Zr	14144	12.65	< 0.06	< 0.06	NC	> 211	> 235729
Gas	B	16655	146.58	4.72	0.33	14	443	50392
	Cl	54	66.71	1.03	0.25	4	262	210
	F	215	61.61	0.51	0.15	3	423	1472
	I	537	448.56	210.84	162.13	1	3	3
	S	538	94.75	< 0.07	< 0.07	NC	> 1579	> 8961
	Se	573	37.22	22.78	< 0.07	> 325.4	> 620	> 9547

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

- The analyzed MgO concentration of 1.15 wt% instead of the target value of 0.06 wt% was used to calculate the feed flux

Table 6.15. Melter Emission Rates for DM 1200 AZ101 Test 5.

		Average Feed Flux (mg/min)	Run 1 (mg/min)	Run 2 (mg/min)	Run 3 (mg/min)	Average (mg/min)	DF Across Melter
Particles	Total ^s	275333	730	958	1161	949.7	290
	Al	10787	13.43	10.66	21.25	15.11	714
	As	83	0.38	0.10	0.65	0.38	221
	B	8545	13.71	34.64	30.22	26.19	326
	Ba	99	0.14	0.19	0.25	0.19	514
	Ca	492	1.11	1.19	1.81	1.37	359
	Cd	912	1.44	2.78	2.68	2.30	397
	Cr	75	0.23	0.25	0.30	0.26	289
	Cs	208	0.86	2.12	1.40	1.46	142
	Cu	66	0.08	0.22	0.24	0.18	361
	Fe	20003	25.10	20.16	39.17	28.15	711
	I	275	< 0.06	< 0.06	< 0.06	< 0.06	> 4589
	K	389	1.36	4.21	2.81	2.80	139
	Li	7674	12.77	19.14	22.69	18.20	422
	Mg#	1920	3.26	3.10	5.56	3.97	105
	Mn	6461	2.94	3.11	4.23	3.43	1886
	Na	13462	29.45	66.48	57.85	51.26	263
	Ni	1168	1.48	1.22	2.39	1.70	689
	P	156	0.52	0.28	1.12	0.64	245
	Pb	383	0.42	0.58	0.81	0.60	634
	S	276	1.06	1.79	1.63	1.49	185
	Sb	435	0.14	0.09	0.11	0.11	3892
	Se	294	32.36	40.78	43.14	38.76	8
	Si	58601	33.56	32.16	49.43	38.38	1527
	Sr	5401	5.87	6.76	11.07	7.90	684
	Te	308	0.97	1.23	1.28	1.16	266
	Ti	99	0.21	0.24	0.41	0.29	346
	Zn	4424	4.74	4.22	7.62	5.53	801
	Zr	7256	6.62	5.32	9.98	7.30	993
Gas	B	8545	47.13	73.35	75.57	65.35	131
	Cl	28	< 0.07	< 0.07	< 0.07	< 0.07	> 459
	F	110	140.87	142.14	135.78	139.60	1
	I	275	7.52	16.81	14.52	12.95	21
	S	276	7.63	11.55	2.74	7.31	38
	Se	294	0.26	0.33	0.98	0.52	562

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

- The analyzed MgO concentration of 1.15 wt% instead of the target value of 0.06 wt% was used to calculate the feed flux

Table 6.16. SBS Emission Rates for DM 1200 AZ101 Test 5.

		Average Melter Emissions Flux (mg/min)	Run 1 (mg/min)	Run 2 (mg/min)	Run 3 (mg/min)	Average (mg/min)	DF Across SBS
Particles	Total ^s	949.7	46.8	102	59.9	69.6	14
	Al	15.11	0.08	0.19	0.21	0.16	95
	As	0.38	0.08	0.22	0.17	0.16	2
	B	26.19	0.22	0.15	0.13	0.17	156
	Ba	0.19	< 0.06	< 0.06	< 0.06	< 0.06	> 3
	Ca	1.37	0.16	0.35	0.31	0.27	5
	Cd	2.30	0.33	0.31	0.24	0.29	8
	Cr	0.26	< 0.06	< 0.06	< 0.06	< 0.06	> 4
	Cs	1.46	0.25	0.26	0.22	0.24	6
	Cu	0.18	< 0.06	< 0.06	< 0.06	< 0.06	> 3
	Fe	28.15	0.35	0.15	0.21	0.24	118
	I	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	NC
	K	2.80	0.18	0.33	0.25	0.25	11
	Li	18.20	0.55	0.94	0.76	0.75	24
	Mg	3.97	< 0.06	0.10	0.10	0.07	61
	Mn	3.43	< 0.06	< 0.06	< 0.06	< 0.06	> 57
	Na	51.26	2.32	4.81	3.54	3.56	14
	Ni	1.70	< 0.06	< 0.06	< 0.06	< 0.06	> 28
	P	0.64	< 0.06	0.07	0.13	< 0.09	> 7
	Pb	0.60	0.08	0.09	0.09	0.09	7
	S	1.49	0.77	0.34	0.52	0.54	3
	Sb	0.11	< 0.06	< 0.06	< 0.06	< 0.06	> 2
	Se	38.76	5.65	4.10	4.64	4.80	8
	Si	38.38	0.46	1.79	1.07	1.10	35
	Sr	7.90	< 0.06	0.07	0.07	0.05	132
	Te	1.16	0.34	0.36	0.41	0.37	3
	Ti	0.29	< 0.06	< 0.06	< 0.06	< 0.06	> 5
	Zn	5.53	< 0.06	0.08	0.09	0.06	92
	Zr	7.30	< 0.06	< 0.06	< 0.06	< 0.06	> 122
Gas	B	65.35	5.85	9.01	6.11	6.99	9
	Cl	< 0.06	< 0.07	< 0.07	< 0.07	< 0.07	> 0
	F	139.60	18.24	31.46	23.67	24.46	6
	I	12.95	4.89	13.13	8.89	8.97	1
	S	7.31	3.11	10.32	2.00	5.14	1
	Se	0.52	1.17	0.41	0.24	0.61	1

NC – Not calculated

^s - From gravimetric analysis of filters and rinse dry-downs

Table 6.17. WESP Emission Rates for DM 1200 AZ101 Test 5.

		Average Feed Flux (mg/min)	Average Melter Emissions Flux (mg/min)	Average SBS Emissions Flux (mg/min)	WESP Emission s Flux (mg/min)	DF Across WESP	DF Across SBS, WESP	Cumulative DF Across Melter, SBS, WESP
Particles	Total ^s	275333	949.7	69.6	0.8	86	1187	344166
	Al	10787	15.11	0.16	< 0.06	> 2.5	> 252	> 179776
	As	83	0.38	0.16	< 0.06	> 2.5	> 6	> 1390
	B	8545	26.19	0.17	< 0.06	> 2.6	> 436	> 142414
	Ba	99	0.19	< 0.06	< 0.06	NC	> 3	> 1644
	Ca	492	1.37	0.27	< 0.06	> 4.3	> 23	> 8200
	Cd	912	2.30	0.29	< 0.06	> 4.6	> 38	> 15203
	Cr	75	0.26	< 0.06	< 0.06	NC	> 4	> 1256
	Cs	208	1.46	0.24	< 0.06	> 3.8	> 24	> 3463
	Cu	66	0.18	< 0.06	< 0.06	NC	> 3	> 1100
	Fe	20003	28.15	0.24	< 0.06	> 3.7	> 469	> 333391
	I	275	< 0.06	< 0.06	< 0.06	NC	NC	> 4589
	K	389	2.80	0.25	< 0.06	> 3.9	> 47	> 6476
	Li	7674	18.20	0.75	< 0.06	> 11.7	> 303	> 127899
	Mg [#]	1920	3.97	0.07	< 0.06	> 1.0	> 66	> 32000
	Mn	6461	3.43	< 0.06	< 0.06	NC	> 57	> 107683
	Na	13462	51.26	3.56	< 0.06	> 55.6	> 854	> 224367
	Ni	1168	1.70	< 0.06	< 0.06	NC	> 28	> 19472
	P	156	0.64	0.07	< 0.06	> 1.0	> 11	> 2605
	Pb	383	0.60	0.09	< 0.06	> 1.3	> 10	> 6390
	S	276	1.49	0.54	< 0.06	> 8.5	> 25	> 4597
	Sb	435	0.11	< 0.06	< 0.06	NC	> 2	> 7254
	Se	294	38.76	4.80	< 0.06	> 75.0	> 646	> 4898
	Si	58601	38.38	1.10	< 0.06	> 17.3	> 640	> 976685
	Sr	5401	7.90	0.05	< 0.06	> 0.7	> 132	> 90023
	Te	308	1.16	0.37	< 0.06	> 5.7	> 19	> 5136
	Ti	99	0.29	< 0.06	< 0.06	NC	> 5	> 1651
	Zn	4424	5.53	0.06	< 0.06	> 0.9	> 92	> 73733
	Zr	7256	7.30	< 0.06	< 0.06	NC	> 122	> 120939
Gas	B	8545	65.35	6.99	0.44	16	150	19629
	Cl	28	< 0.06	< 0.07	< 0.07	NC	NC	> 459
	F	110	139.60	24.46	31.93	1	4	3
	I	275	12.95	8.97	2.96	3	4	93
	S	276	7.31	5.14	1.15	4	6	240
	Se	294	0.52	0.61	0.11	6	5	2776

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

[#] - The analyzed MgO concentration of 1.15 wt% instead of the target value of 0.06 wt% was used to calculate the feed flux

Table 6.18. Melter Emission Rates for DM 1200 AZ101 Test 6.

		Average Feed Flux (mg/min)	Run 1 (mg/min)	Run 2 (mg/min)	Run 3 (mg/min)	Melter Average (mg/min)	DF Across Melter
Particles	Total ^s	160333	228.2	229.0	162.0	206.4	797
	Al	6281	7.32	3.83	2.66	4.60	1364
	As	49	0.19	1.04	0.47	0.57	85
	B	4976	1.87	1.32	1.24	1.48	3367
	Ba	57	< 0.06	< 0.06	< 0.06	< 0.06	> 957
	Ca	287	4.51	0.92	0.51	1.98	145
	Cd	531	0.74	3.80	1.38	1.97	269
	Cr	44	0.16	0.17	0.11	0.15	302
	Cs	121	0.26	0.68	0.35	0.43	282
	Cu	38	0.09	< 0.06	< 0.06	< 0.07	> 543
	Fe	11649	7.28	5.74	6.45	6.49	1795
	I	160	< 0.06	< 0.06	< 0.06	< 0.06	> 2672
	K	226	0.32	0.45	0.30	0.36	632
	Li	4469	1.41	1.63	1.22	1.42	3149
	Mg [#]	1114	1.05	0.48	0.45	0.66	1687
	Mn	3762	0.43	0.35	0.29	0.36	10536
	Na	7839	3.47	4.48	3.27	3.74	2096
	Ni	680	0.49	0.29	0.30	0.36	1884
	P	91	0.10	< 0.06	0.12	< 0.08	> 1240
	Pb	223	0.18	0.37	0.20	0.25	896
	S	161	0.95	1.45	1.12	1.17	137
	Sb	253	< 0.06	0.25	0.08	< 0.13	> 1946
	Se	171	20.39	37.55	27.24	28.39	6
	Si	34125	20.07	9.34	7.94	12.45	2742
	Sr	3145	1.24	0.95	0.93	1.04	3026
	Te	179	2.25	14.10	5.22	7.19	25
	Ti	58	1.53	0.19	0.09	0.60	96
	Zn	2576	0.89	0.74	0.65	0.76	3397
	Zr	4226	0.68	0.57	0.44	0.56	7501
Gas	B	4976	6.24	23.09	13.74	14.36	347
	Cl	16	3.99	12.35	8.47	8.27	2
	F	64	4.99	34.68	22.52	20.73	3
	I	160	30.12	22.67	30.80	27.86	6
	S	161	9.05	32.92	16.60	19.52	8
	Se	171	9.74	6.50	14.01	10.08	17

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs[#] - The analyzed MgO concentration of 1.15 wt% instead of the target value of 0.06 wt% was used to calculate the feed flux

Table 6.19. SBS Emission Rates for DM 1200 AZ101Test 6.

		Average Melter Emissions Flux (mg/min)	Run 1 (mg/min)	Run 2 (mg/min)	Run 3 (mg/min)	Average (mg/min)	DF Across SBS
Particles	Total ^s	206.4	29.2	77.0	25.3	43.8	6
	Al	4.60	< 0.06	0.15	< 0.06	< 0.09	> 51
	As	0.57	0.20	0.71	0.12	0.34	2
	B	1.48	0.19	0.19	< 0.06	< 0.15	> 10
	Ba	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	NC
	Ca	1.98	0.09	0.25	0.14	0.16	12
	Cd	1.97	0.70	2.54	0.29	1.18	2
	Cr	0.15	0.08	0.09	0.10	0.09	2
	Cs	0.43	0.20	0.43	0.11	0.25	2
	Cu	0.03	< 0.06	< 0.06	< 0.06	< 0.06	> 1
	Fe	6.49	0.07	0.08	< 0.06	< 0.07	> 108
	I	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	NC
	K	0.36	0.11	0.19	0.09	0.13	3
	Li	1.42	0.25	0.48	0.20	0.31	5
	Mg	0.66	< 0.06	< 0.06	< 0.06	< 0.06	> 11
	Mn	0.36	< 0.06	< 0.06	< 0.06	< 0.06	> 6
	Na	3.74	0.91	1.65	0.71	1.09	3
	Ni	0.36	< 0.06	< 0.06	< 0.06	< 0.06	> 6
	P	0.07	0.23	< 0.06	0.42	0.22	NC
	Pb	0.25	0.10	0.24	0.08	0.14	2
	S	1.17	0.57	0.43	0.22	0.41	3
	Sb	0.11	< 0.06	0.21	< 0.06	< 0.11	> 1
	Se	28.39	5.85	11.58	3.16	6.86	4
	Si	12.45	0.51	1.11	0.25	0.62	20
	Sr	1.04	< 0.06	< 0.06	< 0.06	< 0.06	> 17
	Te	7.19	2.51	9.07	1.50	4.36	2
	Ti	0.60	< 0.06	< 0.06	< 0.06	< 0.06	> 10
	Zn	0.76	< 0.06	< 0.06	< 0.06	< 0.06	> 13
	Zr	0.56	< 0.06	< 0.06	< 0.06	< 0.06	> 9
Gas	B	14.36	1.23	2.23	0.62	1.36	11
	Cl	8.27	1.35	2.71	0.23	1.43	6
	F	20.73	0.98	1.96	0.92	1.29	16
	I	27.86	< 0.07	< 0.07	< 0.07	< 0.07	> 464
	S	19.52	< 0.07	< 0.07	< 0.07	< 0.07	> 325
	Se	10.08	8.35	6.34	1.42	5.37	2

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

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Table 6.20. WESP Emission Rates for DM 1200 AZ101 Test 6.

		Average Feed Flux (mg/min)	Average Melter Emissions Flux (mg/min)	Average SBS Emissions Flux (mg/min)	WESP Emissions Flux (mg/min)	DF Across WESP	DF Across SBS, WESP	Cumulative DF Across Melter, SBS, WESP
Particles	Total ^s	160333	206.4	43.8	0.8	55	258	208225
	Al	6281	4.60	0.05	< 0.06	> 0.8	> 77	> 104688
	As	49	0.57	0.34	< 0.06	> 5.4	> 9	> 810
	B	4976	1.48	0.13	< 0.06	> 2.0	> 25	> 82931
	Ba	57	< 0.06	< 0.06	< 0.06	NC	NC	> 957
	Ca	287	1.98	0.16	< 0.06	> 2.5	> 33	> 4775
	Cd	531	1.97	1.18	< 0.06	> 18.4	> 33	> 8853
	Cr	44	0.15	0.09	< 0.06	> 1.4	> 2	> 731
	Cs	121	0.43	0.25	< 0.06	> 3.8	> 7	> 2017
	Cu	38	0.03	< 0.06	< 0.06	NC	> 1	> 640
	Fe	11649	6.49	0.05	< 0.06	> 0.8	> 108	> 194142
	I	160	< 0.06	< 0.06	< 0.06	NC	NC	> 2672
	K	226	0.36	0.13	< 0.06	> 2.1	> 6	> 3771
	Li	4469	1.42	0.31	< 0.06	> 4.8	> 24	> 74479
	Mg [#]	1114	0.66	< 0.06	< 0.06	NC	> 11	> 18560
	Mn	3762	0.36	< 0.06	< 0.06	NC	> 6	> 62707
	Na	7839	3.74	1.09	< 0.06	> 17.0	> 62	> 130654
	Ni	680	0.36	< 0.06	< 0.06	NC	> 6	> 11339
	P	91	0.07	0.22	< 0.06	> 3.4	> 1	> 1517
	Pb	223	0.25	0.14	< 0.06	> 2.2	> 4	> 3721
	S	161	1.17	0.41	< 0.06	> 6.3	> 20	> 2677
	Sb	253	0.11	0.07	< 0.06	> 1.1	> 2	> 4224
	Se	171	28.39	6.86	< 0.06	> 107.2	> 473	> 2852
	Si	34125	12.45	0.62	< 0.06	> 9.8	> 207	> 568748
	Sr	3145	1.04	< 0.06	< 0.06	NC	> 17	> 52423
	Te	179	7.19	4.36	< 0.06	> 68.1	> 120	> 2991
	Ti	58	0.60	< 0.06	< 0.06	NC	> 10	> 961
	Zn	2576	0.76	< 0.06	< 0.06	NC	> 13	> 42937
	Zr	4226	0.56	< 0.06	< 0.06	NC	> 9	> 70426
Gas	B	4976	14.36	1.36	0.16	8	89	30724
	Cl	16	8.27	1.43	< 0.07	> 20.4	> 138	> 267
	F	64	20.73	1.29	0.67	2	31	96
	I	160	27.86	< 0.07	0.17	NC	167	961
	S	161	19.52	< 0.07	< 0.07	NC	> 325	> 2677
	Se	171	10.08	5.37	< 0.07	> 76.7	> 168	> 2852

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

[#] - The analyzed MgO concentration of 1.15 wt% instead of the target value of 0.06 wt% was used to calculate the feed flux

Table 6.21. Melter Emission Rates for DM 1200 AZ101 Test 7.

		Average Feed Flux (mg/min)	Run 1 (mg/min)	Run 2 (mg/min)	Run 3 (mg/min)	Average (mg/min)	DF Across Melter
Particles	Total ^s	957667	2294	2206	2135	2212	433
	Al	37518	29.00	24.24	22.72	25.32	1482
	As	290	9.99	9.89	12.06	10.65	27
	B	29721	41.58	32.59	18.07	30.75	967
	Ba	343	0.16	0.14	0.14	0.14	2381
	Ca	1711	2.93	3.75	3.40	3.36	509
	Cd	3173	31.68	34.46	39.14	35.09	90
	Cr	262	1.13	1.06	1.04	1.08	244
	Cs	723	9.31	9.54	9.75	9.53	76
	Cu	230	0.29	0.26	0.21	0.25	904
	Fe	69576	62.93	53.39	45.52	53.95	1290
	I	958	< 0.06	< 0.06	< 0.06	< 0.06	> 15961
	K	1352	6.17	6.12	6.21	6.17	219
	Li	26692	20.50	16.83	18.57	18.63	1432
	Mg [#]	6643	2.42	2.65	4.70	3.26	2038
	Mn	22473	3.98	3.55	2.80	3.44	6528
	Na	46824	59.23	51.83	56.70	55.92	837
	Ni	4064	3.45	3.03	2.76	3.08	1319
	P	544	1.58	0.73	0.77	1.02	531
	Pb	1334	4.38	4.38	4.43	4.40	303
	S	959	40.96	47.27	36.94	41.72	23
	Sb	1514	3.23	3.20	3.52	3.31	457
	Se	1022	516.16	547.76	622.23	562.05	2
	Si	203827	75.65	59.88	52.92	62.82	3245
	Sr	18787	8.73	6.40	6.77	7.30	2573
	Te	1072	116.78	119.69	130.30	122.25	9
	Ti	344	0.65	0.61	0.51	0.59	582
	Zn	15388	8.58	7.57	5.81	7.32	2102
	Zr	25239	6.08	4.08	3.69	4.62	5466
Gas	B	29721	262.81	270.37	345.19	292.79	102
	Cl	96	91.67	98.49	93.60	94.59	1
	F	383	219.57	277.70	299.92	265.73	1
	I	958	248.28	288.33	131.03	222.54	4
	S	959	514.07	442.20	487.67	481.31	2
	Se	1022	17.07	39.73	34.27	30.35	34

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

- The analyzed MgO concentration of 1.15 wt% instead of the target value of 0.06 wt% was used to calculate the feed flux

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Table 6.22. SBS Emission Rates for DM 1200 AZ101 Test 7.

		Average Melter Emissions Flux (mg/min)	Run 1 (mg/min)	Run 2 (mg/min)	Run 3 (mg/min)	Average (mg/min)	DF Across SBS
Particles	Total ^s	2212	320	568	496	461.3	5
	Al	25.32	< 0.06	0.08	< 0.06	< 0.07	> 362
	As	10.65	5.42	6.66	6.56	6.21	2
	B	30.75	1.57	1.77	1.18	1.50	20
	Ba	0.14	< 0.06	< 0.06	< 0.06	< 0.06	> 2
	Ca	3.36	0.16	0.30	0.21	0.23	15
	Cd	35.09	18.97	22.67	19.74	20.46	2
	Cr	1.08	0.48	0.59	0.38	0.48	2
	Cs	9.53	4.95	5.93	5.03	5.30	2
	Cu	0.25	0.20	0.10	< 0.06	< 0.12	> 2
	Fe	53.95	0.34	0.41	0.31	0.35	153
	I	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	NC
	K	6.17	2.32	2.95	2.22	2.50	2
	Li	18.63	6.41	8.04	5.99	6.81	3
	Mg	3.26	< 0.06	< 0.06	0.07	< 0.06	> 54
	Mn	3.44	< 0.06	< 0.06	0.13	< 0.08	> 43
	Na	55.92	20.04	23.67	18.67	20.79	3
	Ni	3.08	0.10	0.14	0.07	0.10	30
	P	1.02	0.26	< 0.06	0.08	< 0.13	> 8
	Pb	4.40	2.14	2.63	1.92	2.23	2
	S	41.72	18.31	20.30	17.72	18.77	2
	Sb	3.31	1.63	1.99	1.77	1.80	2
	Se	562.05	149.19	134.27	137.48	140.31	4
	Si	62.82	1.43	1.64	1.54	1.53	41
	Sr	7.30	< 0.06	< 0.06	< 0.06	< 0.06	> 122
	Te	122.25	66.47	78.49	67.29	70.75	2
	Ti	0.59	< 0.06	< 0.06	0.11	0.04	10
	Zn	7.32	0.60	1.08	0.59	0.76	10
	Zr	4.62	< 0.06	< 0.06	< 0.06	< 0.06	> 77
Gas	B	292.79	29.30	29.81	25.80	28.30	10
	Cl	94.59	32.99	28.19	26.35	29.18	3
	F	265.73	43.41	31.72	32.33	35.82	7
	I	222.54	10.61	13.15	4.99	9.58	23
	S	481.31	37.13	31.03	29.51	32.56	15
	Se	30.35	37.90	38.86	37.50	38.09	1

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

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Table 6.23. WESP Emission Rates for DM 1200 AZ101 Test 7.

		Average Feed Flux (mg/min)	Average Melter Emissions Flux (mg/min)	Average SBS Emissions Flux (mg/min)	WESP Emissions Flux (mg/min)	DF Across WESP	DF Across SBS, WESP	Cumulative DF Across Melter, SBS, WESP
Particles	Total ^s	957667	2212	461.3	1.53	302	1446	593987
	Al	37518	25.32	0.03	< 0.06	> 0.4	> 422	> 625300
	As	290	10.65	6.21	< 0.06	> 97.1	> 177	> 4835
	B	29721	30.75	1.50	< 0.06	> 23.5	> 512	> 495345
	Ba	343	0.14	< 0.06	< 0.06	NC	> 2	> 5718
	Ca	1711	3.36	0.23	< 0.06	> 3.5	> 56	> 28522
	Cd	3173	35.09	20.46	< 0.06	> 319.7	> 585	> 52880
	Cr	262	1.08	0.48	< 0.06	> 7.6	> 18	> 4368
	Cs	723	9.53	5.30	< 0.06	> 82.9	> 159	> 12045
	Cu	230	0.25	0.10	< 0.06	> 1.5	> 4	> 3825
	Fe	69576	53.95	0.35	< 0.06	> 5.5	> 899	> 1159605
	I	958	< 0.06	< 0.06	< 0.06	NC	NC	> 15961
	K	1352	6.17	2.50	< 0.06	> 39.0	> 103	> 22525
	Li	26692	18.63	6.81	< 0.06	> 106.4	> 311	> 444860
	Mg#	6643	3.26	0.02	< 0.06	> 0.3	> 54	> 110717
	Mn	22473	3.44	0.04	< 0.06	> 0.7	> 57	> 374544
	Na	46824	55.92	20.79	< 0.06	> 324.9	> 932	> 780395
	Ni	4064	3.08	0.10	< 0.06	> 1.6	> 51	> 67729
	P	544	1.02	0.11	< 0.06	> 1.8	> 17	> 9060
	Pb	1334	4.40	2.23	< 0.06	> 34.9	> 73	> 22225
	S	959	41.72	18.77	< 0.06	> 293.3	> 695	> 15991
	Sb	1514	3.31	1.80	< 0.06	> 28.1	> 55	> 25232
	Se	1022	562.05	140.31	0.10	1367	5478	9962
	Si	203827	62.82	1.53	0.08	19	780	2532065
	Sr	18787	7.30	< 0.06	< 0.06	NC	> 122	> 313120
	Te	1072	122.25	70.75	0.09	814	1406	12330
	Ti	344	0.59	0.04	< 0.06	> 0.6	> 10	> 5741
	Zn	15388	7.32	0.76	< 0.06	> 11.8	> 122	> 256460
	Zr	25239	4.62	< 0.06	< 0.06	NC	> 77	> 420651
Gas	B	29721	292.79	28.30	1.38	21	213	21613
	Cl	96	94.59	29.18	< 0.07	> 416.8	> 1576	> 1596
	F	383	265.73	35.82	1.91	19	139	201
	I	958	222.54	9.58	1.26	8	176	759
	S	959	481.31	32.56	12.53	3	38	77
	Se	1022	30.35	38.09	0.61	62	50	1668

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

- The analyzed MgO concentration of 1.15 wt% instead of the target value of 0.06 wt% was used to calculate the feed flux

Table 6.24. Melter Emission Rates for DM 1200 AZ101 Test 8.

		Average Feed Flux (mg/min)	Run 1 (mg/min)	Run 2 (mg/min)	Run 3 (mg/min)	Average (mg/min)	DF Across Melter
Particles	Total ^s	285167	1354	1066	1453	1291	221
	Al	11172	4.83	7.02	4.88	5.58	2004
	As	86	1.08	1.16	1.99	1.41	61
	B	8850	59.37	46.56	78.05	61.33	144
	Ba	102	0.22	0.21	0.50	0.31	328
	Ca	510	2.01	2.55	1.87	2.14	238
	Cd	945	5.04	4.29	6.59	5.31	178
	Cr	78	0.20	0.17	0.32	0.23	340
	Cs	215	6.12	5.33	7.28	6.24	34
	Cu	68	0.11	0.10	0.14	0.12	581
	Fe	20718	10.88	15.20	11.55	12.54	1652
	I	285	< 0.06	< 0.06	< 0.06	< 0.06	> 4753
	K	402	8.46	6.96	12.92	9.45	43
	Li	7948	23.25	22.81	32.84	26.30	302
	Mg [#]	1978	2.44	3.02	2.79	2.75	719
	Mn	6692	1.47	1.65	1.46	1.53	4384
	Na	13943	135.21	103.26	180.51	139.66	100
	Ni	1210	0.73	0.77	0.73	0.74	1628
	P	162	0.35	0.25	1.43	0.68	239
	Pb	397	1.11	0.80	1.39	1.10	361
	S	286	2.87	3.56	4.53	3.65	78
	Sb	451	0.09	0.12	2.68	0.96	468
	Se	304	28.47	28.15	31.22	29.28	10
	Si	60694	13.96	24.80	1055.78	364.85	166
	Sr	5594	5.37	6.50	6.86	6.25	896
	Te	319	2.86	2.01	4.20	3.02	106
	Ti	103	0.14	0.36	0.12	0.21	491
	Zn	4582	2.57	3.19	2.93	2.90	1582
	Zr	7515	2.29	2.90	2.25	2.48	3034
Gas	B	8850	53.84	60.53	51.32	55.23	160
	Cl	29	< 0.07	< 0.07	< 0.07	< 0.07	> 475
	F	114	< 0.07	< 0.07	< 0.07	< 0.07	> 1901
	I	285	12.97	17.97	14.64	15.19	19
	S	286	19.40	12.97	18.90	17.09	17
	Se	304	1.23	0.25	0.29	0.59	513

NC – Not calculated

^s - From gravimetric analysis of filters and rinse dry-downs

- The analyzed MgO concentration of 1.15 wt% instead of the target value of 0.06 wt% was used to calculate the feed flux

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Table 6.25. SBS Emission Rates for DM 1200 AZ101 Test 8.

		Average Melter Flux (mg/min)	Run 1 (mg/min)	Run 2 (mg/min)	Run 3 (mg/min)	Average (mg/min)	DF Across SBS
Particles	Total ^s	1291	218.8	182.6	213.3	205	6
	Al	5.58	0.58	< 0.06	0.33	0.30	18
	As	1.41	0.31	0.19	0.76	0.42	3
	B	61.33	0.32	1.98	2.87	1.72	36
	Ba	0.31	< 0.06	< 0.06	< 0.06	< 0.06	> 5
	Ca	2.14	0.34	0.21	0.64	0.40	5
	Cd	5.31	1.82	1.42	1.46	1.56	3
	Cr	0.23	0.07	0.06	< 0.06	0.04	4
	Cs	6.24	1.97	1.30	1.38	1.55	4
	Cu	0.12	< 0.06	< 0.06	< 0.06	< 0.06	> 2
	Fe	12.54	0.36	0.07	0.30	0.24	52
	I	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	NC
	K	9.45	2.11	1.58	1.78	1.82	5
	Li	26.30	4.01	3.08	3.35	3.48	8
	Mg	2.75	0.20	0.13	0.20	0.18	16
	Mn	1.53	< 0.06	< 0.06	0.12	< 0.08	> 19
	Na	139.66	25.31	22.79	23.40	23.83	6
	Ni	0.74	0.08	< 0.06	< 0.06	< 0.07	> 11
	P	0.68	< 0.06	0.13	< 0.06	< 0.08	> 9
	Pb	1.10	0.28	0.18	0.15	0.20	5
	S	3.65	0.43	2.62	0.28	1.11	3
	Sb	0.96	< 0.06	0.07	< 0.06	< 0.06	> 16
	Se	29.28	5.16	5.80	5.74	5.57	5
	Si	364.85	1.62	0.73	1.69	1.35	271
	Sr	6.25	0.37	0.24	0.26	0.29	22
	Te	3.02	1.29	0.89	0.86	1.01	3
	Ti	0.21	< 0.06	< 0.06	< 0.06	< 0.06	> 3
	Zn	2.90	0.26	0.14	0.26	0.22	13
	Zr	2.48	< 0.06	< 0.06	< 0.06	< 0.06	> 41
Gas	B	55.23	19.43	17.02	13.89	16.78	3
	Cl	< 0.06	< 0.07	< 0.07	< 0.07	< 0.06	NC
	F	< 0.06	< 0.07	< 0.07	< 0.07	< 0.06	NC
	I	15.19	5.88	2.44	2.84	3.72	4
	S	17.09	2.91	1.69	4.13	2.91	6
	Se	0.59	0.21	< 0.07	0.57	0.26	2

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

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Table 6.26. WESP Emission Rates for DM 1200 AZ101 Test 8.

		Average Feed Flux (mg/min)	Average Melter Emissions Flux (mg/min)	Average SBS Emissions Flux (mg/min)	WESP Emissions Flux (mg/min)	DF Across WESP	DF Across SBS, WESP	Cumulative DF Across Melter, SBS, WESP
Particles	Total ^s	285167	1291	205	1.1	186	1174	259243
	Al	11172	5.58	0.30	< 0.06	> 4.7	> 93	> 186197
	As	86	1.41	0.42	< 0.06	> 6.6	> 23	> 1440
	B	8850	61.33	1.72	< 0.06	> 26.9	> 1022	> 147500
	Ba	102	0.31	< 0.06	< 0.06	NC	> 5	> 1703
	Ca	510	2.14	0.40	< 0.06	> 6.2	> 36	> 8493
	Cd	945	5.31	1.56	< 0.06	> 24.5	> 88	> 15746
	Cr	78	0.23	0.04	< 0.06	> 0.7	> 4	> 1301
	Cs	215	6.24	1.55	< 0.06	> 24.2	> 104	> 3587
	Cu	68	0.12	< 0.06	< 0.06	NC	> 2	> 1139
	Fe	20718	12.54	0.24	< 0.06	> 3.8	> 209	> 345298
	I	285	< 0.06	< 0.06	< 0.06	NC	NC	> 4753
	K	402	9.45	1.82	< 0.06	> 28.5	> 157	> 6707
	Li	7948	26.30	3.48	< 0.06	> 54.4	> 438	> 132467
	Mg [#]	1978	2.75	0.18	< 0.06	> 2.8	> 46	> 32967
	Mn	6692	1.53	0.04	< 0.06	> 0.6	> 25	> 111529
	Na	13943	139.66	23.83	< 0.06	> 372.4	> 2328	> 232380
	Ni	1210	0.74	0.03	< 0.06	> 0.4	> 12	> 20168
	P	162	0.68	0.04	< 0.06	> 0.7	> 11	> 2698
	Pb	397	1.10	0.20	< 0.06	> 3.1	> 18	> 6618
	S	286	3.65	1.11	< 0.06	> 17.3	> 61	> 4762
	Sb	451	0.96	0.02	< 0.06	> 0.3	> 16	> 7513
	Se	304	29.28	5.57	< 0.06	> 87.0	> 488	> 5073
	Si	60694	364.85	1.35	0.06	21	5652	940302
	Sr	5594	6.25	0.29	< 0.06	> 4.5	> 104	> 93238
	Te	319	3.02	1.01	< 0.06	> 15.8	> 50	> 5320
	Ti	103	0.21	< 0.06	< 0.06	NC	> 3	> 1710
	Zn	4582	2.90	0.22	< 0.06	> 3.4	> 48	> 76367
	Zr	7515	2.48	< 0.06	< 0.06	NC	> 41	> 125258
Gas	B	8850	55.23	16.78	1.81	9	30	4883
	Cl	29	< 0.06	< 0.06	< 0.07	NC	NC	> 475
	F	114	< 0.06	< 0.06	< 0.07	NC	NC	> 1901
	I	285	15.19	3.72	4.82	1	3	59
	S	286	17.09	2.91	2.37	1	7	120
	Se	304	0.59	0.26	0.18	1	3	1659

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

[#] - The analyzed MgO concentration of 1.15 wt% instead of the target value of 0.06 wt% was used to calculate the feed flux

Table 6.27. Melter Emission Rates for DM 1200 AZ101 Test 9.

		Target Glass Temp	1150°C	1200°C	1200°C		
		Average Feed Flux (mg/min)	Run 1 (mg/min)	Run 2 (mg/min)	Run 3 (mg/min)	Average (mg/min)	DF Across Melter
Particles	Total ^s	281833	354	560	693	536	526
	Al	11041	2.50	2.57	1.69	2.25	4902
	As	85	1.99	6.86	3.46	4.10	21
	B	8747	2.56	6.34	3.55	4.15	2108
	Ba	101	< 0.06	< 0.06	< 0.06	< 0.06	> 1683
	Ca	504	0.46	0.75	0.55	0.59	859
	Cd	934	14.20	48.19	33.96	32.12	29
	Cr	77	0.10	0.07	0.11	0.09	824
	Cs	213	0.87	2.40	1.25	1.50	141
	Cu	68	< 0.06	0.23	0.06	< 0.12	> 567
	Fe	20476	5.03	5.57	4.24	4.95	4140
	I	282	< 0.06	< 0.06	< 0.06	< 0.06	> 4697
	K	398	0.51	1.10	0.65	0.76	526
	Li	7855	1.39	2.71	1.47	1.86	4227
	Mg#	1958	0.62	0.61	0.56	0.60	3264
	Mn	6614	0.25	0.30	0.17	0.24	27815
	Na	13780	6.37	11.12	7.23	8.24	1673
	Ni	1196	0.33	0.34	0.21	0.29	4081
	P	160	0.10	0.37	< 0.06	< 0.18	> 889
	Pb	392	1.19	3.55	2.74	2.49	157
	S	282	2.62	4.55	2.60	3.26	87
	Sb	446	0.27	0.64	0.35	0.42	1060
	Se	301	68.54	194.35	241.37	168.09	2
	Si	59985	8.54	8.57	7.10	8.07	7434
	Sr	5529	1.03	1.24	0.73	1.00	5540
	Te	315	48.46	122.29	119.01	96.59	3
	Ti	101	< 0.06	< 0.06	< 0.06	< 0.06	> 1690
	Zn	4528	1.17	1.50	1.08	1.25	3620
	Zr	7428	0.54	0.48	0.19	0.40	18529
Gas	B	8747	25.62	37.44	33.69	32.25	271
	Cl	28	12.90	16.41	14.42	14.58	2
	F	113	26.46	36.29	27.36	30.04	4
	I	282	60.87	127.18	107.75	98.60	3
	S	282	77.97	148.19	131.49	119.22	
	Se	301	5.40	19.19	5.94	10.18	30

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

- The analyzed MgO concentration of 1.15 wt% instead of the target value of 0.06 wt% was used to calculate the feed flux

Table 6.28. SBS Emission Rates for DM 1200 AZ101 Test 9.

		Target Glass Temp.	1150°C	1200°C	1200°C		
		Average Melter Emissions Flux (mg/min)	Run 1 (mg/min)	Run 2 (mg/min)	Run 3 (mg/min)	Average (mg/min)	DF Across SBS
Particles	Total ^s	536	119	195	268	194	3
	Al	2.25	0.17	0.46	0.28	0.30	7
	As	4.10	1.50	2.71	1.42	1.87	2
	B	4.15	0.11	0.39	0.12	0.21	20
	Ba	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	NC
	Ca	0.59	0.39	0.77	0.27	0.48	1
	Cd	32.12	10.84	18.40	13.15	14.13	2
	Cr	0.09	< 0.06	< 0.06	< 0.06	< 0.06	> 2
	Cs	1.50	0.56	0.90	0.49	0.65	2
	Cu	0.10	< 0.06	0.09	< 0.06	< 0.07	> 1
	Fe	4.95	0.16	0.28	0.20	0.21	23
	I	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	NC
	K	0.76	0.27	0.55	0.25	0.36	2
	Li	1.86	0.34	0.63	0.27	0.41	5
	Mg	0.60	0.09	0.18	0.11	0.13	5
	Mn	0.24	< 0.06	< 0.06	< 0.06	< 0.06	> 4
	Na	8.24	1.90	3.51	1.66	2.36	3
	Ni	0.29	< 0.06	< 0.06	< 0.06	< 0.06	> 5
	P	0.15	< 0.06	0.50	< 0.06	< 0.21	NC
	Pb	2.49	1.12	1.36	1.28	1.25	2
	S	3.26	1.77	1.68	1.41	1.62	2
	Sb	0.42	0.21	0.30	0.14	0.22	2
	Se	168.09	16.05	41.55	87.68	48.43	3
	Si	8.07	1.10	2.14	1.28	1.51	5
	Sr	1.00	< 0.06	< 0.06	< 0.06	< 0.06	> 17
	Te	96.59	29.61	46.96	42.81	39.79	2
	Ti	< 0.06	< 0.06	0.08	< 0.06	< 0.07	NC
	Zn	1.25	0.08	0.13	0.19	0.13	9
	Zr	0.40	< 0.06	< 0.06	< 0.06	< 0.06	> 7
Gas	B	32.25	3.67	5.56	3.76	4.33	7
	Cl	14.58	4.61	5.97	3.62	4.73	3
	F	30.04	3.42	3.66	1.77	2.95	10
	I	98.60	10.60	17.47	17.49	15.19	6
	S	119.22	0.14	< 0.07	< 0.07	< 0.09	> 1325
	Se	10.18	10.28	19.16	2.19	10.54	1

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

Table 6.29 WESP Emission Rates for DM 1200 AZ101 Test 9

		Average Feed Flux (mg/min)	Average Melter Emissions Flux (mg/min)	Average SBS Emissions Flux (mg/min)	WESP Emissions Flux (mg/min)	DF Across WESP	DF Across SBS, WESP	Cumulative DF Across Melter, SBS, WESP
Particles	Total ^s	281833	536	194	1.7	114	315	165784
	Al	11041	2.25	0.30	< 0.06	> 4.7	> 38	> 184021
	As	85	4.10	1.87	< 0.06	> 29.3	> 68	> 1423
	B	8747	4.15	0.21	< 0.06	> 3.2	> 69	> 145776
	Ba	101	< 0.06	< 0.06	< 0.06	NC	NC	> 1683
	Ca	504	0.59	0.48	< 0.06	> 7.5	> 10	> 8394
	Cd	934	32.12	14.13	< 0.06	> 220.8	> 535	> 15562
	Cr	77	0.09	< 0.06	< 0.06	NC	> 2	> 1286
	Cs	213	1.50	0.65	< 0.06	> 10.2	> 25	> 3545
	Cu	68	0.10	0.03	< 0.06	> 0.5	> 2	> 1126
	Fe	20476	4.95	0.21	< 0.06	> 3.3	> 82	> 341262
	I	282	< 0.06	< 0.06	< 0.06	NC	NC	> 4697
	K	398	0.76	0.36	< 0.06	> 5.6	> 13	> 6629
	Li	7855	1.86	0.41	< 0.06	> 6.4	> 31	> 130919
	Mg [#]	1958	0.60	0.13	< 0.06	> 2.0	> 10	> 32633
	Mn	6614	0.24	< 0.06	< 0.06	NC	> 4	> 110225
	Na	13780	8.24	2.36	< 0.06	> 36.8	> 137	> 229664
	Ni	1196	0.29	< 0.06	< 0.06	NC	> 5	> 19932
	P	160	0.15	0.17	< 0.06	> 2.6	> 3	> 2666
	Pb	392	2.49	1.25	< 0.06	> 19.6	> 42	> 6541
	S	282	3.26	1.62	< 0.06	> 25.3	> 54	> 4706
	Sb	446	0.42	0.22	< 0.06	> 3.4	> 7	> 7426
	Se	301	168.09	48.43	< 0.06	> 756.7	> 2801	> 5014
	Si	59985	8.07	1.51	< 0.06	> 23.6	> 134	> 999743
	Sr	5529	1.00	< 0.06	< 0.06	NC	> 17	> 92149
	Te	315	96.59	39.79	0.16	243	590	1928
	Ti	101	< 0.06	0.03	< 0.06	> 0.4	NC	> 1690
	Zn	4528	1.25	0.13	< 0.06	> 2.1	> 21	> 75474
	Zr	7428	0.40	< 0.06	< 0.06	NC	> 7	> 123794
Gas	B	8747	32.25	4.33	0.44	10	74	20011
	Cl	28	14.58	4.73	1.37	3	11	21
	F	113	30.04	2.95	0.24	13	128	479
	I	282	98.60	15.19	1.52	10	65	186
	S	282	119.22	0.05	< 0.07	> 0.7	> 1987	> 4706
	Se	301	10.18	10.54	0.21	50	48	1434

NC – Not Calculated

^s - From gravimetric analysis of filters and rinse dry-downs

- The analyzed MgO concentration of 1.15 wt% instead of the target value of 0.06 wt% was used to calculate the feed flux

Table 6.30. Test 1 Melter Outlet Particle Size Distribution Results.

Date	Impactor Stage	Cutpoint, μm	Net Wt (mg)	Concentration (mg/dscf)	Mass Percent
6/29/01	1	15.43	15.3	32.4012	71.8
	2	11.63	3.92	8.3015	18.4
	3	4.50	1.25	2.6472	5.9
	4	2.26	0.43	0.9106	2.0
	5	1.30	0.05	0.1059	0.2
	6	0.73	0.04	0.0847	0.2
	7	0.43	0	0.0000	0.0
	8	<0.43	0.32	0.6777	1.5
6/29/01	1	15.87	0	0.0000	0.0
	2	11.97	0.56	1.6607	51.4
	3	4.63	0.27	0.8007	24.8
	4	2.33	0.18	0.5338	16.5
	5	1.34	0.08	0.2372	7.3
	6	0.75	0	0.0000	0.0
	7	0.44	0	0.0000	0.0
	8	<0.44	0	0.0000	0.0
6/30/01	1	15.37	0.23	0.1939	7.0
	2	11.59	0.87	0.7333	26.4
	3	4.48	0.71	0.5985	21.5
	4	2.25	0.57	0.4805	17.3
	5	1.30	0.19	0.1602	5.8
	6	0.73	0.13	0.1096	3.9
	7	0.43	0.09	0.0759	2.7
	8	<0.43	0.51	0.4299	15.5

Table 6.31. Test 2 Melter Outlet Particle Size Distribution Results.

Date	Impactor Stage	Cutpoint, μm	Net Wt (mg)	Concentration (mg/dscf)	Mass Percent
7/29/01	1	16.34	4.42	0.8662	57.0
	2	12.33	0.07	0.0137	0.9
	3	4.76	0	0	0
	4	2.40	0.16	0.0313	2.1
	5	1.38	0.14	0.0274	1.8
	6	0.77	0.38	0.0744	4.9
	7	0.46	1.12	0.2194	14.4
	8	<0.46	1.47	0.2879	18.9
7/30/01	1	15.54	6.99	10.6331	66.7
	2	11.72	0.59	0.8975	5.6
	3	4.53	0.32	0.4868	3.1
	4	2.28	0.25	0.3803	2.4
	5	1.31	0.47	0.7150	4.5
	6	0.73	0.57	0.8671	5.4
	7	0.43	0.59	0.8975	5.6
	8	<0.43	0.7	1.0648	6.7
7/31/01	1	15.87	7.13	16.633	66.7
	2	11.97	0.59	1.3764	5.5
	3	4.63	0.24	0.5599	2.2
	4	2.33	0.23	0.5366	2.2
	5	1.34	0.53	1.2364	5.0
	6	0.75	0.735	1.7146	6.9
	7	0.44	0.37	0.8632	3.5
	8	<0.44	0.86	2.0063	8.0

Table 6.32. Test 3 Melter Outlet Particle Size Distribution Results.

Date	Impactor Stage	Cutpoint, μm	Net Wt (mg)	Concentration (mg/dscf)	Mass Percent
8/8/01	1	16.11	70.42	432.1870	73.7
	2	12.15	5.07	31.1160	5.3
	3	4.70	5.13	31.4842	5.4
	4	2.36	4.59	28.1701	4.8
	5	1.36	3.34	20.4985	3.5
	6	0.76	2.09	12.8269	2.2
	7	0.45	2.1	12.8883	2.2
	8	<0.45	2.86	17.5526	3.0
8/9/01	1	14.68	48.9	513.1448	77.4
	2	11.07	3.54	37.1479	5.6
	3	4.28	4.86	50.9997	7.7
	4	2.15	2.48	26.0245	3.9
	5	1.24	1.61	16.8950	2.5
	6	0.70	0.79	8.2901	1.2
	7	0.41	0.26	2.7284	0.4
	8	<0.41	0.77	8.0802	1.2
8/10/01	1	14.48	14.48	118.9699	70.4
	2	10.93	1.13	9.2843	5.5
	3	4.22	0.86	7.0659	4.2
	4	2.12	0.68	5.5870	3.3
	5	1.22	0.5	4.1081	2.4
	6	0.68	0.93	7.6410	4.5
	7	0.41	0.83	6.8194	4.0
	8	<0.41	1.15	9.4486	5.6

Table 6.33. Test 4 Melter Outlet Particle Size Distribution Results.

Date	Impactor Stage	Cutpoint, μm	Net Wt (mg)	Concentration (mg/dscf)	Mass Percent
8/22/01	1	12.5	16.9	2.345	65.3
	2	9.4	2.43	0.336	9.4
	3	3.63	0	0	0
	4	1.82	1.45	0.201	5.6
	5	1.05	0.79	0.109	3.05
	6	0.59	0	0	0
	7	0.36	2.170	0.300	8.35
	8	<0.36	2.160	0.299	8.30
8/23/01	1	14.4	34.3	6.538	65.3
	2	10.9	3.060	0.583	5.82
	3	4.21	3.960	0.754	7.50
	4	2.12	3.210	0.611	6.11
	5	1.22	1.840	0.350	3.50
	6	0.68	1.620	0.309	3.08
	7	0.41	2.110	0.402	4.01
	8	<0.41	2.460	0.468	4.68
8/24/01	1	15.0	25.58	5.978	67.9
	2	11.3	1.940	0.514	5.15
	3	4.37	3.170	0.839	8.41
	4	2.2	2.670	0.707	7.08
	5	1.26	0.410	0.109	1.09
	6	0.7	1.270	0.336	3.37
	7	0.42	1.450	0.384	3.85
	8	<0.42	1.210	0.320	3.21

Table 6.34. Test 5 Melter Outlet Particle Size Distribution.

Date	Impactor Stage	Cutpoint (microns)	Net Mass (mg)	Concentration (mg/dscf)	Mass Percent
09/28/01	1	>14.42	13.3	1.076	56
	2	10.88 – 14.42	0.85	0.069	4
	3	4.20 – 10.88	1.29	0.104	5
	4	2.12 – 4.20	1.74	0.141	7
	5	1.22 – 2.12	2.37	0.192	10
	6	0.68 – 1.22	1.44	0.116	6
	7	0.41 – 0.68	0.79	0.064	3
	8	<0.41	1.83	0.148	8
09/29/01	1	>14.16	48.2	4.368	63
	2	10.68 – 14.16	2.60	0.236	3
	3	4.13 – 10.68	2.90	0.263	4
	4	2.08 – 4.13	5.1	0.462	7
	5	1.19 – 2.08	10.07	0.913	13
	6	0.67 – 1.19	3.82	0.346	5
	7	0.40 – 0.67	2.31	0.209	3
	8	<0.40	2.08	0.189	3
09/30/01	1	>13.91	22.57	3.390	61
	2	10.49 – 13.91	2.96	0.445	8
	3	4.06 – 10.49	1.48	0.222	4
	4	2.04 – 4.06	2.23	0.335	6
	5	1.17 – 2.04	2.85	0.428	8
	6	0.66 – 1.17	2.39	0.359	6
	7	0.39 – 0.66	1.32	0.198	4
	8	<0.39	1.11	0.167	3

Table 6.35. Test 6 Melter Outlet Particle Size Distribution.

Date	Impactor Stage	Cutpoint (microns)	Net Mass (mg)	Concentration (mg/dscf)	Mass Percent
10/15/01	1	>13.58	9.20	0.545	64
	2	10.24 – 13.58	1.32	0.079	9
	3	3.96 – 10.24	1.04	0.062	7
	4	1.99 – 3.96	0.510	0.030	4
	5	1.15 – 1.99	0.310	0.018	2
	6	0.64 – 1.15	0.310	0.021	2
	7	0.38 – 0.64	0.570	0.034	4
	8	<0.38	1.130	0.067	8
10/16/01	1	>16.44	137.94	8.15	83
	2	12.40 – 16.44	11.90	0.699	7
	3	4.79 – 12.40	9.21	0.541	6
	4	2.41 – 4.79	2.58	0.152	2
	5	1.39 – 2.41	0.98	0.058	1
	6	0.77 – 1.39	1.17	0.069	1
	7	0.46 – 0.77	1.08	0.063	1
	8	<0.46	1.96	0.115	1
10/17/01	1	>14.87	3.48	0.277	47
	2	11.22 – 14.87	0.550	0.044	7
	3	4.34 – 11.22	0.480	0.038	7
	4	2.18 – 4.34	0.400	0.032	5
	5	1.25 – 2.18	0.170	0.014	2
	6	0.70 – 1.25	0.0	0.000	0
	7	0.41 – 0.70	1.07	0.085	15
	8	<0.41	1.21	0.096	16

Table 6.36. Test 7 Melter Outlet Particle Size Distribution.

Date	Impactor Stage	Cutpoint (microns)	Net Mass (mg)	Concentration (mg/dscf)	Mass Percent
10/23/01	1	>14.11	25.56	4.79	55
	2	10.64 – 14.11	1.93	0.362	4
	3	4.11 – 10.64	1.15	0.216	2
	4	2.07 – 4.11	1.010	0.189	2
	5	1.19 – 2.07	0.840	0.157	2
	6	0.67 – 1.19	3.20	0.600	7
	7	0.40	8.12	1.522	18
	8	<0.40	4.35	0.815	9
10/24/01	1	>15.0	23.50	4.766	47
	2	11.31 – 15.0	1.030	0.209	2
	3	4.37 – 11.31	1.110	0.225	2
	4	2.20 – 4.37	0.770	0.156	2
	5	1.26 – 2.20	0.730	0.148	1
	6	0.71 – 1.26	3.74	0.758	7
	7	0.42 – 0.71	10.63	2.156	21
	8	<0.42	8.53	1.730	17
10/25/01	1	>14.0	9.24	1.639	36
	2	10.56 – 14.0	0.530	0.094	2
	3	4.08 – 10.56	0.510	0.090	2
	4	2.50 – 4.08	0.430	0.076	2
	5	1.18 – 2.05	0.180	0.032	1
	6	0.66 – 1.18	4.410	0.782	17
	7	0.39 – 0.66	4.630	0.822	18
	8	<0.39	5.470	0.971	22

Table 6.37. Test 8 Melter Outlet Particle Size Distribution.

Date	Impactor Stage	Cutpoint (microns)	Net Mass (mg)	Concentration (mg/dscf)	Mass Percent
10/30/01	1	>15.53	5.6	1.073	20
	2	11.72 – 15.53	1.33	0.255	5
	3	4.53 – 11.72	0.72	0.138	3
	4	2.28 – 4.53	2.27	0.435	8
	5	1.31 – 2.28	3.13	0.600	11
	6	0.73 – 1.31	4.79	0.918	17
	7	0.43 – 0.73	4.75	0.91	17
	8	<0.43	4.96	0.95	18
10/31/01	1	>14.26	5.79	1.325	21
	2	10.76 – 14.26	1	0.229	4
	3	4.16 – 10.76	1.14	0.261	4
	4	2.09 – 4.16	2.3	0.526	8
	5	1.20 – 2.09	4.39	1.005	16
	6	0.67 – 1.20	5.68	1.3	21
	7	0.40 – 0.67	4.67	1.069	17
	8	<0.40	2.45	0.561	9
11/1/01	1	>15.68	4.97	1.525	21
	2	11.83 – 15.68	0.69	0.212	3
	3	4.57 – 11.83	0.73	0.224	3
	4	2.30 – 4.57	2.62	0.804	11
	5	1.32 – 2.30	3.35	1.028	14
	6	0.74 – 1.32	4.82	1.479	21
	7	0.43 – 0.74	4.5	1.38	19
	8	<0.43	1.62	0.497	7

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Table 6.38. Test 9 Melter Outlet Particle Size Distribution.

Date	Impactor Stage	Cutpoint (microns)	Net Mass (mg)	Concentration (mg/dscf)	Mass Percent
Test 9a: 11/07/01	1	>14.29	4.69	1.733	56
	2	10.78 – 14.29	0.18	0.066	2
	3	4.17 – 10.78	0.09	0.033	1
	4	2.10 – 4.17	0.08	0.03	1
	5	1.20 – 2.10	0.09	0.033	1
	6	0.67 – 1.20	0.73	0.27	9
	7	0.40 – 0.67	0.78	0.288	9
	8	<0.40	1.68	0.621	20
Test 9b: 11/08/01	1	>16.43	5.94	2.575	51
	2	12.39 – 16.43	0.24	0.104	2
	3	4.79 – 12.39	0.30	0.13	3
	4	2.41 – 4.79	0.31	0.134	3
	5	1.38 – 2.41	0.36	0.156	3
	6	0.77 – 1.38	1.47	0.637	13
	7	0.46 – 0.77	1.35	0.585	12
	8	<0.46	1.59	0.689	14
Test 9b: 11/09/01	1	>12.83	3.19	1.124	36
	2	9.68 – 12.83	0.35	0.123	4
	3	3.74 – 9.68	0.04	0.014	2
	4	1.88 – 3.74	0.08	0.028	1
	5	1.08 – 1.88	0.20	0.07	2
	6	0.61 – 1.08	1.65	0.581	19
	7	0.36 – 0.61	2.03	0.715	23
	8	<0.36	1.27	0.447	14

Table 6.39. SBS Outlet Particle Size Distribution Results.

Test	Impactor Stage	Cutpoint, μm	Net Wt (mg)	Concentration (mg/dscf)	Mass Percent
1	1	15.35	0	0.0000	0.0
	2	11.58	0	0.0000	0.0
	3	4.48	0	0.0000	0.0
	4	2.25	7.77	2.6625	24.3
	5	1.29	0	0.0000	0.0
	6	0.72	2.76	0.9457	8.6
	7	0.42	15.07	5.1639	47.1
	8	<0.42	6.41	2.1965	20.0
2	1	14.03	0.17	0.0522	1.1
	2	10.58	0.13	0.0399	0.8
	3	4.09	0.06	0.0184	0.4
	4	2.06	0.12	0.0369	0.8
	5	1.18	0.55	0.1690	3.5
	6	0.66	4.09	1.2568	26.2
	7	0.39	4.92	1.5118	31.5
	8	<0.39	5.59	1.7177	35.8
3	1	15.71	0	0	0
	2	11.85	0	0	0
	3	4.58	0	0	0
	4	2.30	0	0	0
	5	1.32	0	0	0
	6	0.74	0.76	3.3763	3.6
	7	0.43	19.45	86.4078	92.9
	8	<0.43	1.13	5.0201	5.4
4	1	15.7	0.31	0.027	2.79
	2	11.8	0.14	0.012	1.26
	3	4.56	0.07	0.006	0.63
	4	2.29	0	0	0
	5	1.32	0.54	0.047	4.86
	6	0.74	3.08	0.266	27.7
	7	0.43	3.44	0.298	30.96
	8	<0.43	3.53	0.305	31.77

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Table 6.40. SBS Outlet Particle Size Distribution Results.

Date	Impactor Stage	Cutpoint (microns)	Net Mass (mg)	Concentration (mg/dscf)	Mass Percent
Test 5: 09/29/01	1	>14.75	0.56	0.040	5
	2	11.13 – 14.75	0.23	0.016	2
	3	4.30 – 11.13	0.21	0.015	2
	4	2.16 – 4.30	0.05	0.004	0
	5	1.24 – 2.16	0.28	0.020	2
	6	0.69 – 1.24	1.89	0.134	16
	7	0.41 – 0.69	3.41	0.241	29
	8	<0.41	5.20	0.368	44
Test 6: 10/16/01	1	>15.42	0.08	0.002	1
	2	11.63 – 15.42	0.02	0.001	0
	3	4.49 – 11.63	0.00	0.000	0
	4	2.26 – 4.49	0.00	0.000	0
	5	1.30 – 2.26	0.23	0.006	3
	6	0.73 – 1.30	1.92	0.049	21
	7	0.43 – 0.73	2.89	0.074	32
	8	<0.43	4.02	0.103	44
Test 7: 10/25/01	1	>17.44	1.47	0.264	8
	2	13.15 – 17.44	0.16	0.029	1
	3	5.08 – 13.15	0.09	0.016	1
	4	2.56 – 5.08	0.08	0.014	1
	5	1.47 – 2.56	0.31	0.056	2
	6	0.82 – 1.47	5.52	0.992	31
	7	0.48 – 0.82	6.66	1.197	37
	8	<0.48	3.48	0.625	20
Test 8: 10/31/01	1	>13.73	1.06	0.457	17
	2	10.36 – 13.73	0.30	0.129	5
	3	4.00 – 10.36	0.11	0.047	2
	4	2.01 – 4.00	0.10	0.043	2
	5	1.16 – 2.01	0.32	0.138	5
	6	0.65 – 1.16	1.49	0.643	24
	7	0.38 – 0.65	1.4	0.604	23
	8	<0.38	1.31	0.565	22
Test 9b: 11/8/01	1	>15.81	2.29	0.573	33
	2	11.93 – 15.81	0.14	0.035	2
	3	4.61 – 11.93	0.04	0.010	1
	4	2.32 – 4.61	0.03	0.008	1
	5	1.33 – 2.32	0.14	0.035	2
	6	0.74 – 1.33	0.90	0.225	13
	7	0.44 – 0.74	2.06	0.515	30
	8	<0.44	1.24	0.31	18

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Table 6.41. Compositional Analysis by Particle Size: Test 1, Melter Emissions.

Particle Size (microns)	> 15.4	11.6 – 15.4	4.5 – 11.6	2.3 – 4.5	1.3 – 2.3	0.7 – 1.3	0.4 – 0.7	< 0.4
Total Mass (mg)	0.23	0.87	0.71	0.57	0.19	0.13	0.09	0.51
Mass Fraction (%)	7%	26%	22%	17%	6%	4%	3%	15%
Al	3.5%	4.1%	2.8%	1.2%	0.8%	<0.05%	<0.05%	<0.05%
As	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	0.8%	3.3%	0.2%
B	1.7%	2.5%	3.9%	2.9%	1.8%	1.2%	0.6%	<0.05%
Ba	<0.05%	0.1%	0.1%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%
Ca	<0.05%	0.2%	0.1%	0.4%	2.9%	3.8%	1.1%	<0.05%
Cd	0.2%	0.2%	0.2%	0.2%	0.3%	<0.05%	0.6%	0.5%
Cr	<0.05%	0.1%	0.1%	0.1%	<0.05%	<0.05%	0.6%	1.0%
Cs	<0.05%	0.6%	<0.05%	<0.05%	2.6%	<0.05%	<0.05%	2.4%
Cu	<0.05%	<0.05%	<0.05%	<0.05%	0.8%	0.8%	1.7%	<0.05%
Fe	5.7%	7.4%	9.3%	10.4%	10.3%	12.3%	2.8%	0.4%
I	NA	NA	NA	NA	NA	NA	NA	NA
K	1.3%	0.7%	0.8%	1.1%	1.8%	0.4%	0.6%	0.7%
Li	0.9%	1.0%	1.3%	1.1%	1.3%	1.5%	2.8%	1.4%
Mg	0.7%	0.6%	0.8%	1.0%	1.1%	1.2%	0.6%	0.1%
Mn	0.7%	0.6%	0.4%	0.3%	0.3%	0.4%	<0.05%	0.1%
Na	5.4%	4.8%	6.5%	8.4%	7.4%	8.8%	21.1%	7.8%
Ni	<0.05%	0.6%	0.7%	0.4%	2.4%	2.3%	5.0%	<0.05%
P	<0.05%	<0.05%	0.3%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%
Pb	<0.05%	0.1%	0.1%	<0.05%	<0.05%	0.4%	0.6%	0.3%
S	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	13.8%	5.6%	2.0%
Sb	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%
Se	10.4%	7.2%	10.9%	16.9%	21.8%	22.7%	31.1%	16.6%
Si	12.6%	11.0%	9.7%	5.4%	3.2%	2.7%	<0.05%	1.7%
Sr	1.3%	1.3%	1.7%	1.8%	1.6%	1.2%	0.6%	0.1%
Te	0.7%	0.8%	0.1%	0.2%	1.6%	0.8%	10.6%	9.0%
Ti	<0.05%	0.1%	<0.05%	0.1%	<0.05%	<0.05%	<0.05%	<0.05%
Zn	1.3%	1.4%	1.8%	1.9%	1.8%	1.2%	1.1%	0.2%
Zr	1.1%	0.6%	0.2%	0.1%	0.3%	<0.05%	<0.05%	<0.05%
Mass Fraction Sum (%)	47.4%	45.9%	51.8%	53.8%	63.9%	76.2%	90.0%	44.4%

NC- Not Calculated
NA – Not Available

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Table 6.42. Compositional Analysis by Particle Size: Test 2, Melter Emissions.

Particle Size (microns)	> 15.5	11.7 – 15.5	4.5 – 11.7	2.3 – 4.5	1.3 – 2.3	0.7 – 1.3	0.4 – 0.7	< 0.4
Total Mass (mg)	6.99	0.59	0.32	0.25	0.47	0.57	0.59	0.70
Mass Fraction (%)	67%	6%	3%	2%	4%	5%	6%	7%
Al	0.8%	<0.05%	<0.05%	0.4%	0.7%	1.5%	2.8%	3.4%
As	0.3%	1.5%	0.9%	1.0%	0.5%	0.6%	0.3%	0.1%
B	0.1%	1.7%	4.5%	5.0%	4.0%	4.5%	2.9%	3.1%
Ba	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%
Ca	0.3%	0.3%	<0.05%	0.4%	0.1%	<0.05%	<0.05%	<0.05%
Cd	0.9%	9.7%	6.1%	1.6%	1.1%	0.7%	0.8%	0.6%
Cr	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%
Cs	<0.05%	0.9%	<0.05%	<0.05%	1.1%	<0.05%	0.9%	<0.05%
Cu	<0.05%	0.5%	0.3%	<0.05%	<0.05%	0.1%	2.3%	<0.05%
Fe	1.2%	0.2%	2.7%	7.8%	8.7%	7.9%	7.4%	7.1%
I	NA	NA	NA	NA	NA	NA	NA	NA
K	0.1%	1.1%	1.3%	1.6%	1.0%	0.9%	0.8%	0.6%
Li	0.7%	0.8%	0.9%	1.0%	1.1%	1.1%	1.0%	1.0%
Mg	0.4%	<0.05%	0.2%	0.8%	0.9%	0.7%	0.6%	0.6%
Mn	0.1%	<0.05%	<0.05%	0.4%	0.1%	0.4%	0.3%	0.5%
Na	3.7%	5.4%	5.0%	7.6%	7.1%	5.7%	4.6%	4.7%
Ni	0.1%	1.1%	1.6%	0.6%	0.5%	0.7%	4.7%	0.1%
P	0.1%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%
Pb	<0.05%	0.6%	0.5%	0.2%	0.1%	0.1%	0.1%	0.1%
S	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%
Sb	0.3%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%
Se	11.2%	10.0%	14.2%	16.4%	12.0%	10.1%	10.5%	11.9%
Si	1.7%	<0.05%	<0.05%	2.8%	4.6%	6.4%	8.8%	10.8%
Sr	0.8%	0.1%	0.5%	1.2%	1.6%	1.4%	1.3%	1.4%
Te	3.6%	38.6%	29.5%	6.6%	4.1%	2.7%	2.5%	2.3%
Ti	<0.05%	<0.05%	0.2%	<0.05%	0.1%	<0.05%	0.1%	<0.05%
Zn	0.7%	0.1%	0.3%	1.2%	1.5%	1.4%	1.3%	1.4%
Zr	0.1%	<0.05%	<0.05%	<0.05%	0.1%	0.2%	0.3%	0.6%
Mass Fraction Sum (%)	27.2%	72.6%	68.6%	56.6%	51.1%	46.9%	54.2%	50.4%

NC- Not Calculated

NA – Not Available

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Table 6.43. Compositional Analysis by Particle Size: Test 3, Melter Emissions.

Particle Size (microns)	> 16.1	12.2 – 16.1	4.7 – 12.2	2.4 – 4.7	1.4 – 2.4	0.8 – 1.4	0.5 – 0.8	< 0.5
Total Mass (mg)	70.42	5.07	5.13	4.59	3.34	2.09	2.10	2.86
Mass Fraction (%)	74%	5%	5%	5%	3%	2%	2%	3%
Al	4.3%	3.5%	2.0%	1.2%	0.4%	0.1%	<0.05%	<0.05%
As	0.1%	0.2%	<0.05%	0.1%	0.1%	0.4%	0.5%	0.6%
B	2.7%	2.7%	2.9%	3.7%	1.9%	0.4%	<0.05%	<0.05%
Ba	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%
Ca	0.2%	0.1%	0.2%	0.2%	0.1%	<0.05%	<0.05%	<0.05%
Cd	0.3%	0.2%	0.3%	0.6%	0.7%	1.1%	1.2%	1.4%
Cr	0.1%	<0.05%	0.1%	0.2%	0.2%	0.3%	0.3%	0.4%
Cs	<0.05%	0.1%	0.2%	0.3%	0.3%	1.2%	1.5%	1.8%
Cu	<0.05%	<0.05%	<0.05%	0.4%	<0.05%	<0.05%	<0.05%	<0.05%
Fe	6.8%	5.6%	7.6%	13.4%	9.7%	2.7%	0.3%	0.1%
I	NA	NA	NA	NA	NA	NA	NA	NA
K	0.1%	0.1%	0.2%	0.2%	0.3%	0.7%	0.9%	1.0%
Li	1.3%	1.1%	1.2%	1.6%	1.3%	2.0%	2.0%	2.5%
Mg	0.8%	0.6%	0.8%	1.2%	0.9%	0.5%	0.1%	0.1%
Mn	0.5%	0.5%	0.2%	0.2%	0.1%	0.1%	<0.05%	<0.05%
Na	3.9%	3.3%	3.7%	5.1%	4.5%	8.8%	9.1%	10.6%
Ni	0.5%	0.4%	0.5%	1.3%	0.2%	0.1%	<0.05%	<0.05%
P	0.1%	0.2%	<0.05%	<0.05%	0.1%	<0.05%	<0.05%	<0.05%
Pb	0.1%	0.1%	0.1%	0.2%	0.1%	0.2%	0.2%	0.2%
S	0.1%	0.6%	0.1%	1.0%	1.4%	8.0%	9.2%	11.5%
Sb	0.1%	<0.05%	<0.05%	0.1%	<0.05%	<0.05%	<0.05%	0.1%
Se	5.0%	3.6%	4.2%	8.6%	9.0%	10.4%	8.1%	10.6%
Si	10.3%	9.2%	6.5%	6.2%	2.9%	0.8%	<0.05%	<0.05%
Sr	1.5%	1.2%	1.5%	2.4%	1.4%	0.5%	0.1%	<0.05%
Te	1.2%	1.2%	1.9%	5.0%	6.4%	6.9%	5.9%	6.5%
Ti	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%
Zn	1.3%	1.2%	1.2%	1.9%	1.2%	0.6%	0.2%	0.2%
Zr	0.7%	0.6%	0.2%	0.1%	0.1%	<0.05%	<0.05%	<0.05%
Mass Fraction Sum (%)	42.2%	36.5%	35.6%	55.3%	43.3%	45.7%	39.6%	47.6%

NC- Not Calculated

NA – Not Available

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Table 6.44. Compositional Analysis by Particle Size: Test 4, Melter Emissions.

Particle Size (microns)	> 12.5	9.4 – 12.5	3.6 – 9.4	1.8 – 3.6	1.1 – 1.8	0.6 – 1.1	0.4 – 0.6	< 0.4
Total Mass (mg)	16.90	2.43	0.00	1.45	0.79	0.00	2.17	2.16
Mass Fraction (%)	65%	9%	0%	6%	3%	0%	8%	8%
Al	3.4%	3.4%	NC	1.3%	0.8%	NC	<0.05%	0.3%
As	<0.05%	0.1%	NC	<0.05%	<0.05%	NC	0.2%	0.3%
B	1.8%	2.2%	NC	2.4%	1.4%	NC	<0.05%	0.1%
Ba	<0.05%	<0.05%	NC	<0.05%	0.1%	NC	<0.05%	<0.05%
Ca	0.2%	0.6%	NC	0.8%	0.7%	NC	0.2%	0.2%
Cd	0.2%	0.2%	NC	0.3%	0.4%	NC	0.8%	0.6%
Cr	<0.05%	<0.05%	NC	0.1%	0.1%	NC	0.3%	0.2%
Cs	<0.05%	<0.05%	NC	<0.05%	0.7%	NC	1.5%	<0.05%
Cu	<0.05%	<0.05%	NC	<0.05%	<0.05%	NC	<0.05%	<0.05%
Fe	5.1%	5.2%	NC	10.3%	9.8%	NC	0.3%	0.4%
I	NA	NA	NA	NA	NA	NA	NA	NA
K	0.1%	0.1%	NC	0.2%	0.3%	NC	0.6%	0.4%
Li	1.4%	1.0%	NC	1.4%	1.5%	NC	1.7%	1.0%
Mg	0.6%	0.6%	NC	1.1%	1.1%	NC	0.1%	0.1%
Mn	0.3%	0.4%	NC	0.2%	0.2%	NC	<0.05%	0.1%
Na	4.1%	3.3%	NC	5.4%	6.8%	NC	7.6%	4.8%
Ni	0.3%	0.4%	NC	0.3%	0.2%	NC	<0.05%	0.1%
P	<0.05%	0.3%	NC	0.3%	1.8%	NC	0.2%	<0.05%
Pb	0.1%	0.1%	NC	0.1%	0.2%	NC	0.2%	0.1%
S	0.1%	0.7%	NC	<0.05%	3.9%	NC	7.7%	4.5%
Sb	0.1%	<0.05%	NC	<0.05%	<0.05%	NC	<0.05%	<0.05%
Se	14.3%	4.5%	NC	9.6%	12.5%	NC	11.8%	10.0%
Si	8.5%	9.3%	NC	6.0%	4.4%	NC	<0.05%	0.5%
Sr	1.0%	0.9%	NC	1.5%	1.3%	NC	<0.05%	0.1%
Te	0.9%	0.7%	NC	3.3%	5.4%	NC	8.8%	6.0%
Ti	0.2%	<0.05%	NC	<0.05%	0.1%	NC	<0.05%	<0.05%
Zn	1.1%	1.0%	NC	1.7%	1.6%	NC	0.2%	0.2%
Zr	0.6%	0.6%	NC	0.2%	0.3%	NC	<0.05%	0.1%
Mass Fraction Sum (%)	44.5%	35.7%	NC	46.5%	55.5%	NC	42.3%	29.9%

NC- Not Calculated

NA – Not Available

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Table 6.45. Compositional Analysis by Particle Size: Test 5, Melter Emissions.

Particle Size (microns)	> 14.2	10.7 – 14.2	4.1 – 10.7	2.1 – 4.1	1.2 – 2.1	0.7- 1.2	0.4 - 0.7	<0.4
Total Mass (mg)	48.20	2.60	2.90	5.10	10.07	3.82	2.31	2.08
Mass Fraction (%)	63%	3%	4%	7%	13%	5%	3%	3%
Al	1.5%	2.4%	1.4%	0.4%	<0.05%	<0.05%	<0.05%	<0.05%
As	0.1%	0.3%	<0.05%	0.1%	<0.05%	0.1%	0.2%	0.6%
B	1.5%	2.4%	3.1%	4.0%	2.2%	4.8%	4.8%	2.0%
Ba	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%
Ca	0.1%	0.2%	0.2%	0.1%	<0.05%	0.1%	<0.05%	<0.05%
Cd	0.1%	0.2%	0.2%	0.2%	0.1%	0.4%	0.6%	0.5%
Cr	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	0.1%
Cs	NA	NA	NA	NA	NA	NA	NA	NA
Cu	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%
Fe	2.4%	3.9%	4.8%	3.7%	0.8%	0.5%	0.1%	0.2%
I	NA	NA	NA	NA	NA	NA	NA	NA
K	0.1%	0.2%	0.2%	0.4%	0.2%	0.6%	0.6%	0.6%
Li	1.2%	1.9%	2.3%	2.5%	1.2%	2.5%	2.3%	1.9%
Mg	0.3%	0.5%	0.6%	0.5%	0.2%	0.2%	0.1%	0.1%
Mn	0.2%	0.4%	0.3%	0.2%	0.1%	0.1%	<0.05%	0.1%
Na	2.9%	4.3%	6.0%	8.2%	4.8%	10.9%	12.4%	9.7%
Ni	0.2%	0.3%	0.3%	0.1%	<0.05%	<0.05%	<0.05%	<0.05%
P	0.1%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%
Pb	0.1%	0.1%	0.1%	<0.05%	<0.05%	0.1%	<0.05%	<0.05%
S	<0.05%	<0.05%	0.3%	0.3%	0.1%	0.9%	0.8%	<0.05%
Sb	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%
Se	2.2%	3.6%	4.5%	4.0%	2.4%	5.9%	6.7%	6.8%
Si	3.7%	5.3%	3.8%	1.1%	0.1%	<0.05%	<0.05%	<0.05%
Sr	0.7%	1.1%	1.2%	0.7%	0.2%	0.4%	0.2%	0.1%
Te	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%
Ti	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%	<0.05%
Zn	0.5%	0.9%	0.8%	0.5%	0.1%	0.2%	0.1%	0.1%
Zr	0.6%	1.0%	1.1%	0.8%	0.2%	0.1%	<0.05%	<0.05%
Mass Fraction Sum (%)	18.5%	28.9%	31.0%	27.9%	12.9%	27.9%	29.2%	23.0%

NC- Not Calculated

NA – Not Available

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Table 6.46 Average Concentrations (ppmv) of Selected Species in Off-Gas Measured by FTIR Spectroscopy for DM 1200 AZ-101 Tests.

Test #	1 6/25/01 – 6/28/01			2 7/24/01 – 8/1/01			3 8/7/01-8/10/01		4 8/21/01 – 8/24/01		
Port*	Melter Outlet	SBS Outlet	WESP Outlet	Melter Outlet	SBS Outlet	WESP Outlet	Melter Outlet	SBS Outlet	Melter Outlet	SBS Outlet	WESP Outlet
Total Sampling Time (hr)	7.2	5.6	3.1	18.8	17.0	8.3	17.9	12.4	8.3	8.6	1.9
Acetonitrile	1.7	< 1.0	< 1.0	< 1.0	1.1	< 1.0	8.5	1.6	6.3	2.1	< 1.0
Acrylonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
CO ₂	3960	5590	6500	3880	3960	4670	8380	8440	6320	7390	5720
CO	< 1.0	1.9	2.1	18.6	18.2	23.3	24.5	73.2	< 1.0	1.4	3.6
H ₂ O [%]	11.8	3.4	3.8	8.3	2.6	3.4	34.0	5.8	24.6	5.6	5.9
HCl	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.7	< 1.0	< 1.0
HCN	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2	< 1.0	< 1.0	< 1.0
HF	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	5.2	1.9	2.6	< 1.0	< 1.0
HNO ₂	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
HNO ₃	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
N ₂ O	9.0	15.4	17.5	5.2	5.1	5.9	19.4	16.0	11.5	15.5	12.4
NH ₃	< 1.0	< 1.0	< 1.0	20.7	8.5	5.5	7.5	4.9	3.1	< 1.0	< 1.0
NO	158	238	266	26.7	28.0	31.2	461	334	323	350	238
NO ₂	16.6	24.1	34.4	< 1.0	< 1.0	3.2	18.1	67.8	10.6	27.4	23.7
SO ₂	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.0	< 1.0	< 1.0

*Note: Measurements at the three locations (Melter, SBS, WESP) were not made simultaneously; each data set corresponds to a different test time interval.

Table 6.46. Average Concentrations (ppmv) of Selected Off-Gas Species Measured by FTIR Spectroscopy (continued).

Test #	5 (9/25 – 10/1)			6 (10/11 – 10/17)			7 (10/23 – 10/26)		
Port*	Melter Outlet	SBS Outlet	WESP Outlet	Melter Outlet	SBS Outlet	WESP Outlet	Melter Outlet	SBS Outlet	WESP Outlet
Acetonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.4	147	< 1.0	< 1.0
Acrylonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	5.2
CO ₂	5740	6100	6490	1170	1380	2040	2120	4650	3200
CO	209	197	242	26.2	27.0	57.4	75.1	150	62.9
H ₂ O [%]	8.4	4.3	4.3	7.9	3.0	4.7	17.2	7.7	2.1
HCl	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
HCN	6.9	7.2	8.2	< 1.0	< 1.0	< 1.0	1.2	4.3	3.9
HF	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	7.4	3.0	< 1.0
HNO ₂	8.3	11.8	17.8	< 1.0	< 1.0	< 1.0	5.5	< 1.0	< 1.0
HNO ₃	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	5.6	< 1.0	< 1.0
N ₂ O	123	126	131	4.8	6.3	8.0	11.0	24.5	21.0
NH ₃	13.3	1.8	< 1.0	3.6	3.0	1.8	2.7	4.9	< 1.0
NO	2680	2470	2360	95.8	122	203	213	488	304
NO ₂	1040	993	1540	2.1	3.3	12.8	188	14.0	6.2
SO ₂	2.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

*Note: Measurements at the three locations (Melter, SBS, WESP) were not made simultaneously; each data set corresponds to a different test time interval.

Test #	8 (10/29 – 11/2)		9a (11/6 – 11/7)		9b (11/8 – 11/9)
Port*	SBS Outlet	WESP Outlet	SBS Outlet	WESP Outlet	SBS Outlet
Acetonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acrylonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
CO ₂	10,080	11,800	4330	4340	5060
CO	345	437	19.7	19.9	23.6
H ₂ O [%]	3.0	3.3	2.5	2.9	2.7
HCl	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
HCN	10.2	10.3	< 1.0	< 1.0	< 1.0
HF	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
HNO ₂	10.1	15.0	< 1.0	< 1.0	< 1.0
HNO ₃	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
N ₂ O	192	215	6.2	6.4	7.2
NH ₃	< 1.0	< 1.0	3.8	< 1.0	6.0
NO	2780	2580	40.4	39.4	46.7
NO ₂	1060	1690	< 1.0	1.2	< 1.0
SO ₂	< 1.0	< 1.0	< 1.0	< 1.0	1.5

*Note: Measurements at the three locations (Melter, SBS, WESP) were not made simultaneously; each data set corresponds to a different test time interval.

Table 6.47. Average NO_x Emission Fluxes as Measured by FTIR Spectroscopy.

Test	NO [mole/h]	NO ₂ [mole/h]	Feed [mole/h]
1	2.06 (Melter outlet) 3.12 (SBS outlet) 3.26 (WESP outlet)	0.22 (Melter outlet) 0.33 (SBS outlet) 0.44 (WESP outlet)	2.18
2	0.36 (Melter outlet) 0.44 (SBS outlet) 0.48 (WESP outlet)	0.01 (Melter outlet) 0.01 (SBS outlet) 0.05 (WESP outlet)	1.94
3	7.14 (Melter outlet) 5.27 (SBS outlet)	0.32 (Melter outlet) 1.09 (SBS outlet)	7.81
4	4.97 (Melter outlet) 5.59 (SBS outlet)	0.16 (Melter outlet) 0.44 (SBS outlet)	4.49
5	40.60 (Melter outlet) 43.70 (SBS outlet) 39.47 (WESP outlet)	15.95 (Melter outlet) 18.12 (SBS outlet) 25.64 (WESP outlet)	77.85
6	1.39 (Melter outlet) 1.89 (SBS outlet) 3.61 (WESP outlet)	0.03 (Melter outlet) 0.05 (SBS outlet) 0.23 (WESP outlet)	1.98
7	3.38 (Melter outlet) 10.71 (SBS outlet) 5.33 (WESP outlet)	3.34 (Melter outlet) 0.28 (SBS outlet) 0.11 (WESP outlet)	7.67
8	43.20 (SBS outlet) 41.91 (WESP outlet)	16.53 (SBS outlet) 27.60 (WESP outlet)	77.85
9a	0.63 (SBS outlet) 0.60 (WESP outlet)	0.01 (SBS outlet) 0.02 (WESP outlet)	1.82
9b	0.68 (SBS outlet)	0.01 (SBS outlet)	2.39

Figure 1.1 Cross-section of the DM1200 melter through the discharge chamber.

Figure 1.2. Cross-section of the DM1200 melter showing electrodes.

NOTES:

1. [3] EFFLUENT GAS SAMPLING LOCATIONS.
2. [2] OPTIONAL GAS SAMPLING LOCATIONS.
3. GAS TEMPERATURE, PRESSURE INSTRUMENTATION AT INLET AND OUTLET OF EACH EFFLUENT CONTROL COMPONENT.
4. ALL COMPONENTS SITUATED WITHIN CLOSED BUILDING.
5. CATALYST BEDS USED FOR RESEARCH PURPOSES (USE IS OPTIONAL).

Figure 1.3. Schematic diagram of the DM1200 off-gas system used for these tests.

Figure 1.4. Process flow diagram of the modified SBS cooling system.

Figure 2.1. Rheograms comparing AZ-101 melter feeds from DM1200 melter tests.

Figure 3.1. Glass production rates for DM1200 Test 1 (570 g/l with no bubbling).

Figure 3.2. Glass production rates for DM1200 Test 2 (570 g/l + 10 g sugar/l with no bubbling).

Figure 3.3. Glass production rates for DM1200 Test 3 (400 g/l with deep bubbling).

Figure 3.4. Glass production rates for DM1200 Test 4 (400 g/l with shallow bubbling).

Figure 3.5. Glass production rates for DM1200 Test 5 (nitrated feed, sugar ratio = 0.5, 420 g/l with no bubbling).

Figure 3.6. Glass production rates for DM1200 Test 6 (frit additives, 7.5 g sugar/l, 480 g/l with no bubbling).

Figure 3.7. Glass production rates for DM1200 Test 7 (frit additives, 7.5 g sugar/l, 480 g/l, with bubbling).

Figure 3.8. Glass production rates for DM1200 Test 8 (nitrated feed, sugar ratio = 0.7, with no bubbling).

Figure 3.9. Glass production rates for DM1200 Test 9 (570 g/l, 10 g sugar feeding with peristaltic feeding). Note that glass temperature was increased for the second half of this test.

Figure 3.10. Glass temperature for DM1200 Test 1 (570 g/l with no bubbling).

Figure 3.11. Glass temperature for DM1200 Test 2 (570 g/l + 10 g sugar/l with no bubbling).

Figure 3.12. Glass temperature for DM1200 Test 3 (400 g/l with deep bubbling).

Figure 3.13. Glass temperature for DM1200 Test 4 (400 g/l with shallow bubbling).

Figure 3.14. Glass temperature for DM1200 Test 5 (nitrated feed, sugar ratio = 0.5, 420 g/l with no bubbling).

Figure 3.15. Glass temperature for DM1200 Test 6 (frit additives, 7.5 g sugar/l, 480 g/l with no bubbling).

Figure 3.16. Glass temperature for DM1200 Test 7 (frit additives, 7.5 g sugar/l, 480 g/l with bubbling).

Figure 3.17. Glass temperature for DM1200 Test 8 (nitrated feed, sugar ratio = 0.7, with no bubbling).

Figure 3.18. Glass temperatures for DM1200 Test 9 (570 g/l, 10 g sugar/l, continuous feeding).

Figure 3.19. Plenum temperatures and electrode power for DM1200 Test 1 (570 g/l with no bubbling).

Figure 3.20. Plenum temperatures and electrode power for DM1200 Test 2 (570 g/l and 10 g sugar/l with no bubbling).

Figure 3.21. Plenum temperatures and electrode power for DM1200 Test 3 (400 g/l with deep bubbling).

Figure 3.22. Plenum temperatures and electrode power for DM1200 Test 4 (400 g/l with shallow bubbling).

Figure 3.23. Plenum temperatures and electrode power for DM1200 Test 5 (nitrated feed, sugar ratio = 0.5, 420 g/l with no bubbling).

Figure 3.24. Plenum temperatures and electrode power for DM1200 Test 6 (frit additives, 7.5 g sugar/l, 480 g/l with no bubbling).

Figure 3.25. Plenum temperatures and electrode power for DM1200 Test 7 (frit additives, 7.5 g sugar/l, 480 g/l with bubbling).

Figure 3.26. Plenum temperatures and electrode power for DM1200 Test 8 (nitrated feed, sugar ratio = 0.7, with no bubbling).

Figure 3.27. Plenum temperatures and electrode power DM1200 Test 9 (570 g/l, 10 g sugar/l, continuous feeding).

Figure 3.28. Electrode temperatures and power for DM1200 Test 9.

Figure 4.1. Melter pressure during Test 1, as logged at 2 minute intervals.

Figure 4.2. Melter pressure during Test 1, smoothed by averaging over 5 measurements.

Figure 4.3. Ten-minute time-averaged melter pressure during Test 2.

Figure 4.4. Ten-minute time-averaged melter pressure during Test 3.

Figure 4.5. Ten-minute time-averaged melter pressure during Test 4.

Figure 4.6. Ten-minute time-averaged melter pressure during Test 5.

Figure 4.7. Ten-minute time-averaged melter pressure during Test 6.

Figure 4.8. Ten-minute time-averaged melter pressure during Test 7.

Figure 4.9. Ten-minute time-averaged melter pressure during Test 8.

Figure 4.10. Ten-minute time-averaged melter pressure during Test 9.

Figure 4.11. SBS gas inlet and outlet temperatures during Test 1.

Figure 4.12. SBS inlet, outlet and differential pressures during Test 1 (note that differential pressure sensor clogged after 100 hours).

Figure 4.13. SBS cooling water and bed temperatures for Test 1 (cooling water data averaged over 10 minutes (5 measurements)).

Figure 4.14. Calculated heat loads on the cooling water jacket and plate heat exchanger for Test 1.

Figure 4.15. SBS gas inlet and outlet temperatures during Test 2.

Figure 4.16. SBS inlet, outlet and differential pressures during Test 2.

Figure 4.17. SBS cooling water and bed temperatures for Test 2 (cooling water data averaged over 10 minutes (5 measurements)).

Figure 4.18. Calculated heat loads on the cooling water jacket and plate heat exchanger for Test 2.

Figure 4.19. SBS gas inlet and outlet temperatures during Test 3.

Figure 4.20. SBS inlet, outlet, and differential pressures during Test 3. Note: Between 10 and 22 hours of operations, differential pressure sensor was clogged.

Figure 4.21. SBS cooling water and bed temperatures for Test 3 (cooling water data averaged over 10 minutes (5 measurements)).

Figure 4.22. Calculated heat loads on the cooling water jacket and plate heat exchanger for Test 3.

Figure 4.23. SBS gas inlet and outlet temperatures during Test 4.

Figure 4.24. SBS inlet, outlet, and differential pressures during Test 4.

Figure 4.25. SBS cooling water and bed temperatures for Test 4 (cooling water data averaged over 10 minutes (5 measurements)).

Figure 4.26. Calculated heat loads on the cooling water jacket and plate heat exchanger for Test 4.

(a)

(b)

**Figure 4.27. a. Deposits in SBS bowl,
b. Close-up of deposits in SBS bowl
(Test 4).**

(a)

(b)

**Figure 4.28. a. SBS down-comer deposits - close-up
b. SBS down-comer deposits
(Test 4).**

(a)

(b)

**Figure 4.29. a) Modified SBS down-comer gas diffuser with Teflon gasket and centering tool
b) Installed gasket and downcomer
(Test 4).**

(a)

(b)

**Figure 4.30. (a) Installed SBS down-comer (side view)
(b) Installed SBS down-comer (bottom view)
(Test 4).**

Figure 4.31. SBS gas inlet and outlet temperatures during Test 5.

Figure 4.32. SBS inlet, outlet and differential pressures during Test 5.

Figure 4.33. SBS cooling water and bed temperatures for Test 5 (cooling water data averaged over 10 minutes (5 measurements)).

Figure 4.34. Calculated heat loads on the cooling water jacket and plate heat exchanger for Test 5.

Figure 4.35. SBS bottom dish deposits showing square deposition pattern caused by sparge lances (Test 5).

Figure 4.36. General view of the SBS weir tubes and deposits inside the down-comer pipe (Test 5).

Figure 4.37. Deposits dislodged from the SBS down-comer pipe (Test 5).

Figure 4.38. SBS gas inlet and outlet temperatures during Test 6.

Figure 4.39. SBS inlet, outlet, and differential pressures during Test 6.

Figure 4.40. SBS cooling water and bed temperatures for Test 6 (cooling water data averaged over 10 minutes (5 measurements)).

Figure 4.41. Calculated heat loads on the cooling water jacket and plate heat exchanger for Test 6.

Figure 4.42. Deposits in the SBS bowl and bottom view of the weir tubes with down-comer pipe (Test 6).

Figure 4.43. SBS gas inlet and outlet temperatures during Test 7.

Figure 4.44. SBS inlet, outlet, and differential pressures during Test 7. Note: Feed was interrupted from hours 38 to 43.

Figure 4.45. SBS cooling water and bed temperatures during Test 7 (cooling water data averaged over 10 min. (5 measurements)). Note: Feed was interrupted from hours 38 to 43.

Figure 4.46. Calculated heat loads on the cooling water jacket and plate heat exchanger for Test 7. Note: Feed was interrupted from hours 38 to 43.

Figure 47. Deposits in the SBS bowl and bottom view of the down-comer pipe showing deposits (Test #7).

**Figure 4.48. Deposits in the SBS down-comer pipe
(Test 7).**

Figure 4.49. SBS gas inlet and outlet temperatures during Test 8. Note: Between 23 and 28 hours of operations, water circulation in cooling coil was interrupted.

Figure 4.50. SBS inlet, outlet, and differential pressures during Test 8.

Figure 4.51. SBS cooling water and bed temperatures for Test 8 (cooling water data averaged over 10 minutes (5 measurements)).

Figure 4.52. Calculated heat loads on the cooling water jacket and plate heat exchanger for Test 8. Note: Between 23 and 28 hours of operations, water circulation in SBS cooling coil was interrupted.

Figure 4.53. SBS gas inlet and outlet temperatures during Test 9.

Figure 4.54. SBS inlet, outlet, and differential pressures during Test 9. Note: Differential pressure sensor was clogged for the first 17.5 hours and from hours 106 to 109.

Figure 4.55. SBS cooling water and bed temperatures for Test 9 (cooling water data averaged over 10 minutes (5 measurements)).

Figure 4.56. Calculated heat loads on the cooling water jacket and plate heat exchanger for Test 9.

Figure 4.57. Deposits in the SBS bottom dish (Test 9).

Figure 4.58. Deposits in the SBS down-comer (Test 9).

Figure 4.59. WESP inlet and outlet temperatures and differential pressure across the WESP measured during Test 1.

Figure 4.60. WESP inlet and outlet temperatures and differential pressure across the WESP measured during Test 2.

Figure 4.61. WESP inlet and outlet temperatures and differential pressure across the WESP measured during Test 3.

Figure 4.62. WESP inlet and outlet temperatures and differential pressure across the WESP measured during Test 4.

Figure 4.63. Views of WESP collector plates and rods before wash-down at the end of Test 4.

Figure 4.64. Views of WESP collector plates and rods after wash-down at the end of Test 4.

Figure 4.65. WESP inlet and outlet temperatures and differential pressure across the WESP measured during Test 5.

Figure 4.66. WESP inlet and outlet temperatures and differential pressure across the WESP measured during Test 6.

Figure 4.67. Views of WESP collector plates and rods before wash-down at the end of Test 6.

Figure 4.68. Views of WESP collector plates and rods after wash-down at the end of Test 6.

Figure 4.69. WESP inlet and outlet temperatures and differential pressure across the WESP measured during Test 7. Note: A cooling water line break necessitated interruption of feeding and diversion of off-gas to bypass line between 38th and 43th hours of operations.

Figure 4.70. Views of WESP collector plates and rods before wash-down at the end of Test 7.

Figure 4.71. Views of WESP collector plates and rods after wash-down at the end of Test 7.

Figure 4.72. WESP inlet and outlet temperatures and differential pressure across the WESP measured during Test 8. Note: Between 23 and 28 hours of operations, water circulation in SBS cooling coil was interrupted.

Figure 4.73. View of WESP collector plates and rods before wash-down at the end of Test 8.

Figure 4.74. View of WESP collector plates and rods after wash-down at the end of Test 8.

Figure 4.75. WESP inlet and outlet temperatures and differential pressure across the WESP measured during Test 9. (Differential pressure sensor clogged at 30 hours).

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Figure 4.82. Outlet temperature and differential pressure for HEPA #1 during Test 4.

Figure 4.83. Outlet temperature and differential pressure for HEPA #1 during Test 5.

Figure 4.84. Outlet temperature and differential pressure for HEPA #1 during Test 6.

Figure 4.85. Outlet temperature and differential pressure for HEPA #1 during Test 7.
Note: Feed was interrupted from hours 38 to 43.

Figure 4.86. Outlet temperature and differential pressure for HEPA #1 during Test 8.

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Figure 4.95. Test 5 accumulated SBS blow-down volume and average accumulated feed water.

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Figure 4.97. Test 7 accumulated SBS blow-down volume and average accumulated feed water.

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Figure 4.99. Test 9 accumulated SBS blow-down volume and average accumulated feed water.

Figure 4.100. Feed composition (excludes oxygen, nitrogen species, and organic compounds).

Figure 4.101. SBS suspended solids composition from the end of Test 3 (excludes oxygen, nitrogen species, organic compounds, chlorine, and fluorine).

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Figure 4.105. Accumulations of major constituents in SBS fluids during Tests 1 and 2.

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Figure 5.1. XRF analysis of selected oxides in melter glasses.

Figure 5.2. XRF analysis of selected minor oxides in melter glasses.

Figure 5.3. XRF analysis of volatile elements in melter glasses.

Figure 5.4. DCP analysis of major oxides in melter glasses.

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Figure 5.6. Divalent iron as a percentage of total Fe in melter glasses from select tests.

Figure 6.1. Feed composition (excludes oxygen, nitrogen species, and organic compounds).

Figure 6.2. Test 3 melter exhaust composition (excludes oxygen, nitrogen species, organic compounds).

Figure 6.3. Test 3 SBS exhaust composition (excludes oxygen, nitrogen species, organic compounds).

Figure 6.4. Off-gas concentration of NO measured by FTIR spectroscopy at intervals during Test 1.

Figure 6.5. Off-gas concentration of NO measured by FTIR spectroscopy at intervals during Test 2.

Figure 6.6. Off-gas concentration of NO measured by FTIR spectroscopy at intervals during Test 3.

Figure 6.7. Off-gas concentration of measured by FTIR spectroscopy at intervals during Test 4.

Figure 6.8. Off-gas concentration of NO measured by FTIR spectroscopy at intervals during Test 5.

Figure 6.9. Off-gas concentration of NO measured by FTIR spectroscopy at intervals during Test 6.

Figure 6.10. Off-gas concentration of NO measured by FTIR at intervals during Test 7.

Figure 6.11. Off-gas concentration of NO measured by FTIR spectroscopy at intervals during Test 8.

Figure 6.12. Off-gas concentration of NO measured by FTIR spectroscopy at intervals during Test 9a.

Figure 6.13. Off-gas concentration of NO measured by FTIR spectroscopy at intervals during Test 9b.

Figure 7.1. Summary of DM1200 glass production rates for each test; Tx= present tests, Cx= commissioning tests (reference 5).

Figure 7.2. Summary of glass production rates as a function of total bubbler flow rate per unit melt surface area from DM100, DM1000, and DM1200 tests. (Note: Solids contents for Test 2 and 3 are different.)

APPENDIX A

ANALYSIS OF OFF-GAS SYSTEM DEPOSITS

Components in the off-gas system were inspected throughout testing to provide additional information on component performance. In many instances, deposits that were found were sampled and analyzed. Provided in this Appendix are masses, analyzed compositions, SEM micrographs, EDS spectra, and back-scattered electron (BSE) images of the solid and sludge samples from the SBS bowl, SBS down-comer, WESP, and the off-gas blowers. Descriptions and a summary of the results for all of the samples are provided in Table A.1.

Post-test inspections were conducted on off-gas system components as follows:

Test 1:

- WESP collector plates, rods, and WESP bottom.

Test 2:

- WESP collector plates, rods, and WESP bottom.

Test 3:

- SBS bowl, diffuser plate, down-comer, and overflow tank.
- WESP collector plates, rods, and WESP bottom.
- Paxton blower.

Test 4:

- Film cooler.
- SBS bowl, diffuser plate, down-comer, and overflow tank.
- WESP collector plates, rods, and WESP bottom.

Test 5:

- SBS bowl, diffuser plate, down-comer, and overflow tank.
- WESP collector plates, rods, and WESP bottom.

Test 6:

- Film cooler.
- SBS bowl, diffuser plate, down-comer, and overflow tank.

- WESP collector plates, rods, and WESP bottom.

Test 7:

- SBS bowl, diffuser plate, down-comer, and overflow tank.
- WESP collector plates, rods, and WESP bottom.

Test 8:

- Film cooler.
- SBS bowl, diffuser plate, down-comer, and overflow tank.
- WESP collector plates and rods and WESP bottom.

Test 9:

- SBS bowl, diffuser plate, down-comer, and overflow tank.
- WESP collector plates, rods, and WESP bottom.
- Paxton blower.

No observation of color changes or solid depositions in the HEME were made during any of the tests.

Tests 1 and 2

At the end of each of the first two tests, solid samples from the WESP internals were obtained. DCP analysis (Table A.1) of a sample taken after Test 1 (12G-W-136A) indicated that the deposits consist mainly of iron, selenium, and tellurium, with lesser amounts of cadmium, chromium, and sulfur. SEM BSE images and EDS spectra of sample 12G-W-136A are given in Figures A1-A.3. SEM/EDS analysis of this material revealed agglomerated particles primarily consisting of Fe oxide and Se- and Te-containing phases. Some sulfur-containing regions were also observed and many other elements were present in trace amounts.

BSE images and EDS spectra of five regions from a sample taken after Test 2 (12J-W-13B) are presented in Figures A.4 through Figure A.9. Material was selected on the basis of color and texture, mounted directly to an SEM stub with carbon tape, and left uncoated. BSE images were taken of representative areas and EDS spectra were collected. SEM/EDS analysis of the sample revealed significant variations in iron, tellurium, and cadmium concentrations. Other elements detected were sulfur, chlorine, and chromium. It should be noted that the cesium peak annotated on the spectra is buried beneath the tellurium peaks and may not be as significant as indicated in the EDS analysis results.

3

DCP analysis (Table A.1) of the sludge samples from the SBS overflow tank (12K-S-6A and 12K-S-6B) show compositions that are similar to each other, and to that of the melter feed for many components (e.g., SiO_2 between 42 and 46 wt%, Fe_2O_3 about 10%). Sample 12K-S-10ARe was prepared from 12K-S-10A and SEM/EDS analysis revealed a variety of materials; the corresponding spectra and point-by-point EDS results are given in Figures A.10 - A.15.

Deposits from the down-comer (12K-S-10B) were analyzed using BSE imaging and EDS spectra, as shown in Figures A.16 and A.17. Material was selected on the basis of color and texture, mounted directly to an SEM stub with carbon tape, and left uncoated. SEM/EDS analysis revealed significant variations in iron, selenium, and silicon concentrations. Representative BSE images show two primary regions: one region showed a stratified material, the other was a reddish, agglomerated material. Sulfur, fluorine, calcium, and zinc were also detected. Dense pockets of fluorine were observed periodically in the stratified material.

Figures A.18 - A.21 show BSE images and EDS spectra of a solid sample (12K-W-6B) that was taken from WESP collector plate and rods. Material was selected from this sample on the basis of color and texture, mounted directly to an SEM stub with carbon tape, and left uncoated. SEM/EDS analysis revealed significant variations in iron, selenium, and tellurium concentrations; sulfur, cadmium, and chromium were also detected.

DCP analysis (Table A.1) of solids taken from the surface of Paxton blower rotor blades and outlet pipe (12K-O-10A) and filtered solids from washing these components (12K-O-10B) show the most abundant constituent to be selenium, with significant amounts of aluminum, nickel, sodium, and tellurium. BSE images and EDS spectra of the same samples are given in Figures A.22 and A.23. SEM/EDS analysis revealed agglomerated particles primarily consisting of Se and Ni deposits. In addition, pockets of S, Fe, Al, F, Na, and Te were observed along with trace amounts of I. Point 1 on the BSE image (Figure A.22) was most representative of material throughout sample; Region 4 is some type of plastic material with the above-mentioned deposits on the surface.

Test 4

Figures A.24 - A.29 show BSE images and EDS spectra for samples of down-comer deposits (12K-O-144B) collected at the end of this test. SEM/EDS analysis revealed large regions of agglomerated material, including regions of crystallization. Major elements observed were Al, Mg, Ca, Mn, Zn, Se, Sr, and F.

DCP analysis (Table A.1) of the filtered solids from solutions generated by washing the WESP electrode rods (12K-O-144C) indicate the material to be rich in Te and Se, with lesser amounts of As, Cd, Cr, Fe, Pb, Sb and Si.

Deposited solids of less than half an inch in thickness were observed on the walls of the film cooler at the end of this test but samples were not collected.

Test 5

Approximately 1.4 kg of solids was removed from the SBS bowl at the end of this test. Deposits were removed from the WESP collector plates and rods. The WESP collector plate and rods were very clean after the wash-down.

Test 6

No solids build-up was observed in the film cooler; however, only a small part of the film cooler could be seen during the inspection.

A slight amount of corrosion was observed on the star-tips of the WESP collector rods.

The mass of the solids removed from the SBS bowl was 0.028 kg with very little solids build-up observed on the SBS down-comer.

Test 7

DCP analysis (Table A.1) of two separate samples of sludge from the SBS bowl (12N-O-133A) both indicate the material to be similar in composition to the melter feed (e.g., about 45 wt% SiO₂ and about 11 wt% Fe₂O₃) with enrichments of certain volatile constituents (Se and Te).

Figures A.30 - A.32 show SEM/EDS analysis results of down-comer solids, which revealed a variety of agglomerated materials composed primarily of Se, Te, Fe, and Si. Large regions of sodium overlapping with fluorine (presumably sodium fluoride) were evident.

Test 8

DCP analysis (Table A.1) of the solids from the SBS overflow tank (12O-O-70A) and solids from the SBS bowl (12O-O-75A) are similar to each other with respect to selenium. Material in the overflow tank contains more insoluble constituents, such as iron and silicon, whereas material from the SBS bowl contains more soluble constituents, such as boron and tellurium.

Before the wash-down of the WESP, large amounts of solids were observed on the rods. However, the wash-down was effective in removing the accumulated solids.

At the end of the test, inspection of the film cooler revealed a layer of solid deposits less than ½" thick primarily near the bottom on one side. The rest of the pipe was clean up to the transition pipe. Above the transition pipe, dry powdery solids were present.

Test 9

The masses of solids removed from SBS bowl and SBS down-comer were 0.44 kg and 0.044 kg, respectively.

Before the WESP wash-down, both the collector plates and rods were caked with solids. The plates and rods were covered with solids from the bottom up to about 12" up from the bottom. The wash-down was effective in removing the solids from this area but there were some solids left on the collector rods and plates from approximately 24" from the bottom towards the top.

Solids obtained from the Paxton blower (12Q-O-119B) only partially dissolved using the standard dissolution method (a nitric/hydrofluoric acid mixture with microwave heating); the major component of the dissolved fraction was iron.

Table A.1. DCP Analyzed Compositions (wt% Oxide Basis) of Samples Taken During DM 1200 Off-Gas System Inspections.

Test #	1	2	3	3
Date/Time	7/05/01, 10:00	8/02/01, 10:15	8/13/01, 13:20	8/13/01, 13:20
Sample Name	12G-W-136A	12J-W-13B	12K-S-6A	12K-S-6B
Figures	A.1-A.3	A.4-A.9	-	-
Mass (kg)	NA	NA	7.644	2.296
Sample Description	WESP solids from internal rods and diffuser plate	Dry crust on WESP upper internals.	Sludge at the bottom of SBS overflow tank.	Sludge at the bottom of SBS overflow tank
Wt % water in original sample	NA	NA	36.22	37.67
Dried at 110°C prior to analysis?	No	No	Yes	Yes
Al ₂ O ₃	0.04	Main constituents determined by SEM/EDS are Te, Fe, Cd; also present were S, Cl, Cr and Cs, as shown in EDS spectra (Figures A.4-A.9).	10.63	9.69
As ₂ O ₃	0.13		0.09	0.08
B ₂ O ₃	0.36		1.69	1.43
BaO	0.00		0.04	0.04
CaO	0.05		0.14	0.14
CdO	1.24		0.41	0.39
CoO	ND		0.03	0.01
Cr ₂ O ₃	1.42		0.08	0.08
CuO	0.03		0.03	0.03
Fe ₂ O ₃	37.72		9.61	9.91
K ₂ O	0.23		0.05	0.04
Li ₂ O	0.31		0.62	0.54
MgO	0.02		0.49	0.45
MnO ₂	0.09		2.61	2.42
Na ₂ O	0.97		1.17	1.01
NiO	0.07		0.61	0.62
P ₂ O ₅	<0.01		0.43	0.41
PbO	0.96		0.18	0.19
SO ₃	1.23		ND	ND
Sb ₂ O ₃	0.86		0.29	0.25
SeO ₂	15.66		2.79	2.96
SiO ₂	0.47		42.28	45.94
SrO	0.01		1.03	0.85
TeO ₂	23.76		1.40	1.55
TiO ₂	0.03		0.10	0.09
ZnO	0.16		1.83	1.55
ZrO ₂	0.01		5.16	5.06
Sum	85.84		83.87	85.74

ND-Not detected

NA-Not analyzed

Table A.1. DCP Analyzed Compositions (wt% Oxide Basis) of Samples Taken During DM1200 Off-Gas System Inspections (Continued).

Test #	3	3	3	3
Date/Time	8/14/01, 21:30	8/16/01, 13:27	8/13/01, 13:55	8/15/01, 11:24
Sample Number	12K-S-10A	12K-S-10B	12K-W-6B	12K-O-10A
Figures	A.10-A.15	A.16-A.17	A.18-A.21	A.22-A.23
Mass (kg)	9.12	0.572	NA	0.00145
Sample Description	Sludge from SBS bowl.	Solids from SBS-down-comer pipe.	Solids scraped from WESP collector plate and rods.	Solids from surface of rotor blades and outlet pipe of Paxton blower.
Wt % water of original sample	NA	NA	NA	NA
Dried at 110°C prior to analysis?	Yes	No	No	No
Al ₂ O ₃	(Sample #12K-S-10ARe). Main constituents determined by SEM/EDS for 20 points on the sample can be seen in Figures A.11 through Figure A.15.	Main constituents determined by SEM/EDS are Fe, Se, Si; other elements present were S, F, Ca, Zn and F, as shown in EDS spectra (Figures A.16-A.17).	Main constituents determined by SEM/EDS are Fe, Se, Te; other elements present were S, Cd, Cr and Cs, as shown in EDS spectra (Figures A.18-A.21).	7.51
As ₂ O ₃				0.08
B ₂ O ₃				0.37
BaO				0.01
CaO				0.31
CdO				0.33
Cr ₂ O ₃				0.52
CuO				ND
Fe ₂ O ₃				3.05
K ₂ O				1.09
Li ₂ O				0.96
MgO				0.09
MnO				0.09
Na ₂ O				5.17
NiO	Note: 12K-S-10A was not homogenized. 5.18 kg of supernate was poured into a separate container and named 12K-S-10AS. The remaining residue was named 12K-S-10ARe. A large hard chunk was removed from the sample, dried and sent for SEM/EDS analysis.			8.49
P ₂ O ₅				0.32
PbO				0.13
Sb ₂ O ₃				0.07
SeO ₂				30.82
SiO ₂				1.84
SrO				0.02
TeO ₂				2.87
TiO ₂				0.07
ZnO				0.51
ZrO ₂				0.02
Sum				67.89

ND-Not detected

NA-Not analyzed

Table A.1. DCP Analyzed Compositions (wt% Oxide Basis) of Samples Taken During DM1200 Off-Gas System Inspections (Continued).

Test #	3	4	4	4
Date/Time	8/15/01, 11:24	8/29/01, 15:10	8/30/01, 08:18	8/30/01, 11:26
Sample Number	12K-O-10B	12K-S-144A	12K-O-144B	12K-O-144C
Figures	-	-	A.24-A.29	-
Mass (kg)	NA	5.986	0.328	NA
Sample Description	Filtered solids from solution after flushing Paxton outlet pipe.	Sludge from SBS bowl solids.	Solids collected from SBS down-comer pipe.	Filtered solids from solution after washing the WESP electrode rods.
Wt % water of original sample	NA	39.93	NA	NA
Dried at 110°C prior to analysis?	Yes, after filtering.	No	-	Yes, after filtering.
Al ₂ O ₃	7.50	pH = 6.90 Density = 1.72 g/ml.	Major constituents determined by SEM/EDS are Al, Mg, Ca, Mn, Zn, Se, Sr and F, as shown in EDS spectra (Figures A.25-A.29).	0.21
As ₂ O ₃	0.09			1.37
B ₂ O ₃	0.11			0.28
BaO	0.02			0.00
CaO	1.32			0.07
CdO	1.58			2.66
Cr ₂ O ₃	0.76			4.85
CuO	0.42			0.05
Fe ₂ O ₃	3.28			7.31
K ₂ O	0.58			0.07
Li ₂ O	0.13			0.06
MgO	0.17			0.05
MnO	0.14			0.13
Na ₂ O	1.43			0.16
NiO	11.31			0.12
P ₂ O ₅	0.51			0.08
PbO	0.34			1.98
Sb ₂ O ₃	0.09			2.49
SeO ₂	31.64			19.48
SiO ₂	2.14			2.85
SrO	0.04			0.01
TeO ₂	7.47			41.68
TiO ₂	0.12			0.04
ZnO	0.90			0.24
ZrO ₂	0.04			0.23
Sum	72.13			86.48

NA-Not analyzed

Table A.1. DCP Analyzed Compositions (wt% Oxide Basis) of Samples Taken During DM1200 Off-Gas System Inspections (Continued).

Test #	7	7	7	8
Date/Time	10/28/01, 05:11	10/28/01, 05:11	10/28/01, 11:59	11/02/01, 20:00
Sample Number	12N-O-133A	12N-O-133A	12N-O-133B	12O-O-70A
Figures	-	-	A.30-A.32	-
Mass (kg)	NA	NA	0.058	1.01
Sample Description	Sludge from bottom of SBS bowl. (Sample #1)	Sludge from bottom of SBS bowl. (Sample #2)	Solids from the SBS down-comer pipe.	Leftover solids after blow-down of SBS overflow tank.
Wt % water of original sample	48.28	48.28	NA	NA
Dried at 110°C prior to analysis?	Yes	Yes	-	Yes, after filtering.
Al ₂ O ₃	3.03	3.13	Major constituents determined by SEM/EDS are Se, Te, Fe and Si, as shown in EDS spectra (Figure A.32).	3.96
As ₂ O ₃	0.09	0.04		<0.01
B ₂ O ₃	5.04	4.98		1.20
BaO	0.03	0.03		0.03
CaO	0.26	0.25		0.13
CdO	0.18	0.17		0.25
Cr ₂ O ₃	0.07	0.07		0.16
CuO	0.01	0.01		0.05
Fe ₂ O ₃	11.10	10.69		25.97
K ₂ O	0.08	0.09		0.07
Li ₂ O	2.52	2.64		0.83
MgO	0.37	0.37		0.24
MnO	0.97	0.94		0.16
Na ₂ O	2.95	2.96		0.73
NiO	0.47	0.47		1.16
P ₂ O ₅	0.24	0.23		0.27
PbO	0.20	0.20		0.26
Sb ₂ O ₃	0.34	0.26		0.22
SeO ₂	10.60	11.20		15.04
SiO ₂	45.76	44.80		31.11
SrO	0.65	0.62		0.16
TeO ₂	2.68	2.63		2.08
TiO ₂	0.22	0.20		0.26
ZnO	1.27	1.30		0.54
ZrO ₂	1.45	1.36		2.03
Sum	90.5	89.63		86.92

ND-Not detected

NA-Not analyzed

Table A.1. DCP Analyzed Compositions (wt% Oxide Basis) of Samples Taken During DM1200 Off-Gas System Inspections (Continued).

Test #	8	8	9
Date/Time	11/03/01, 08:30	11/03/01, 08:30	12/17/01, 16:30
Sample Number	12O-O-75A	12O-O-75A	12Q-O-119B
Figures	-	-	-
Mass (kg)	0.324	0.324	0.038
Sample Description	Solids from SBS bowl. (Sample #1).	Solids from SBS bowl. (Sample #2).	Solids from Paxton blower.
Wt % water of original sample	26.90	26.90	NA
Dried at 110°C prior to analysis?	Yes	Yes	-
Al ₂ O ₃	0.02	0.02	Since the total recovery was only 17.55 %, the results are not reported. However, of that fraction, the main component was Fe ₂ O ₃ .
As ₂ O ₃	0.02	0.03	
B ₂ O ₃	18.75	18.62	
BaO	0.00	0.00	
CaO	0.01	0.02	
CdO	0.34	0.35	
Cr ₂ O ₃	0.10	0.10	
CuO	0.02	0.01	
Fe ₂ O ₃	1.23	1.18	
K ₂ O	0.26	0.26	
Li ₂ O	0.94	0.91	
MgO	0.02	0.03	
MnO	0.01	0.01	
MnO ₂	ND	ND	
Na ₂ O	3.89	3.93	
NiO	0.01	0.01	
P ₂ O ₅	0.01	0.07	
PbO	0.11	0.13	
Sb ₂ O ₃	0.80	0.82	
SeO ₂	9.43	9.21	
SiO ₂	0.19	0.22	
SrO	0.04	0.04	
TeO ₂	32.26	33.61	
TiO ₂	0.01	0.01	
ZnO	0.03	0.03	
ZrO ₂	0.02	0.02	
Sum	68.53	69.62	

ND-Not detected

NA-Not analyzed

Table A.2. Mass of Solids Removed from SBS Bowl and SBS Down-Comer.

Before installation of SBS down- comer with serrated bottom.	Test #	Glass Produced	Solids from SBS bowl.	Solids from SBS down- comer pipe
		Mass (kg)	Mass (kg)	Mass (kg)
	1-3	11075	9.12	0.572
After installation of SBS down- comer with serrated bottom.	4	3465	5.99	0.328
	5	1659	1.4	Solids present; cleaned.
	6	1901	0.028	No visible solids build-up.
	7	5976	<~0.5	0.058
	8	944	0.324	1/4" thick build-up, up to ~4" from end; cleaned.
	9	1706	0.44	0.044

Figure A.1: BSE image of particles. The brighter, more agglomerated materials typically have high concentrations of Se and Te. The darker, more homogeneous materials are predominantly Fe oxide, incorporating varying amounts of Se. (Sample #12G-W-136A).

Figure A.2. General EDS spectrum of agglomerated material, (Sample #12G-136A).

Figure A.3. General EDS spectrum of relatively homogeneous particles, (Sample #12G-W-136A).

Accelerating Voltage: 25 KeV
Resolution: 1024 x 1024

Magnification: 100
Pixel Size: 0.975702 microns

Region #1

Region #1

Figure A.4. BSE image and EDS analysis of Region #1 in sample 12J-W-13B.

Accelerating Voltage: 25 KeV
Resolution: 1024 x 1024

Magnification: 160
Pixel Size: 0.609814 microns

Region #2

Figure A.5. BSE image and EDS analysis of Region #2 in sample 12J-W-13B.

Accelerating Voltage: 25 KeV
Resolution: 1024 x 1024

Magnification: 220
Pixel Size: 0.443501 microns

Region #3

Figure A.6. BSE image and EDS analysis of Region #3 in sample 12J-W-13B.

Accelerating Voltage: 25 KeV
Resolution: 1024 x 1024

Magnification: 100
Pixel Size: 0.975702 microns

Region #4

Figure A.7. BSE image and EDS analysis of Region #4 in sample 12J-W-13B.

Accelerating Voltage: 25 KeV

Magnification: 100

Resolution: 1024 x 1024

Pixel Size: 0.975702 microns

Region #5

Figure A.8. BSE image and EDS analysis of Region #5 in sample 12J-W-13B.

Accelerating Voltage: 25 KeV

Magnification: 100

Resolution: 1024 x 1024

Pixel Size: 0.00975702 microns

Region #5 Close-up

Figure A.9. BSE image and EDS analysis of Region #5 (close-up) in sample 12J-W-13B.

Figure A.10. Point-by-point EDS analysis of particles (Sample #12K-S-10ARe).

Points 1, 10, 13, 18 similar.

Points 2, 5, 12, 16 similar. Varying amounts of Te and Se observed.

Figure A.11. EDS analysis of Regions #1, 10, 13, 18, 2, 5, 12, and 16 in sample 12K-S-10Are.

Points 3, 4, 7, 15 similar.

Points 6, 9, 14, 19, 20 similar. Varying amounts of Te, Se, Cu, and Zn observed.

Figure A.12. EDS analysis of Regions #3, 4, 7, 15, 6, 9, 14, 19, and 20 in sample 12K-S-10Are.

Point 8.

Point 11.

Figure A.13. EDS analysis of Regions #8 and 11 in sample 12K-S-10ARe.

Point 17.

Figure A.14. EDS analysis of Region #17 in sample 12K-S-10ARe.

Figure A.15. A significant fluorine peak was observed in the material shown above (Sample12K-S-10ARe).

General spectrum of stratified region

Figure A.16. BSE image and EDS analysis of stratified region (Sample 12K-S-10B).

General spectrum of reddish agglomerated material

Dark pocket in stratified region

Figure A.17. BSE image and EDS analysis of reddish agglomerated region and dark pocket in stratified region (Sample 12K-S-10B).

Accelerating Voltage: 25 KeV
Resolution: 1024 x 1024

Magnification: 100
Pixel Size: 0.975702 microns

Region #1

Figure A.18. BSE image and EDS analysis of Region #1 in sample 12K-W-6B.

Accelerating Voltage: 25 KeV
Resolution: 1024 x 1024

Magnification: 330
Pixel Size: 0.975702 microns

Region #2

Figure A.19. BSE image and EDS analysis of Region #2 in sample 12K-W-6B.

Accelerating Voltage: 25 KeV
Resolution: 1024_x 1024

Magnification: 330
Pixel Size: 0.295667 microns

Region #3

Figure A.20. BSE image and EDS analysis of Region #3 in sample 12K-W-6B.

Accelerating Voltage: 25 KeV
Resolution: 1024 x 1024

Magnification: 100
Pixel Size: 0.975702 microns

Region #4

Figure A.21. BSE image and EDS analysis of Region #4 in sample 12K-W-6B.

Figure A.22. Points numbered 1-6 relate to the EDS spectra in the following figures. The region labeled "X-RAY MAP" is the general region that x-ray mapping was conducted (Sample # 12K-O-10A).

(Region #1)

(Region #2)

Figure A.23. EDS spectra of two sample regions (Regions #1 and #2) indicated in Figure A.22 (Sample # 12K-O-10A).

Figure A.24. BSE image of agglomerated material (despite carbon coating, charging was still problematic). (Sample # 12K-O-144B).

Figure A.25. Numbered regions in the agglomerated material refer to EDS spectra in the following figures. (Sample # 12K-O-144B).

Region #1

Region #2

Figure A.26. EDS spectra of two sample regions (Regions #1 and #2) indicated in Figure A.25 (Sample # 12K-O-144B).

Region #3

Region #4

Figure A.27. EDS spectra of two sample regions (Regions #3 and #4) indicated in Figure A.25 (Sample # 12K-O-144B).

Region #5

Region #6

Figure A.28. EDS spectra of two sample regions (Regions #5 and #6) indicated in Figure A.25 (Sample # 12K-O-144B).

Region #7

Figure A.29. EDS spectra of sample region (Region #7) indicated in Figure A.25 (Sample # 12K-O-144B).

Figure A.30. BSE image of sample cross-section (Sample #12N-O-133B).

Figure A.31. BSE image of surface mounted specimen shown in Figure A.30 (Sample # 12N-O-133B).

Figure A.32. EDS spectrum revealing general elemental composition. Fluorine is not shown here (Sample # 12N-O-133B).

APPENDIX B

VISCOSITY AND PARTICLE SIZE DISTRIBUTION OF SBS FLUIDS

Viscosities and particle size distributions were determined for six samples of DM1200 SBS fluids. The samples were selected from six different tests, as shown in Table B.1. The viscosities of the fluids were essentially the same as that of water.

SBS blown-down liquids were characterized for particle size distribution using a Microtrac S-3000 particle size analyzer. The particle size distribution measurement range of the instrument was 0.243 to 1408 μm . For these measurements, an aliquot of well-shaken SBS fluid was dispersed in deionized water. The measured particle size distributions are shown in Figures B.1-B.6. Table B.1 provides a summary of the particle size data in terms of mean sizes with respect to volume, number, and surface area statistics.

The mean size in terms of volume statistics ranges from 2 to 13 μm . The particle size at which the volume of suspended solids exceeds 50% of the total cumulative volume ranges from 1 to 7.5 μm . The particle size increases with increasing pH of the SBS liquids, as would be expected based on increased dissolution at low pH. The use of nitrated melter feed resulted in the most acidic SBS fluids and, in turn, the lowest particle sizes for the SBS suspended solids. The sample from Test 3 deviates from this general pH trend, presumably due to agglomeration resulting from the high TSS concentration.

Melter exhaust particle size distribution data are compiled in Tables 30-40 of this report. Based on these results, in term of mass statistics, particles larger than roughly 14 μm in size contribute over 65% of the total mass in melter exhaust particles. In comparison, the suspended solids in the SBS fluids are composed of much smaller particles. This difference may result from a combination of the disassociation of agglomerated particles emitted from the melter when they contact the SBS fluid, as well as attrition and dissolution of larger particles.

*The Catholic University of America
Vitreous State Laboratory*

*DuraMelter 1200 Tests with AZ-101HLW Simulants
Final Report, VSL-02R0100-2, Rev.1*

Table B.1. Measured Properties of SBS Liquids.

Test	Sampling Date	Sample Name	TSS (mg/l)	TDS (mg/l)	pH	Particle Characteristics				Viscosity (Poise) @ >100/s
						mv (μm)	mn (μm)	ma (μm)	ps @50%	
2	8/1/01	12I-S-88A	268	672	8.45	8.01	0.69	3.23	5.43	<0.02
3	8/11/01	12J-S-139A	3584	2720	5.47	12.90	0.55	3.06	7.47	<0.02
4	8/25/01	12K-S-136A	448	1936	4.57	8.25	0.64	2.96	5.35	<0.02
5	10/1/01	12L-S-116A	1076	3356	1.05	2.12	0.63	1.43	2.07	<0.02
7	10/26/01	12N-S-126B	448	2120	2.22	3.49	0.51	1.73	2.55	<0.02
9	11/10/01	12P-S-41A	72	1144	3.48	3.36	0.44	0.94	1.17	<0.02
Deionized Water			NA	NA	NA	NA	NA	NA	NA	<0.02

NA: not analyzed

mv: mean size in terms of volume statistics

mn: mean size in terms of number statistics

ma: mean size in terms of surface area statistics

ps@50%: particle size at 50% volume of particles passed.

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DuraMelter 1200 Tests with AZ-101HLW Simulants
Final Report, VSL-02R0100-2, Rev.1

Figure B.1. Particle size distribution of suspended solids in 12I-S-88A.

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Figure B.2. Particle size distribution of suspended solids in 12J-S-139A.

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Figure B.3. Particle size distribution of suspended solids in 12K-S-136A.

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Figure B.4. Particle size distribution of suspended solids in 12L-S-116A.

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Figure B.5. Particle size distribution of suspended solids in 12N-S-126B.

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DuraMelter 1200 Tests with AZ-101HLW Simulants
Final Report, VSL-02R0100-2, Rev.1

Figure B.6. Particle size distribution of suspended solids in 12P-S-41A.

Duratek, Inc.
River Protection Project

345 Hills Street
Richland, Washington 99352
(509) 376-7055 - Phone
(509) 372-3830 - Fax

August 8, 2003
L-12195

Bechtel National, Inc.
WTP PDC, Submittal Coordinator
2435 Stevens Center Place
MSIN H4-02/MS11-B
Richland, WA 99352

Attn: Mr. L. Scot Jenkins H4-02 (MS14-3A)

SUBCONTRACT NO. 24590-101-TSA-W000-0009
DURATEK FEDERAL SERVICES, INC. RESEARCH AND TECHNOLOGY SUPPORT,
TRANSMITTAL OF FINAL REPORT, APPROVED BY BNI R&T MANAGER FOR USE.

Dear Mr. Jenkins:

Please find attached the following Final Report approved by BNI R&T Manager for use on July 31, 2003:

- Final Report – Tests on the DuraMelter 1200 HLW Pilot Melter System Using
AZ-101 HLW Simulants
VSL-02R0100-2, Revision 1, dated 2/17/2003

Should you have any questions and/or concerns, please contact the undersigned on 376-9942.

Sincerely,

P. K. Brockman
Duratek Federal Services, Inc.
Vice President / RPP Project Manager

Attachments

cc:	Steve Barnes w/o att	H4-02 (MS1-B)	Jeannette Doyle w/o att	H4-02 (MS1-B)
	Karen Hornbuckle w/o att	H4-02 (MS1-B)	Karen Petro w/o att	Columbia
	Joe Perez w/o att	H4-02 (MS1-B)	Scot Jenkins w/o att	H4-02 (MS14-3A)
	Chris Musick w/o att	H4-02 (MS1-B)		
	Brad Bowan w/o att	Columbia		
	Glenn Diener w/o att	Columbia		
	Ron Garretsen w/o att	H4-02 (MS14-3A)		
	Chris Chapman w/o att	H1-11		
	Document Control file w/o att	Columbia		
	P. K. Brockman LB			

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MASTER DISTRIBUTION SCHEDULE

Sheet 1 of 1

Document Number	Rev
VSL-02R0100-2, Tests on the DuraMelter 1200 HLW Pilot Melter System Using HLW AZ-101 Simulants	1

Name	MSIN	Controlled	Uncontrolled	Size					Comments	
				8 1/2 x 11 (A)	11 x 17 (B)	Drawings				As Is
						C	D	E		
Joe Perez	MS1-B								Info	
Paul Rutland	MS1-C								Info	
George Mikula	MS5-K								Info	
Jeanette Doyle	MS1-B								Info	
Gary Smith	MS1-B								Info	
Ivan Papp	MS4-B2								Info	
Sean Sunday	MS14-4B								Info	
Scot Jenkins	MS14-3A								Info	
Greg Pace	MS1-C								Info	
Chi Leung	MS1-C								Info	
Scott Saunders	MS1-C								Info	
P. K. Brockman	H1-11								Info <i>8/21/03 JPD</i>	
Approver	<u>Jeanette Doyle</u> Print Name	<u><i>Jeanette Doyle</i></u> Signature					<u>8/21/03</u> Date

DOCUMENT REVIEW REQUEST

Sheet 1 of 1

TO BE COMPLETED BY DOCUMENT PREPARER				
DOCUMENT NUMBER	DRAFT REVISION #	DOCUMENT TITLE		
VSL-02R/0100-2	0	Test on the DuraMelter 1200 HLW Pilot Melter System Using AZ-101 HLW Simulants		
AB EVALUATION REQUIRED? ☐ YES ☐ NO (see document/procedure electronic index)				
PREPARER: <u>Joe Perez</u>		MS1-B	371-5188	6/19/02
Name (Print)		MSIN	Telephone Number	Date
DISTRIBUTION				
MSIN	REVIEWERS/REVIEWING ORGANIZATION'S MANAGER	ORGANIZATION (DEPARTMENT/ DISCIPLINE)	PURPOSE OF REVIEW	
			REQUIRED REVIEW	INFORMATION ONLY
MS1-B	S.M Barnes	Manager, R&T Vitrification	X	
MS1-C	O. Block	Manager, Vitrification Process Technology	X	
MS4-B1	P. Schuetz	Area Project Manger – HLW	X	
MS3-B	I. G. Papp	Process Engineering	X	
MSII-B	G. T. Warner	Supervisor, Quality Engineernig	X	
MS9-D	S. Jenkins	Manager, R&T Subcontracts		X
MS9-B	P. Vukovich	Procurement		X
MS3-A	C. Winkler	Melter Systems Engineering	X	
MS6-N1	P. Peistrup	ES&H – Environmental Manager	X	
	Other			
MS3-A	D. E. Carl	Melter Systems Engineering		X
MS6-N1	E. Saucedo	ES&H		X
MS1-B	F. W. Damerow	R&T		X
MS1-B	J. S. Lupfer	R&T		X
MS3-B	M. H. Hyman	Process Engineering		X
MS2-B	M. N. Brosee	Commissioning & Operations		X
Comments Due to Preparer by: <u>July 12, 2002</u>		NOTE: "Required Review" requires a response to the originator on whether or not there are comments.		
		Date		

TO BE COMPLETED BY REVIEWER		
REVIEWER'S NAME/ORGANIZATION: <u>J.m. Perez for Steve Barnes / R+T Vitrification</u> DATE: <u>July</u>		
This document was reviewed per 24590-WTP-GPP-PADC-003, Internal Review and Approval of Documents, section 3.0, and is:		
ACCEPTED, NO COMMENTS ☐	COMMENTS ON DOCUMENT ☐	COMMENTS ATTACHED ☒
Document maintains AB consistency? ☐ Yes ☐ No	_____ INITIAL, ES&H	
Document maintains QAM compliance? ☐ Yes ☐ No	_____ INITIAL, QA	
If the document is not compliant with the AB, an ABCN shall be approved and either the AB documents revised or a DTD approved before the document can be issued.		
AB revised (date): _____	ABCN No. _____	Approval Date: _____
	DTD No. _____	Approval Date: _____
Comments Resolved: <u>[Signature]</u>	_____ Date <u>11/21/02</u>	
Signature

DOCUMENT REVIEW RECORD

Sheet 1 of 10

Return to: Joe Perez

Comments Due: July 12, 2002

Document Title: Test on the DuraMelter 1200 HLW Pilot Melter System Using AZ-101 HLW Simulants		Document No. VSL-02R0100-2		Revision: 0	Date: June 11, 2002
Reviewer: JM Perez	Date: 8-15-02	Response by: KS Matlack	Date: 11/12/02	Comments Resolved: <i>[Signature]</i>	Date: 11/21/02

Item No.	Section/ Paragraph	Comment	Response	Significance ^a	Resolution	Incorporated?
1	General	<p>1. The status of equipment inspections and performance are generally not well documented, i.e., film cooler, feed nozzle, overflow, bubbler, T/C and level probes in the glass, lid and glass contact refractory, off-gas jumper and WESP.</p> <p>2. Many key data and analyses, e.g., pH, plenum pressure would be strengthened by adding an average and std. dev. for data so variability can be readily discerned. R&T and VSL will work together to identify key data for added data treatment on future reports.</p>	<p>The Project's desire for inspection data has grown over time. The Test Plan for this work specified only the film cooler, transition line, and the SBS and WESP internals, which are discussed in the report. Any other available data will be added where possible.</p> <p>OK.</p>	M		
2	Pg. 6	Footnote is not consistent with text of last objective regarding use of "L" versus simplified bubbler. This also pertains to the 2nd para. of page 8.	True, but this is correct. The Project elected not to run the tests associated with the last objective so none were performed. We will delete this objective from the list to avoid confusion.	M		
3	Pg. 7, first line	The phrase in () does not make sense. It may belong with the proceeding sentence.	Agreed.	M		
4	Pg. 7, Sec. 1.3.1, 1st para., 3rd sent.	Describe after which test the baffles were installed in the feed tank. I don't remember	Agreed.	M		

ORP-51438, Rev. 0

DOCUMENT REVIEW REQUEST

Sheet 1 of 1

TO BE COMPLETED BY DOCUMENT PREPARER			
DOCUMENT NUMBER	DRAFT REVISION #	DOCUMENT TITLE	
VSL-02R80100-2 <i>LS 4/24/03</i>	0	Test on the DuraMelter 1200 HLW Pilot Melter System Using AZ-101 HLW Simulants	
AB EVALUATION REQUIRED? ☐ YES ☐ NO (see document/procedure electronic index)			
PREPARER: <u>Joe Perez</u>		MS1-B	371-5188
Name (Print)		MSIN	Telephone Number
6/19/02 Date			

DISTRIBUTION				
MSIN	REVIEWERS/REVIEWING ORGANIZATION'S MANAGER	ORGANIZATION (DEPARTMENT/DISCIPLINE)	PURPOSE OF REVIEW	
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MS1-B	S.M Barnes	Manager, R&T Vitrification	X	
MS1-C	O. Block	Manager, Vitrification Process Technology	X	
MS4-B1	P. Schuetz	Area Project Manger – HLW	X	
MS3-B	I. G. Papp	Process Engineering	X	
MSII-B	G. T. Warner	Supervisor, Quality Engineernig	X	
MS9-D	S. Jenkins	Manager, R&T Subcontracts		X
MS9-B	P. Vukovich	Procurement		X
MS3-A	C. Winkler	Melter Systems Engineering	X	
MS6-N1	P. Peistrup	ES&H – Environmental Manager	X	
	Other			
33-A	D. E. Carl	Melter Systems Engineering		X
MS6-N1	E. Saucedo	ES&H		X
MS1-B	F. W. Damerow	R&T		X
MS1-B	J. S. Lupfer	R&T		X
MS3-B	M. H. Hyman	Process Engineering		X
MS2-B	M. N. Brosee	Commissioning & Operations		X

Comments Due to Preparer by: July 12, 2002 **NOTE:** "Required Review" requires a response to the originator on whether or not there are comments.

Date

TO BE COMPLETED BY REVIEWER	
REVIEWER'S NAME/ORGANIZATION: <u>D. Carl/C. Winkler/Melter Systems</u>	DATE: <u>27JUN02</u>
<i>This document was reviewed per 24590-WTP-GPP-PADC-003, Internal Review and Approval of Documents, section 3.0, and is:</i> ACCEPTED, NO COMMENTS ☐ COMMENTS ON DOCUMENT ☐ COMMENTS ATTACHED ☒	
Document maintains AB consistency? ☐ Yes ☐ No	_____ INITIAL, ES&H
Document maintains QAM compliance? ☐ Yes ☐ No	_____ INITIAL, QA
If the document is not compliant with the AB, an ABCN shall be approved and either the AB documents revised or a DTD approved before the document can be issued.	
ABCN No. _____ 3 revised (date): _____	Approval Date: _____ Approval Date: _____
DTD No. _____	
Comments Resolved: <u><i>[Signature]</i></u>	Date: <u>12 JUN 02</u>

Perez, Joseph

From: Hyman, Marve
Sent: Monday, April 28, 2003 11:06 AM
To: Perez, Joseph
Cc: Blodgett, Stephanie; Kaye, James H
Subject: RE: Concurrence - Comments on DM1200 AZ-101 Report VSL-02R0100-2 Rev 0

On behalf of I Papp/Engineering, I concur with VSL-02R0100-2 Rev 0,
 "Tests on the DuraMelter 1200 HLW Pilot Melter System Using AZ-101 HLW
 Simulants."

Marve

-----Original Message-----

From: Perez, Joseph
Sent: Tuesday, April 22, 2003 5:37 PM
To: Hyman, Marve
Cc: Blodgett, Stephanie
Subject: RE: Responses to Comments on DM1200 AZ-101 Report

Marv, I was putting a report approval packet together and I couldn't
 resurrect what should have been the final e:mail from you or the
 coordinator on this comment set. Do you have a record of it. I usually
 get the signed hard copy back from you. It would have been something
 you would have done in early December or so.

Sorry for the imposition.
 Thanks,

Joe Perez
 R&T/WTP
 Ph.: 509.371.8444
 Fax: 509.371.8346

-----Original Message-----

From: Hyman, Marve
Sent: Tuesday, November 12, 2002 3:21 PM
To: Perez, Joseph
Cc: Blodgett, Stephanie; Howell, John F.; Rouse, James
Subject: FW: Responses to Comments on DM1200 AZ-101 Report

Joe: Here are some replies to the comment responses.

General: Can we assume that the edits and improvements that were
 suggested will be incorporated as appropriate?

Item No. MH7: If the temperature readings are not suspect, then the
 conjecture is suspect, especially considering the decrease in
 temperature for Test 7. The conjecture needs to be qualified or
 replaced by another surmise.

Item No. MH8: Where it is mentioned that the scrubber was bypassed,
 add the words " . . . because there is no _____ scrubber in the WTP
 HLW offgas train." [Insert which scrubber; there is an SBS.]

Item No. MH14: A response to the comment should be given. (I
 inadvertently left out the "M" in the Significance column.)

Cheers, Marve

-----Original Message-----

From: Perez, Joseph
Sent: Tuesday, November 12, 2002 2:23 PM
To: Hyman, Marve; Rouse, James; Larson, Donald
Subject: FW: Responses to Comments on DM1200 AZ-101 Report

Please review your respective comments and tell me and Marve if they are acceptable. Need feedback by Friday if possible.

thanks

Joe Perez
R&T/WTP
Ph.: 509.371.8444
Fax: 509.371.8346

-----Original Message-----

From: Ian L. Pegg [mailto:ianp@vsl.cua.edu]
Sent: Tuesday, November 12, 2002 9:04 AM
To: Perez, Joseph
Cc: ioseph@duratekinc.com; bbowan@duratekinc.com
Subject: Responses to Comments on DM1200 AZ-101 Report

Joe:

Please find attached the subject comment responses.

Regards,

Ian.

DOCUMENT REVIEW REQUEST

Sheet 1 of 1

TO BE COMPLETED BY DOCUMENT PREPARER				
DOCUMENT NUMBER	DRAFT REVISION #	DOCUMENT TITLE		
VSL-02R80100-2 <i>16 4/21/03</i>	0	Test on the DuraMelter 1200 HLW Pilot Melter System Using AZ-101 HLW Simulants		
AB EVALUATION REQUIRED? ☐ YES ☐ NO (see document/procedure electronic index)				
PREPARER: <u>Joe Perez</u>		MSIN: <u>MS1-B</u>	Telephone Number: <u>371-5188</u>	Date: <u>6/19/02</u>
Name (Print)		MSIN	Telephone Number	Date
DISTRIBUTION				
MSIN	REVIEWERS/REVIEWING ORGANIZATION'S MANAGER	ORGANIZATION (DEPARTMENT/DISCIPLINE)	PURPOSE OF REVIEW	
			REQUIRED REVIEW	INFORMATION ONLY
MS1-B	S.M Barnes	Manager, R&T Vitrification	X	
MS1-C	O. Block	Manager, Vitrification Process Technology	X	
MS4-B1	P. Schuetz	Area Project Manger – HLW	X	
MS3-B	I. G. Papp	Process Engineering	X	
MSII-B	G. T. Warner	Supervisor, Quality Engineernig	X	
MS9-D	S. Jenkins	Manager, R&T Subcontracts		X
MS9-B	P. Vukovich	Procurement		X
MS3-A	C. Winkler	Melter Systems Engineering	X	
MS6-N1	P. Peistrup	ES&H – Environmental Manager	X	
	Other			
MS3-A	D. E. Carl	Melter Systems Engineering		X
MS6-N1	E. Saucedo	ES&H		X
MS1-B	F. W. Damerow	R&T		X
MS1-B	J. S. Lupfer	R&T		X
MS3-B	M. H. Hyman	Process Engineering		X
MS2-B	M. N. Brosee	Commissioning & Operations		X
Comments Due to Preparer by: _____		Date: <u>July 12, 2002</u>		
		NOTE: "Required Review" requires a response to the originator on whether or not there are comments.		

TO BE COMPLETED BY REVIEWER			
REVIEWER'S NAME/ORGANIZATION: <u>D. Larson, J. Roule, R. Peters, M. Hyman for I. PAPP/Proc. Eng.</u>		DATE: <u>12 JULY 2002</u>	
This document was reviewed per 24590-WTP-GPP-PADC-003, Internal Review and Approval of Documents, section 3.0, and is:			
ACCEPTED, NO COMMENTS ☐	COMMENTS ON DOCUMENT ☒	COMMENTS ATTACHED ☒	
Document maintains AB consistency? ☐ Yes ☐ No	INITIAL, ES&H _____		
Document maintains QAM compliance? ☐ Yes ☐ No	INITIAL, QA _____		
If the document is not compliant with the AB, an ABCN shall be approved and either the AB documents revised or a DTD approved before the document can be issued.			
AB revised (date): _____	ABCN No. _____	Approval Date: _____	
	DTD No. _____	Approval Date: _____	
Comments Resolved: _____			
Signature		Date	

Note to report, VSL-02R0100-2, "Tests on the DuraMelter 1200 HLW Pilot Melter System Using AZ-101 HLW Simulants" Rev 0

Phil Schuetz (a required reviewer) sent an e:mail stating he would have no comments. However, the report review coordinator misplaced the e:mail replay from Mr. Schuetz.

Joe Perez, R&T document review coordinator

6/11/03

DOCUMENT REVIEW REQUEST

Sheet 1 of 1

What is the
correct Doc #?

TO BE COMPLETED BY DOCUMENT PREPARER

DOCUMENT NUMBER VSL-02R80100-2	DRAFT REVISION # 0	DOCUMENT TITLE Test on the DuraMelter 1200 HLW Pilot Melter System Using AZ-101 HLW Simulants
AB EVALUATION REQUIRED? ☐ YES ☐ NO (see document/procedure electronic index)		
PREPARER: Joe Perez	MSIN: MS1-B	7137-5188
Name (Print)	MSIN	Telephone Number

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Comments Due to Preparer by: July 12, 2002
Date

NOTE: "Required Review" requires a response to the originator on whether or not there are comments.

TO BE COMPLETED BY REVIEWER

REVIEWER'S NAME/ORGANIZATION:	Ronald D. Regal/RA	DATE: 7/25/02
This document was reviewed per 24590-WTP-GPP-PADC-003, Internal Review and Approval of Documents, section 3.0, and is:		
ACCEPTED, NO COMMENTS ☐	COMMENTS ON DOCUMENT ☒	COMMENTS ATTACHED ☐
Document maintains AB consistency? ☐ Yes ☐ No	INITIAL, ES&H	
Document maintains QAM compliance? ☐ Yes ☐ No	INITIAL, QA	
If the document is not compliant with the AB, an ABCN shall be approved and either the AB documents revised or a DTD approved before the document can be issued.		
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Comments Resolved:	Comments received after review period. Addressed @ R-T discretion	
Signature	Date 7/25/02	

Perez, Joseph

From: Perez, Joseph
Sent: Monday, July 22, 2002 1:21 PM
To: Warner, Gregory T; Block, Oliver U; Peistrup, Philip
Cc: Saucedo, Ermelinda; WTP QA
Subject: Test on the DuraMelter 1200 HLW Pilot Melter, VSL-02R80100-2, rev. 0

You were identified as a required reviewer for the subject document.

Comments have not been received by the due date. Issue of the document will proceed without your comments. If comments are subsequently submitted, they will be addressed, resolved and incorporated (as appropriate) in the next revision of the document.

If you do not have comments, please respond as such to this message. In addition, by procedure your signature is required on the Attached DRR. Please complete the form and send it to Joe Perez, R&T, mail stop: MS1-B

Thank-you

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R&T Scoping Statement(s): VH-4 - HLW Melter Tests Pilot Scale

Test Specification Number/Title: 24590-HLW-TSP-RT-01-001, HLW Melter Attainment Studies and Equipment Performance Evaluations

Test Plan Number/Title: a). VSL-01T0100-2, Test Plan - Tests on the DuraMelter 1200 HLW Pilot Melter System Using HLW AZ-101 Simulants
b). VSL-01T0100-3, Test Plan - Throughput Tests on the DuraMelter 1200 HLW Pilot Melter System Using HLW Simulants

Test Report Number/Title: VSL-02R0100-2, Rev. 1, Tests on the DuraMelter 1200 HLW Pilot Melter System Using AZ-101 HLW Simulants

Prepared by: JM Perez, Jr. **Date:** April, 21, 2003

List Test Objectives:	State how objectives were met:
1) Determine processing rates without bubbling on the DM1200 system in longer-duration tests than were performed on the DM1000 system and at a larger scale than the tests performed on the DM100 system.	<p>Nine tests were performed on the DM1200 pilot melter system generating a total of 26,725 kg of glass, as summarized below:</p> <ul style="list-style-type: none"> • Test 1 – High-solids feed (570 g glass/liter), without bubbling (< 4 lpm); 168 hours, 2301 kg glass produced. • Test 2 – High-solids feed (570 g glass/liter) + 10 g sugar /liter, without bubbling (< 4 lpm); 216 hours, 2594 kg glass produced. • Test 3 – Low-solids feed (400 g glass/liter), with deep bubbling 1 (nominal 60 lpm); 115 hours, 6180 kg glass produced. • Test 4 – Low-solids feed (400 g glass/liter), with shallow bubbling (nominal 60 lpm); 122 hours, 3465 kg glass produced. • Test 5 – Nitrated feed (420 g glass/liter) with sugar ratio = 0.5, without bubbling (< 4 lpm); 144 hours, 1659 kg glass produced. • Test 6 – Frit-based feed (480 g glass/liter), without bubbling (< 4 lpm); 155 hours, 1901 kg glass produced. • Test 7 – Frit-based feed (480 g glass/liter), deep bubbling (60 lpm); 120 hours, 5976 kg glass produced. • Test 8 – Nitrated feed (420 g glass/liter) with sugar ratio = 0.7, without bubbling (< 4 lpm); 100 hours, 944 kg glass produced. • Test 9a – High-solids feed (570 g glass/liter) + 10 g sugar /liter, without bubbling (< 4 lpm); continuous feeding (as opposed to pulsed feeding) from two feed tubes instead of one, 69 hours, 859 kg glass produced. • Test 9b – High-solids feed (570 g glass/ liter) + 10 g sugar /liter, without bubbling (< 4 lpm); continuous feeding (as opposed to pulse) from two feed tubes instead of one, 1200°C glass temperature, 54 hours, 847 kg glass produced. <p>Test results are discussed in Section 3, Melter Operations. The DM1200 is approximately 10X larger than the DM100 system. Test durations were nominally 5 days in duration but varied depending on the test objective and whether or not bubblers were used (tests with bubblers achieve steady state more quickly than when bubblers are not used).</p>

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R&T Scoping Statement(s): VH-4 - HLW Melter Tests Pilot Scale

Test Specification Number/Title: 24590-HLW-TSP-RT-01-001, HLW Melter Attainment Studies and Equipment Performance Evaluations

Test Plan Number/Title: a). VSL-01T0100-2, Test Plan - Tests on the DuraMelter 1200 HLW Pilot Melter System Using HLW AZ-101 Simulants
b). VSL-01T0100-3, Test Plan - Throughput Tests on the DuraMelter 1200 HLW Pilot Melter System Using HLW Simulants

Test Report Number/Title: VSL-02R0100-2, Rev. 1, Tests on the DuraMelter 1200 HLW Pilot Melter System Using AZ-101 HLW Simulants

List Test Objectives:	State how objectives were met:
2) If the design-basis rate of 400 kg/m ² /d is achieved without bubbling with a high-solids feed, determine the effect of solids content on processing rates from a similar test but with the nominal solids loading in the melter feed (this corresponds to 20 wt% solids in the Envelope D material from pretreatment).	The design-basis rate was not achieved without bubblers. As a result, this objective was not executed.
3) Determine the effect of continuous versus pulsed feed from two feed tubes instead of one on feed spreading and processing rates.	The change to continuous feeding with two feed tubes using a peristaltic pump as opposed to pulsed feeding from a single feed tube using a simulated ADS pump did not result in an increase in production rates, which is evident when comparing the results to comparable tests discussed above (Test 9a: 230 kg/m ² /day vs. 205-255 kg/m ² /day). As a result it was concluded that the method and location of feeding the DM1200 did not have a measurable affect on production rate.
4) Obtain processing data for a simulated, acidified AZ-101 HLW feed (Test 1 only), as employed at WVDP, using the DM1200 system at the Project nominal melter feed concentration (20 wt% solids from pretreatment, which corresponds to approximately 400 grams of oxides per liter of feed), without bubbling, to determine the effect of nitrated melter feed on feed handling, foaming, cold-cap characteristics, feed spreading, and processing rates.	Non-bubbled tests #5 and #8 were conducted on 9/25/01 and 10/29/01, respectively. Test #5 used a carbon to nitrate ratio of 0.5 and test #8 was conducted with a ratio of 0.7. Maximum steady state processing rates for test #5 and #8 were 220 and 200 kg/m ² /d, respectively. The melter feed was nitrated through the addition of nitric acid to mimic the West Valley feed properties. Melter feed oxide concentration was 420 g/L. The pH of the test #5 and #8 melter feeds averaged 5.6 and 4.9, respectively. Although the cold cap was reported to appear more fluid than the alkaline-based feeds; it did not result in higher throughput rate attainment.
5) Obtain processing data for a simulated AZ-101 HLW feed with frit instead of glass forming chemicals using the DM1200 system, without bubbling, to determine the effect on feed handling, foaming, cold-cap characteristics, and processing rates.	Test #6 was conducted and obtained a steady-state production rate of 210 kg/m ² /d. Throughput rate and processing conditions were not significantly different than the baseline.

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R&T Scoping Statement(s): VH-4 - HLW Melter Tests Pilot Scale

Test Specification Number/Title: 24590-HLW-TSP-RT-01-001, HLW Melter Attainment Studies and Equipment Performance Evaluations

Test Plan Number/Title: a). VSL-01T0100-2, Test Plan - Tests on the DuraMelter 1200 HLW Pilot Melter System Using HLW AZ-101 Simulants
b). VSL-01T0100-3, Test Plan - Throughput Tests on the DuraMelter 1200 HLW Pilot Melter System Using HLW Simulants

Test Report Number/Title: VSL-02R0100-2, Rev. 1, Tests on the DuraMelter 1200 HLW Pilot Melter System Using AZ-101 HLW Simulants

List Test Objectives:	State how objectives were met:
6) Determine the amount of reductant (sugar) to be added to the feed to maintain part of the iron (5 to 15%) in the Fe^{2+} state in order to prevent foaming incidents and determine the processing rate with this feed.	Test #2 was conducted with incrementally increased sugar levels until a measurable change in the $\text{Fe}^{+2} : \text{Fe}^{\text{total}}$ ratio of glass was observed (but not to exceed 20% Fe^{+2}). It was determined that 10 g sugar per liter of melter feed was sufficient to alter the $\text{Fe}^{+2} : \text{Fe}^{\text{total}}$ from ~ 1% Fe^{+2} to ~12% Fe^{+2} . Table 5.4 summarizes the iron redox from all nine tests. Observable cold cap foaming, presumed to be due to reduction of manganese; was eliminated with the use of sugar. This surface foaming did not appear to hamper production during tests using bubblers. Therefore, sugar addition was thought to not be automatically assumed essential for HLW processing with bubblers.
7) Obtain processing data for a simulated AZ-101 HLW feed using the DM1200 system, without bubbling, at an operating temperature of between 1175 and 1200 °C, to determine the effect on feed handling, foaming, cold-cap characteristics, and processing rates.	Test #9b was conducted with the target glass temperature increased to ~1200°C. Actual average temperatures for thermocouples in the glass melt averaged between 1199°C and 1208°C. Glass production rate increased ~50% to 310 kg/m ² /d. It is noteworthy that the melter, SBS and WESP DFs were each lower during test #9 (combined 9a [1 sample period] and 9b [2 sample periods]) than the baseline, test #2. Table 6.2 summarizes these results.
8) Evaluate off-gas system component performance by sampling exhaust at various points in the off-gas system as well as sump solutions from the various off-gas system components.	Section 6 presents results of significant sampling and analyses of off-gas system component performance. Sample condensates and emissions sampling were both carried out.
9) Collect data on mass balance across the melter.	Feed, glass and off-gas emissions were obtained to support mass balance calculations. Flux rates of feed and glass were in agreement within 89% to 100%, depending on the test conducted (Tables 1.2, 1.3 and 1.4). Off-gas flux rates are reported in Table 6.2. Off-gas emissions ranged from ~ 0.2 to ~5 kg/m ² /d. These values were not large enough to close the mass balance in all cases.

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R&T Scoping Statement(s): VH-4 - HLW Melter Tests Pilot Scale

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Test Plan Number/Title: a). VSL-01T0100-2, Test Plan - Tests on the DuraMelter 1200 HLW Pilot Melter System Using HLW AZ-101 Simulants
b). VSL-01T0100-3, Test Plan - Throughput Tests on the DuraMelter 1200 HLW Pilot Melter System Using HLW Simulants

Test Report Number/Title: VSL-02R0100-2, Rev. 1, Tests on the DuraMelter 1200 HLW Pilot Melter System Using AZ-101 HLW Simulants

List Test Objectives:	State how objectives were met:
10) Identify possible processing problems such as foaming, secondary phase formation, and poor cold cap characteristics, particularly in comparison to previous small-scale and DM1000 melter tests.	Section 7, Summary and Conclusions compares DM1200 results with previous DM1000 and DM100 results. Results were generally consistent with DM1000. DM100 test results typically over-estimated larger scale results (see Figure 7.2). Process rates were typically restricted by cold cap solids accumulation. That is, the cold cap thickness was determined to be increasing over time indicating that the melt rates were not keeping up with the feed rate. This necessitated reduction in feed rates. Foam formation at the cold cap/glass interface was judged by R&T to be due to MnO_2 or Mn_2O_3 decomposition to MnO liberating oxygen. This was effectively eliminated with 8 g/L sugar. Later testing with bubblers also demonstrated that at bubbler air rates set to achieve optimum (maximum) throughput, foam accumulation was eliminated.
11) Collect data on product glass composition and product quality.	Section 5 presents results of glass composition and redox analyses. Glass properties for the target glass were obtained during laboratory studies and documented in the test plan.
12) Collect operating data with a simulated air-displacement slurry (ADS) pump melter feed system (i.e., intermittent, pulsed flow of feed to the melter), particularly with respect to off-gas transients.	The majority of tests were conducted with the simulated ADS pump. Figure 4.1 depicts the effect of the intermittent feed system on plenum pressure. Plenum pressure typically ranged between -2 to -8 in. WC.
13) Determine the effect of bubbling and the positioning of the bubblers (deep or shallow) on processing rates.	Deep bubbling (bubbler located 6 in. from floor) resulted in throughput rate of 980 kg/m ² /d with a feed containing 400 g-ox/L (Test #3). Shallow bubbling (bubbler located 13.5 in. from floor) resulted in throughput rate of 540 kg/m ² /d with a feed containing 400 g-ox/L (Test #4).
14) Obtain processing data for a simulated AZ-101 HLW feed with frit instead of glass forming chemicals using the DM1200 system, with bubbling (standard "L" shaped bubbler design), to determine the effect on feed handling, foaming, cold-cap characteristics, and processing rates.	Test #7 resulted in a throughput rate of 1100 kg/m ² /d when processing AZ-101 simulant with frit. Feeding and cold cap processing characteristics were similar to the baseline feed.

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R&T Scoping Statement(s): VH-4 - HLW Melter Tests Pilot Scale

Test Specification Number/Title: 24590-HLW-TSP-RT-01-001, HLW Melter Attainment Studies and Equipment Performance Evaluations

Test Plan Number/Title: a). VSL-01T0100-2, Test Plan - Tests on the DuraMelter 1200 HLW Pilot Melter System Using HLW AZ-101 Simulants
b). VSL-01T0100-3, Test Plan - Throughput Tests on the DuraMelter 1200 HLW Pilot Melter System Using HLW Simulants

Test Report Number/Title: VSL-02R0100-2, Rev. 1, Tests on the DuraMelter 1200 HLW Pilot Melter System Using AZ-101 HLW Simulants

List any Test Exceptions:	Did exceptions impact the objective? ☒ Yes ☐ No (Explain)
1) 24590-101-TEF-W000-0009-38-02 Test Exception #1	Directed VSL to perform SW-846 method sampling of off-gas as a "dress rehearsal" for future DM1200 testing.
List Success Criteria	Did the test meet the criteria? ☒ Yes ☐ No (Explain)
1) Conduct testing per the approved test matrix and obtain steady state throughput data sufficient to assess the effect of the test variables on glass production rate.	As described above the test matrix was successfully executed. Adequate data was obtained with which to measure steady state throughput rates for each variable.
2) Operate the integrated off-gas treatment system	The complete integrated system was operated during testing. Multiple sampling periods occurred during each test to develop emissions estimates and decontamination factors for each unit operation.
List QA Requirements:	Did the subcontractor meet the requirements? ☒ Yes ☐ No (Explain)
1) NQA-1	Work was conducted under an NQA-1 based quality assurance program that is in place at VSL. This program is supplemented by a Quality Assurance Project Plan for RPP-WTP work [11] that is conducted at VSL, which includes the correlation of the VSL QA program with 10-CFR-830.120. Work conducted prior to 8/6/01 (includes execution of Tests #1 and #2) was performed in compliance with the requirements of NQA-1 (1994). Work conducted after 8/6/01 was done in compliance with the requirements of NQA-1 (1989) and NQA-2a (1990).
List R&T Test Conditions:	Were test conditions followed? ☒ Yes ☐ No (Explain)
1) Feed oxide concentrations: <ul style="list-style-type: none"> • "high solids" = 570 g/L • "high water" = 400 g/L • nitrated feed = 420 g/L • feed w/ frit = 480 g/L 	Feeds were within 9 to 20 g-oxide per liter of target values. These are provided in Tables 2.4 and 2.5.

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R&T Scoping Statement(s): VH-4 - HLW Melter Tests Pilot Scale

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Test Plan Number/Title: a). VSL-01T0100-2, Test Plan - Tests on the DuraMelter 1200 HLW Pilot Melter System Using HLW AZ-101 Simulants
b). VSL-01T0100-3, Test Plan - Throughput Tests on the DuraMelter 1200 HLW Pilot Melter System Using HLW Simulants

Test Report Number/Title: VSL-02R0100-2, Rev. 1, Tests on the DuraMelter 1200 HLW Pilot Melter System Using AZ-101 HLW Simulants

2) Operate melter glass temperature nominally at 1150°C; except for high temperature test, Test # 9b which is to be operated at 1200°C	The average value of five thermocouples positioned between nine inch and eighteen inches from the tank floor are used to adjust electrode power input to maintain the temperature at 1150°C, $\pm 25^{\circ}\text{C}$. Operators are also allowed to use judgement in changing the power input set point if any one thermocouple "significantly" exceeds the temperature limit. Table 3.2 reports the average, minimum and maximum values for each test for each thermocouple. The minimum value is a little misleading as the data monitoring includes the initial startup of the melter. However, as seen in Figures 3.10 through 3.18 the tight cluster of data points provides visual evidence of consistently maintaining the average bulk glass temperature around the 1150°C setpoint.
3) Glass composition	The specified AZ-101 composition was maintained throughout the testing period. Feed sample analyses are documented in Table 2.6. Product glass analyses are documented in Tables 5.1 and 5.2.
4) Cold cap coverage	Goal was to maintain full glass surface coverage to the extent possible. Based on visual inspection of cold cap coverage less than full coverage could be maintained during some periods due to the propensity for the feed to accumulate in mounds rather than spreading across the glass surface. This is due to feed properties, and therefore, was acceptable.
5) Plenum temperature maintained between 400°C and 600°C	Average temperatures remained below 600°C for all tests. In about half the tests the average temperature was below 400°C. Because plenum temperature is responsive to cold cap coverage and cold cap conditions, plenum temperature is not independently controlled. Condition was considered fulfilled considering need to maximize feeding and throughput. Table 3.2 reports the average, minimum and maximum values for each test. Figures 3.19 – 3.27, inclusive, provides data plots of plenum temperature versus time.
Was testing performed with simulants? If yes, discuss how results compare to radioactive tests. ☒ Yes ☐ No	
Testing was performed with a simulant specified prior to the BNI contract period. Simulant was required to be held constant in order to be able to assess throughput effects as specific parameters were changed. Review of the report, "WTP-RPT-075, Rev. A, "Development of LAW and HLW Vitrification Physical Property Bounding Conditions and Simulant Verification Criteria" did not identify or document suitable radioactive AZ-101 data. Particle size data showed the simulant to have a mean particle diameter volume distribution 130% larger than an AZ-101 waste core sample data reported in PNL-11025. However, the mean particle diameter number distribution of the simulant was 27% smaller. Particle size can affect fluid properties and melting properties. The effect of GFC particle sizes is expected to significantly affect the rate of melting. Comparing limited HLW radioactive data to simulant data it is currently thought that the VSL simulant may represent the lower end of yield stress and consistency fields. As a result, the actual radioactive waste may be expected to result in lower processing throughput results due to difficulties in cold cap flow. If this is true the test results were conservative in that they overpredict expected production rate and

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R&T Scoping Statement(s): VH-4 - HLW Melter Tests Pilot Scale

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Test Plan Number/Title: a). VSL-01T0100-2, Test Plan - Tests on the DuraMelter 1200 HLW Pilot Melter System Using HLW AZ-101 Simulants
b). VSL-01T0100-3, Test Plan - Throughput Tests on the DuraMelter 1200 HLW Pilot Melter System Using HLW Simulants

Test Report Number/Title: VSL-02R0100-2, Rev. 1, Tests on the DuraMelter 1200 HLW Pilot Melter System Using AZ-101 HLW Simulants

bubblers would still be recommended for the HLW melter.

Are all discrepancies resolved? If no, explain.

☒ Yes ☐ No

Are all subcontractor signoffs completed?

☒ Yes ☐ No

This work is acceptable to complete the indicated:
If Other, please explain what the report completes.

☒ Test Specification(s) ☐ Scoping Statement(s)
☒ Test Plan(s) ☐ Other

Does the Testing or Report suggest any follow-on work? If yes, describe the suggested activity and, if appropriate, attach a Request for Technology Development (RTD). ☒ Yes ☐ No

1. Testing has resulted in the recommendation that bubblers be incorporated into the WTP HLW melter design in order to meet the throughput requirement of 3.0 MT/d base plate production requirement. At the time testing was performed the based plate production requirement was 1.5 MT/d. Bubblers were required to meeting this original lower rate as well.
2. The erratic performance of the WESP indicated serious defects in either its physical or its electrical power supply design. Continued assessment and troubleshooting ultimately determined the defects to be physical; i.e., electrical shorting due to poorly designed isolation, corrosion of clamping components due to the aggressive off gas environment, and lack of sufficient drainage capability to prevent the accumulation of standing water. These defects were corrected in 2002.
3. Solids accumulation of the SBS downcomer near the entrance to the distribution plate dictate that continued assessment and engineering scrutiny be applied to this area.
4. The simulated ADS pump arrangement was a poor representation of the ADS. The installation and use of the ADS pump should be a priority. Note that the ADS pump was installed in 2002.

Additional comments:

Approved by R&T Manager or Designee:

[Signature]

Date:

7/31/2003