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FY2017 ILAW Glass Corrosion Testing with the Single-Pass Flow-Through Method

February 2018

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Pacific Northwest National Laboratory
Richland, Washington 99352

Executive Summary

The inventory of immobilized low-activity waste (ILAW) produced at the Hanford Tank Waste Treatment and Immobilization Plant (WTP) will be disposed of at the near-surface, on-site Integrated Disposal Facility (IDF). When groundwater comes into contact with the waste form, the glass will corrode and radionuclides will be released into the near-field environment. Because the release of the radionuclides is dependent on the dissolution rate of the glass, it is important that the performance assessment (PA) model accounts for the dissolution rate of the glass as a function of various conditions. To accomplish this, an IDF PA glass dissolution model based on Transition State Theory (TST) can be employed. The model is able to account for changes in temperature, exposed surface area, and pH of the contacting solution as well as the effect of silicon solution concentrations, specifically the activity of orthosilicic acid (H_4SiO_4), whose concentration is directly linked to the glass dissolution rate. In addition, the IDF PA model accounts for the ion exchange process. The effect of temperature, pH, H_4SiO_4 activity, and the rate of ion exchange can be parameterized and implemented directly into the PA rate model. The rate model parameters are derived from laboratory tests with the single-pass flow-through (SPFT) method. The provided data can be used by glass researchers to further the understanding of ILAW glass behavior, by IDF PA modelers to use the rate model parameters in PA modeling efforts, and by Department of Energy (DOE) contractors and decision makers as they assess the IDF PA program.

To date, full sets of rate model parameters have been determined for nine ILAW glass compositions; thus, additional rate model parameters on a wider range of compositions will supplement the existing body of data for PA maintenance activities. In this report, we present SPFT results on two simulant ILAW enhanced low-activity waste (LAW) glass correlation (“ORLEC” glasses) developed at the Vitreous State Laboratory at the Catholic University of America (VSL): ORLEC28 and ORLEC33. Understanding the corrosion behavior of these enhanced correlation ILAW glasses will provide data for the IDF PA models and maintenance and provide assurance to the public and WTP operators and stakeholders that the enhanced waste glass product generated at WTP can safely be stored at IDF.

The ORLEC28 and ORLEC33 ILAW glass compositions were developed as part of a program to develop new enhanced ILAW glass correlations (Muller et al. 2016, Muller et al. 2017). The enhanced glass compositions have higher waste loading than the baseline glass compositions previously parameterized for PA modeling purposes (Freedman et al. 2015, Pierce et al. 2004). The purpose of the correlation effort is to calculate the amount and type of glass forming chemicals (GFCs) required for each particular feed batch sent to the WTP LAW facility. In general, limits of waste loading are divided into three main regions: 1) alkali-limited, 2) sulfate-alkali limited, and 3) a maximum sulfate content. Glass formulations must also take into account other factors such as viscosity, short-term durability tests, crystallization, and electrical conductivity. The ORLEC28 glass composition lies in the alkali-limited region whereas the ORLEC33 glass composition lies near the boundary of the alkali-limited and sulfate-alkali limited regions.

The ORLEC28 glass was developed at VSL as part of the Phase 1 Enhanced LAW Glass Correlation effort that examined the immobilization of a range of waste compositions with relatively high-alkali and low-sulfate levels (Muller et al. 2016). The total alkali content ($\text{ALK} = \text{Na}_2\text{O} + 0.66\text{K}_2\text{O}$) of the glass is 24.33 wt% whereas the sulfate loading was relatively low at 0.4 wt%. The composition of ORLEC33 was designed as part of the Phase 2 Enhanced LAW Glass Correlation effort that examined medium and lower alkali regions in the sulfate-versus-alkali feeds (Muller et al. 2017). The glass has a total alkali content of 23.33 wt% and a relatively high SO_3 content of 1.0 wt%. Both glasses meet all ILAW processing and durability requirements. ORLEC28 was selected for SPFT testing to examine high-alkali glasses with intermediate potassium content while ORLEC33 was selected to examine the high sodium LAW with higher sulfate content region (Muller and Pegg 2016a).

Several SPFT tests with ORLEC28 and ORLEC33 were performed in a variety of chemically-controlled conditions and test temperatures. The rate model parameters obtained for ORLEC28 and ORLEC33 are provided in Table ES.1. The dilute-condition rate parameters [(rate constant (k_0), activation energy (E_a), pH-dependent term (η)] are nearly equivalent for both glasses. In comparison to previously-tested ILAW glasses, the k_0 values fall within the range of other ILAW glass k_0 values, whereas the values of E_a and η are slightly greater than the majority of other ILAW glasses. However, E_a still falls within the range of values found for other silicate minerals, which bolsters the theory that the breaking of the Si-O bond in the glass network controls the glass dissolution rate. Additionally, though the η term is slightly larger for ORLEC28 and ORLEC33, the value still falls within uncertainty of the other ILAW glasses ORPLB2 and LAWA44.

Tests conducted at various levels of amorphous silica saturation show that the glasses are sensitive to changes in inlet Si concentrations. However, a decrease in the glass dissolution rate is not always observed with increasing Si inlet concentrations. This leads to situations where a highly subjective choice of fitting the data is necessary. In order to avoid such subjective analysis of the data in the future, other methods of determining K_g , such as through static testing, should be considered. Lastly, secondary phases should be further studied, through both experimental and geochemical modeling, in order to better predict the behavior of ORLEC28 and ORLEC33 and other ILAW glasses in the IDF repository environment.

Table ES.1. Summary of Rate Model Parameters Obtained for Select ILAW Glasses at 15°C

	k_0 (g/[m ² d])	K_g (T) (mol L ⁻¹)	η	E_a (kJ/mol)	$r_{IEX}^{(a)}$ (mol m ⁻² s ⁻¹)	Reference
LD6-5412	9.7×10^6	1.14×10^{-4}	0.40 ± 0.03	74.8 ± 1.0	1.74×10^{-11}	(Mann et al. 2001, McGrail et al. 1997)
LAWABP1	3.4×10^6	4.90×10^{-4}	0.35 ± 0.03	68 ± 3.0	3.4×10^{-11}	(McGrail et al. 2001a)
LAWA44	1.3×10^4 (R ² = 0.78)	1.87×10^{-3} (R ² = 0.95)	0.49 ± 0.08	60 ± 7	5.3×10^{-11}	(Pierce et al. 2004)
LAWB45	1.6×10^4 (R ² = 0.90)	1.79×10^{-3} (R ² = 0.78)	0.34 ± 0.03	53 ± 3	$0.0 \times 10^{0(c)}$	(Pierce et al. 2004)
LAWC22	1.0×10^5 (R ² = 0.98)	1.80×10^{-3} (R ² = 0.94)	0.42 ± 0.02	64 ± 2	1.2×10^{-10}	(Pierce et al. 2004)
ORPLB2	4.5×10^4	1.70×10^{-3}	0.49 ± 0.05	64 ± 4	3.4×10^{-10}	(Papathanassiou et al. 2011)
IDF7-E12	5.7×10^4	1.87×10^{-3}	0.32 ± 0.03	55 ± 5	$<1 \times 10^{-10}$	(Papathanassiou et al. 2017b)
IDF18-A161	5.9×10^6 (R ² = 0.89)	2.3×10^{-4} (R ² = 0.98)	0.28 ± 0.06	61 ± 6	7.6×10^{-11}	(Neeway et al. 2017)
ORPLG9	2.5×10^8 (R ² = 0.91)	Log K _g = 100 ^(b)	0.36 ± 0.07	81 ± 7	5.3×10^{-11}	(Neeway et al. 2017)
ORLEC28	2.7×10^6 (R ² = 0.99)	1.3×10^{-4}	0.55 ± 0.02	79 ± 2	$2.7 \times 10^{-11(d)}$	This report
ORLEC33	3.8×10^6 (R ² = 0.99)	1.1×10^{-4}	0.56 ± 0.02	81 ± 2	$3.3 \times 10^{-11(d)}$	This report

(a) Values as reported in the original document. See Lonergan and Neeway (2017) for a correction to the r_{IEX} calculation.

(b) See Neeway et al. (2017) for a discussion on the K_g value of ORPLG9.

(c) No detectable ion exchange rate for LAWB45.

(d) Values calculated as described in correction proposed in Lonergan and Neeway (2017). See Section 3.3 for a discussion of errors associated with these ion exchange values.

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Acronyms and Abbreviations

aq	aqueous
AFM	Atomic Force Microscopy
ASTM	ASTM International (consensus standards organization, West Conshohocken, PA (www.astm.org))
BET	Brunauer-Emmett-Teller
CCC	Canister Centerline Cooled
DOE	U.S. Department of Energy
EQL	estimated quantification limit
FY	fiscal year (October 1 through September 30, e.g., FY 2017 ends on September 30, 2017)
H ₄ SiO ₄ (aq)	aqueous orthosilicic acid
HLW	high-level waste
ICP-MS	Inductively Coupled Plasma–Mass Spectrometry
ICP-OES	Inductively Coupled Plasma–Optical Emission Spectroscopy
IDF	Integrated Disposal Facility
IEX	ion exchange
ILAW	immobilized low-activity waste
FF	flux fusion
GFC	glass forming chemical
LAW	low-activity waste
MD	microwave-assisted acid digestion
ND	not determined
NQA-1	ASME nuclear quality assurance standard
ORLEC	enhanced LAW glass correlation
ORP	DOE Office of River Protection
PA	performance assessment
PCT	product consistency test
pH(RT)	pH at room temperature
PNNL	Pacific Northwest National Laboratory
PTFE	polytetrafluoroethylene
PUF	pressurized unsaturated flow (test)
<i>q/S</i>	solution-flow-rate-to-surface-area ratio
QA	quality assurance
R&D	research and development
RCRA	Resource Conservation and Recovery Act
SEM	scanning electron microscopy

SiO ₂ (am)	amorphous silica
SPI	Structure Probe, Inc.
SPFT	single-pass flow-through test
S/V	surface area to volume ratio
TEM	Transmission Electron Microscopy
TRIS	<i>tris</i> (hydroxymethyl)aminomethane
TST	transition state theory
VHT	vapor hydration test
VSL	Vitreous State Laboratory at The Catholic University of America
WRPS	Washington River Protection Solutions
WTP	Hanford Tank Waste Treatment and Immobilization Plant
WWFTP	WRPS Waste Form Testing Program
XRD	X-ray Diffraction

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1.0 Introduction

The Hanford Tank Waste Treatment and Immobilization Plant (WTP) will produce immobilized low activity waste (ILAW) glass as part of the clean-up mission at the U.S. Department of Energy (DOE) Hanford Site. This inventory of ILAW glass will be disposed of on-site at the Integrated Disposal Facility (IDF). With its near-surface location, waste forms placed into the IDF will eventually come into contact with groundwater, which will initiate corrosion and release radionuclides into the near-field environment. The release rate of the radionuclides is dependent on the dissolution rate of the glass. The glass dissolution rate is known to be dependent on the glass composition, temperature, exposed surface area, and the pH of the contacting solution. For disposal at the IDF, only the temperature of 15 °C is assumed as a constant (McGrail et al. 2003). Other environmental factors (contacting solution chemistry and pH) are affected by infiltration rates, interactions with engineered barriers, gas-water equilibria, precipitation of secondary phases, alkali-ion exchange, and dissolution of the glass itself.

Per the radioactive waste management DOE Order 435.1, performance assessments (PA) of the disposal site must be performed. The PA describes the potential long-term impacts on human health and the environment resulting from disposal of wastes at the IDF. In order to assess these risks, predictions of the long-term release of radionuclides and other contaminants of concern from the glass are required.

The engineered system of the IDF contains multiple engineered components including a Resource Conservation and Recovery Act (RCRA) cap, back fill material, cement containers or grouted waste, ILAW glass, and a leachate collection system (Mann et al. 2003). A reactive-chemical-transport-modelling framework must account for all facets of this system to describe influences of fluid flow and glass-water reactions on the chemistry of pore water contacting waste forms in the IDF. In this modelling approach the infiltrating solution chemistry is coupled with kinetic rate equations developed to calculate the glass dissolution rate dependence on changes in liquid composition as a function of time and space. The kinetic rate equation assumes that (1) Transition State Theory (TST) arguments and assumptions describe dissolution and precipitation rates departing from equilibrium and (2) the displacement from thermodynamic equilibrium principally governs the driving force behind the transformation of unstable to stable silicate materials.

The input parameters to reactive transport codes are derived from laboratory testing. Specifically, single-pass flow-through (SPFT) (ASTM C1662-10) testing is utilized to supply ILAW kinetic rate model input parameters (Bacon and McGrail 2001, McGrail et al. 1997, McGrail et al. 1998b, McGrail et al. 2000b, Papathanassiou et al. 2011, Pierce et al. 2004). Three additional tests are utilized to obtain information on alteration phases that can form for a certain glass composition; (1) the Pressurized Unsaturated Flow (PUF) test (McGrail et al. 1996), (2) the Product Consistency Test (PCT) (ASTM C1285-14) and (3) the Vapor Hydration Test (VHT) (ASTM C1663-09). A combination of these approaches, amongst others, allows for a discretionary focus on specific components of the glass corrosion process. Further information on the techniques and their application in long-term glass corrosion can be found in McGrail et al. (1998a, 2000a), Neeway et al. (2014), and Ryan and Freedman (2016). This report will present rate model parameter measurements from SPFT testing on two enhanced ILAW correlation glasses: ORLEC28 and ORLEC33.

Both the ORLEC28 and ORLEC33 ILAW glass compositions were designed as part of a program to develop new enhanced ILAW glass correlations that have increased waste loading beyond baseline compositions (Muller et al. 2016, Muller et al. 2017). The purpose of the correlation is to calculate the amount and type of glass forming chemicals (GFCs) required for each particular feed batch sent to the WTP LAW facility. In general, limits of waste loading are broken into three main regions: 1) alkali-limited, 2) sulfate-alkali limited, and 3) a maximum sulfate content. In addition to these waste loading

limits, glass formulations must also take into account other factors such as viscosity, short-term durability tests, crystallization, and electrical conductivity.

The ORLEC28 glass was developed at the Vitreous State Laboratory (VSL) at The Catholic University of America as part of the Phase 1 Enhanced LAW Glass Correlation effort (Muller et al. 2016). This set of Phase 1 glasses examined the relatively high-alkali/low-sulfate region of waste. Similar to correlation baseline glass formulations, the GFCs are varied depending on the sulfur to alkali ratio in the LAW stream. The ORLEC28 glass was developed based on a mix of waste from Tanks AN-105 (48.34%) and AP-101 (51.66%). The target Na_2O concentration was 22.11 wt% and the target K_2O concentration was 3.36 wt% resulting in a total alkali content ($\text{ALK} = \text{Na}_2\text{O} + 0.66\text{K}_2\text{O}$) of 24.33 wt%. In this waste region, SnO_2 is added to improve chemical durability (Muller et al. 2016). Sulfate loading was 0.4 wt%. The ORLEC28 glass was selected for DM100 melter tests and met all of the ILAW processing and durability (PCT-A B release of 0.51 g m^{-2} and 24-day VHT alteration rate of $7 \text{ g m}^{-2} \text{ d}^{-1}$) requirements. The glass was selected for SPFT testing to examine high-alkali glasses with intermediate potassium content (Muller and Pegg 2016a).

The composition of ORLEC33 was designed as part of the Phase 2 Enhanced LAW Glass Correlation effort (Muller et al. 2017). The Phase 2 Enhanced Glasses examined medium and lower alkali regions in the sulfate-versus-alkali feeds. The ORLEC33 glass had a target Na_2O concentration of 23.00 wt% and the target K_2O concentration was 0.50 wt% resulting in a total alkali content ($\text{ALK} = \text{Na}_2\text{O} + 0.66\text{K}_2\text{O}$) of 23.33 wt%. The glass has a relatively high SO_3 content of 1.0 wt%. In this region of the correlation line, SnO_2 is not added while V_2O_5 is added to increase SO_3 solubility (Muller et al. 2017). The ORLEC33 crucible test resulted in a glass PCT-A boron release of 0.74 g m^{-2} and 24-day VHT alteration rate of $28.8 \text{ g m}^{-2} \text{ d}^{-1}$, which both meet ILAW durability requirements. The glass was chosen for SPFT testing to examine the high sodium LAW with higher sulfate content region (Muller and Pegg 2016a).

The SPFT results and the rate law parameters generated for ORLEC28 and ORLEC33 can be compared to other ILAW glasses – both baseline glasses and enhanced glasses. In particular, a direct comparison can be made with the other enhanced correlation glasses, ORLEC14 and ORLEC46, that are also scheduled to undergo SPFT testing in FY2017 (Muller and Pegg 2016a). The results demonstrate that the enhanced correlation glasses exhibit corrosion behavior that is similar to previously-tested glass compositions. However, in order to generate a set of data that is capable of supporting the expected large range of glass compositions, it is suggested that a wider range of compositions are chosen in order to bracket glass compositions that will be produced at WTP once the facility becomes operational.

1.1 Purpose and Organization

The purpose of this report is to provide ILAW rate model parameters for PA maintenance for the glasses ORLEC28 and ORLEC33. The rate model parameters are tabulated with rate model parameters from past ILAW glasses (Table ES.1). Section 2.0 describes the fabrication and characterization of ORLEC28 and ORLEC33 and the SPFT test method. Section 3.0 presents SPFT results collected on ORLEC28 and ORLEC. Section 4.0 summarizes the key conclusions of this testing effort and compares the ILAW rate model parameter values to a select number of previously-tested ILAW glasses. The present effort uses the SPFT data to provide input to the IDF PA maintenance effort, in particular, for enhanced ILAW correlation glasses. The data used to calculate the rate model parameters are provided in Appendix A. All raw data obtained from this effort are presented in Appendix B-D.

1.2 Quality Assurance

This work was conducted with funding from Washington River Protection Solutions (WRPS) under contract 36437-161, ILAW Glass Testing for Disposal at IDF. The work was conducted as part of Pacific Northwest National Laboratory (PNNL) Project 68391, ILAW Glass Testing for Disposal at IDF.

All research and development (R&D) work at PNNL is performed in accordance with PNNL's laboratory-level Quality Management Program, which is based on a graded application of NQA-1-2000, *Quality Assurance Requirements for Nuclear Facility Applications*, to R&D activities. In addition to the PNNL-wide quality assurance (QA) controls, the QA controls of the WRPS Waste Form Testing Program (WWFTP) QA program were also implemented for the work. The WWFTP QA program consists of the WWFTP Quality Assurance Plan (QA-WWFTP-001) and associated QA-NSLW-numbered procedures that provide detailed instructions for implementing NQA-1 requirements for R&D work. The WWFTP QA program is based on the requirements of NQA-1-2008, *Quality Assurance Requirements for Nuclear Facility Applications*, and NQA-1a-2009, *Addenda to ASME NQA-1-2008 Quality Assurance Requirements for Nuclear Facility Applications*, graded on the approach presented in NQA-1-2008, Part IV, Subpart 4.2, "Guidance on Graded Application of the Nuclear Quality Assurance (NQA) Standard for Research and Development". Performance of the FY2016 SPFT tests and preparation of this report were assigned the technology level "Applied Research" and were conducted in accordance with procedure QA-NSLW-1102, *Scientific Investigation for Applied Research*. All staff members contributing to the work have technical expertise in the subject matter and received QA training prior to performing quality-affecting work. The "Applied Research" technology level provides adequate controls to ensure that the activities were performed correctly. Use of both the PNNL-wide and WWFTP QA controls ensured that all client QA expectations were addressed in performing the work.

2.0 Glass Selection, Kinetic Rate Equation, and SPFT Test Method

2.1 Kinetic Rate Model Equation

The current understanding of the glass-water interaction has been summarized in two recent review articles (Gin et al. 2013, Vienna et al. 2013). Based on these reviews, it has been concluded that when glass is contacted with initially-dilute water in a closed system, it corrodes at a relatively fast rate, known as the forward rate. Glass dissolution in dilute systems is described as Stage I behavior. As the reaction proceeds and species are released from the glass into solution, the glass dissolution rate slows and eventually reaches a rate that, in static conditions, is three to four orders of magnitude slower than the forward rate. The slow residual rate of glass dissolution is described as Stage II behavior. The mechanisms responsible for controlling the long-term release rate have not yet been determined but may be a combination of an affinity effect, water diffusion in glass, dissolution of a passivating layer, reactive transport of species through the alteration layer, or the precipitation of secondary phases. As the glass dissolution reaction continues and the solution becomes saturated with respect to secondary phases, precipitation of certain phases may result in a marked acceleration in the reaction rate. This resumption in rate has been termed Stage III.

The entire glass-water interaction entails a complex set of coupled physicochemical mechanisms and a single equation or model that fully addresses the complexities and reflects observed behaviors has not yet been developed. However, a general rate equation based on arguments and assumptions of TST has been used to describe the dissolution of glass (and more ordered materials) in the presence of an aqueous solution and the general rate equation is described below. Transition State Theory is based on the concept that, in a set of elementary reactions, the overall reaction rate is governed by the slowest elementary reaction. Elementary reactions have simple stoichiometry and can be combined as an overall reaction. In many cases, the elementary reactions can only be inferred. Grambow (1985) argued that the rate-limiting reaction that best describes glass dissolution is the dissolution of SiO_2 to form silicic acid:

where $\text{SiO}_2 \cdot 2\text{H}_2\text{O}^\ddagger$ represents an activated complex. Note that a double-headed arrow links the reactants and the activated complex in Eq. 2-1, symbolizing a reversible reaction. The rate at which the activated complex (a transitional, short-lived aggregate of atoms that form during the collision process) changes from reactants to products limits the rate at which the overall reaction can proceed (Eyring 1935). As demonstrated in Eq. 2-1 with the single-direction arrow, the TST formulation assumes that the decay of the activated complex to form orthosilicic acid [$\text{H}_4\text{SiO}_4(aq)$] is an irreversible reaction.

The general rate equation based on TST of chemical kinetics given as (Åagaard and Helgeson 1982):

$$r_\phi = k_\phi \prod_i a_i^{-\hat{n}_{i,j}} \left(1 - \exp\left(-\frac{A}{\sigma RT}\right) \right) \quad \text{Eq. 2-2}$$

where:

- r_ϕ = dissolution rate
- k_ϕ = kinetic constant of hydrolysis of the mineral ϕ
- a_i = activity of the reactants i in the limiting elementary step j

- $\hat{n}_{i,j}$ = stoichiometric coefficient for reactant i in the limiting reaction j
 A = chemical affinity of the overall dissolution reaction
 σ = average stoichiometric number of the overall reaction
 R = gas constant
 T = temperature

The reaction affinity, A , is the derivative of the total free energy, G , with respect to a reaction coordinate or the extent of the reaction, ξ . Therefore, the rate calculated from Eq. 2-2 is proportional to the free energy in the system. Eq. 2-2 relates the composition of water contacting the glass to the corrosion rate. Currently, H^+ (or OH^- as explained in Section 3) is the only aqueous species that has been found to directly influence the rate via the product term of activities (McGrail et al. 1997). However, other species such as Al and Na have been proposed to influence the dissolution rate of waste glasses, basalt glasses, and amorphous silica (Abratis et al. 2000a, Oelkers and Gislason 2001, Rimstidt et al. 2016). When applying the assumption made by Grambow (1985) where the dissolution of SiO_2 is the rate-limiting reaction, Eq. 2-2 can be simplified to account for the flux of any element i released from the glass into the aqueous phase by:

$$r_i = k_0 v_i a_{H^+}^{-\eta} \exp\left(\frac{-E_a}{RT}\right) \left[1 - \left(\frac{Q}{K_g}\right)^\sigma\right] \quad \text{Eq. 2-3}$$

- where:
- r_i = the dissolution rate ($g\ m^{-2}\ d^{-1}$)
 - v_i = the stoichiometric coefficient of element i in the glass
 - k_0 = intrinsic rate constant ($g\ m^{-2}\ d^{-1}$)
 - a_{H^+} = hydrogen ion activity
 - η = pH power law coefficient
 - E_a = activation energy ($J\ mol^{-1}$)^a
 - R = gas constant ($8.314\ J\ mol^{-1}\cdot K^{-1}$)
 - T = temperature, K
 - Q = ion-activity product
 - K_g = pseudo-equilibrium constant for glass
 - σ = Temkin coefficient

The ion activity product, Q , is a variable that must be computed by the numerical simulator as a function of time and space in the disposal system. Additionally, it has been argued that the Temkin coefficient, σ , is assumed to equal one because any value where σ is not equal to one is inconsistent with TST (Lasaga 1995). Therefore, it is necessary to determine the four remaining parameters, k_0 , E_a , η , and K_g , for a range of glass formulations in order to implement Eq. 2-3 into a numerical simulator. A benefit of Eq. 2-3 is that it is solidly based on the TST of chemical kinetics, in which a series of reaction rates are governed by the slowest elementary reaction. Therefore, it is simply necessary to ascertain the rate-limiting step in dissolution rather than attempt to fully understand all of the possible reactions and kinetic pathways that can occur during the reaction of glass with aqueous solution. Because this rate-limiting step is an “elementary reaction,” the stoichiometry of the reaction is typically simple and can be easily defined in a

^a Note, that E_a in Eq. 2-2 is included in the k_0 term.

reactive transport model. Additionally, we note that due to the importance of the pH dependence of the dissolution reaction, it has been explicitly removed from the product term in Eq. 2-2.

An additional term is necessary to describe the ILAW rate equation. The need for an additional term can be seen from Eq. 2-3, which suggests that the reaction rate will become zero when the ion-activity product, Q , is equal to the pseudo-equilibrium constant for glass, K_g . However glass can never reach thermodynamic equilibrium with an aqueous solution and therefore the rate will not become zero (Strachan and Neeway 2014). One mechanism responsible for continued glass corrosion in silica-saturated solutions is ion exchange. This reaction results in the selective extraction of Na, or other alkali, via the reaction:

where Matrix-Na represents the unreacted glass containing Na, and Matrix-H represents a hydrated glass where the Na has been replaced with an equimolar amount of hydrogen. This reaction occurs independently of matrix dissolution. The rate of this ion exchange reaction, referred to hereafter as r_{IEX} , has been determined from SPFT for numerous glasses (Freedman et al. 2015, Neeway et al. 2017, Papathanassiou et al. 2011, Papathanassiou et al. 2017b). The r_{IEX} value assumes a constant flux of Na from the glass into solution. In addition, an error in the calculation of r_{IEX} was identified and a corrected term, referred to hereafter as r_{IEX}^* , has been proposed (Lonergan and Neeway 2017). Further details on the correction are provided in Section 2.2.4

However, even in light of the correction to r_{IEX}^* , the ion exchange rate calculation may be a simplification of the coupling of the actual diffusive process with a constantly dissolving dissolution front. Therefore, as identified in recent documents, a more concerted effort should be made to understand the use of a diffusion-controlled alkali release term, which would increase the accuracy of the ion exchange model for implementation in future PA efforts (Lonergan and Neeway 2017, Papathanassiou et al. 2017a, Ryan and Freedman 2016).

2.2 Experimental Materials and Methods

2.2.1 Glass Preparation

Both ORLEC28 and ORLEC33 were prepared using reagent grade or higher purity chemicals. The ORLEC glasses tested here were prepared by batching and mixing the desired chemicals and melting in a furnace at 1200 °C for 75 minutes in a 100% Pt crucible. The glass melt was hand-stirred for 10 seconds every 30 minutes with a Pt rod. Following the melt, the glass was air quenched on a stainless steel pour plate. The glass remaining on the Pt crucible walls was quenched by cooling the crucible in a water bath. No visible crystals were present in the quenched sample. The glass from the pour plate was placed back into the crucible with glass remaining on the walls and the crucible was placed into a furnace 1200 °C for 75 minutes and hand-stirred for 10 seconds every 30 minutes with a Pt rod. After 75 minutes of melting the glass at 1200 °C, the furnace temperature was lowered to 1150 °C. Once the furnace temperature reached 1150 °C, the glass was slowly cooled to simulate the Canister Centerline Cooled (CCC) temperature profile^b shown in Table 2.2. At the end of the profile, the glass was cooled overnight in the furnace (after turning off) to room temperature. Because rhenium is known to volatilize during melting, it was added at a concentration twice the target value, i.e. 0.2 wt%. To accommodate the Re₂O₇ addition, 0.1 wt% SiO₂ is removed compared to composition provided in Muller and Pegg (2016b).

^b Memorandum, Canister Centerline Cooling Data, Revision 1, CCN: 074181, RPP-WTP, October 29, 2003

The target composition of ORLEC28 and ORLEC33, along with other representative ILAW glasses that have undergone a full suite of SPFT testing, is given in Table 2.1.

Table 2.1. Target composition (mass%) of selected ILAW glasses for which rate law parameters from SPFT testing are available.

Oxide	LD6-5412 ^(a)	LAWABP1 ^(b)	LAWA44 ^(c)	LAWB45 ^(d)	LAWC22 ^(d)	ORPLB2 ^(e)	ORPLG9 ^(e)	IDF18-A161	IDF7-E12 ^(g)	ORLEC28	ORLEC33
Al ₂ O ₃	12	10	6.2	6.13	6.08	10	6.76	10.04	7.58	10.00	9.23
B ₂ O ₃	5	9.25	8.9	12.34	10.06	7.3	8.51	13.51	9.82	10.00	11.00
CaO	4	NI	1.99	6.63	5.12	1.1	2.7	7.9	10.02	1.95	2.50
Cr ₂ O ₃	0.04	0.02	0.02	0.07	0.02	0.52	0.59	0.02	0.50	0.44	0.08
Fe ₂ O ₃	0	2.5	6.98	5.26	5.43	1.1	0.2	0.99	0.24	0.60	0.20
K ₂ O	1.46	2.2	0.5	0.26	0.1	0.12	5.76	0.44	0.55	3.36	0.50
La ₂ O ₃	NI	2	NI	NI	NI	NI	NI	NI	NI	NI	NI
Li ₂ O	NI	NI	NI	4.62	2.51	NI	NI	NI	2.49	NI	NI
MgO	NI	1	1.99	2.97	1.51	1.1	0.96	0.99	1.04	1.00	1.00
Na ₂ O	20	20	20	6.5	14.4	25	21	20.66	16.00	22.11	23.00
SO ₃	0.21	0.1	0.1	0.84	0.34	0.52	0.2	1.1	1.50	0.40	1.00
SiO ₂	55.91	41.89	44.55	47.86	46.67	39.98	40.82	36.05	41.19	37.66	40.84
SnO ₂	NI	NI	NI	NI	NI	1.08	2.84	NI	NI	2.33	0.00
TiO ₂	NI	2.49	1.99	0	1.14	NI	NI	NI	NI	0.60	0.00
V ₂ O ₅	NI	NI	NI	NI	NI	2	NI	0.99	1.74	0.00	2.10
ZnO	NI	2.6	2.96	3.15	3.07	3.65	3.4	2.95	3.21	3.00	3.00
ZrO ₂	NI	5.25	2.99	3.15	3.03	5.44	5.68	2.95	3.53	6.03	5.03
Others	1.38	0.70	0.83	0.22	0.52	1.09	0.58	1.41	0.59	0.52	0.52

(a) LD6-5412 – also known as HLP-46; see McGrail et al. (1998b) and Vienna et al. (2001).

(b) LAWABP1 – also known as HLP-51; see McGrail et al. (2001a).

(c) LAWA44 – also known as HLP-56; see Muller et al. (2001).

(d) See Muller et al. (2001) for LAWB45 and LAWC22.

(e) ORPLB2 – also known as IDF1-B2; ORPLG9 – also known as IDF2-G9; see Papathanassiou et al. (2011).

(g) IDF7-E12 – also known as ORPLE12; see Muller and Pegg (2016b).

NI = not included.

Others include minor amounts of Ag₂O, BaO, CdO, Ce₂O₃, Cl, Cr₂O₃, Cs₂O, F, I, MnO, MoO₃, Nd₂O₃, NiO, P₂O₅, PbO₂, Pr₂O₃, Re₂O₇, SeO₂, SrO, TeO₂, and Y₂O₃. Not all elements are present in every glass composition.

Table 2.2. CCC temperature profile for ILAW glass.

Segment	Time (min)	Start Temp. (°C)	Rate (°C/min)	End Temp. (°C)
1	0-16	1114	-7.125	1000
2	16-73	1000	-1.754	900
3	73-195	900	-0.615	825
4	195-355	825	-0.312	775
5	355-640	775	-0.175	725
6	640-1600	725	-0.13	600
7	1600-3710	600	-0.095	400

2.2.2 Glass Characterization

The CCC heat-treated samples ORLEC28 and ORLEC33 were characterized by optical microscopy, Scanning Electron Microscopy (SEM), X-ray Diffraction (XRD), and Atomic Force Microscopy (AFM).

Optical microscopy images of the ORLEC28 CCC glass are provided in Figure 2.1. The figure shows the glass in the crucible after CCC heat treatment (Figure 2.1a), a piece of the bulk glass (Figure 2.1b), a piece of the glass taken from the crucible/glass interface (Figure 2.1c), and a translucent thin section of glass with a thickness less than 3 mm (Figure 2.1d). There are visible crystals at the air/glass interface (Figure 2.1a), however the crystals are not visibly present in the bulk glass images from Figure 2.1b and this is confirmed with the translucent glass piece provided in Figure 2.1d. On the other hand, crystals were present at the crucible/glass interface. The crystals were evenly distributed along this interface with a thickness near 1 mm and were identified with XRD, as described below.

An XRD pattern of a sample of ORLEC28 glass from the bulk glass and the crucible/glass interface is shown in Figure 2.2. The pattern was obtained with a Cu K-alpha wavelength source (40 mA, 40 kV) from 5° to 70° (2 θ) with a step size of 0.03° and a dwell time of 4.0 seconds. Both the bulk glass and crucible/glass-interface samples in Figure 2.2 show peaks from the fluorite (CaF₂) standard and an amorphous hump near 26° to 32° 2 θ , indicative of an amorphous material. Though the fluorite standard was added for quantification purposes, the relative percentages of each phase determined by these tests are not necessarily representative of the proportion of each crystalline phase for the entire sample. For bulk glass samples (Figure 2.2a), the amount of crystalline material in the glass sample is under the assumed detection limit of 1.0 wt% for the analysis conditions. For the crucible/glass-interface sample (Figure 2.2b) the crystalline material was composed primarily of the sodalite mineral group, nosean [Na₈Al₆Si₆O₂₄(SO₄)·H₂O], cassiterite (SnO₂), and baddeleyite (ZrO₂). The presence of cassiterite and baddeleyite is likely due to the relatively high concentrations of SnO₂ and ZrO₂ in the glass of 2.33 and 6.03wt%, respectively. The alkali-containing nosean phase (Na₈Al₆Si₆O₂₄SO₄) has also been observed for other enhanced ILAW glasses with high alkali content (Neeway et al. 2017). Though this phase appeared at the glass-crucible interface, it did not appear to have an effect on the overall concentration of SO₃ in the bulk glass (Table 2.3).

Figure 2.1. Images of ORLEC28 CCC a) in the crucible after CCC; b) the bulk glass showing the emerald-colored product with no visible crystals; c) crucible-glass interface showing the presence of crystals; and d) a thin section showing the absence of crystals.

Figure 2.2. XRD pattern of ORLEC28 for (a) a sample taken from the bulk of the CCC sample and (b) a sample taken from the crucible/glass interface.

Figure 2.3 shows a SEM image of the bulk portion of the ORLEC28 sample as well as a sample taken near the crucible-glass interface. The backscatter electron SEM image of the bulk demonstrates that the glass is largely homogeneous. The bulk glass from the CCC heat-treated sample was used for SPFT testing. However, the outer surfaces along the crucible wall show the presence of a dendritic crystalline phase, most likely nosean. These crystalline phases, which can also be observed in the images provided in Figure 2.1, were manually removed from the CCC sample before further preparation of the glass for testing.

Figure 2.3. Backscatter electron SEM of the bulk ORLEC28-CCC glass (left) and a crystal phase, most likely nosean, near the crucible-glass interface of the ORLEC28-CCC sample (right).

Optical images of ORLEC33 CCC are provided in Figure 2.4. The figure shows the glass in the crucible after CCC heat treatment (Figure 2.4a), a piece of the bulk glass (Figure 2.4b), a translucent thin section of glass with a thickness less than 3 mm (Figure 2.4c), and a piece of the glass taken from the crucible/glass interface (Figure 2.4d). As was observed with the ORLEC28 glass, there were some crystals present at both the interface with air and the interface with the crucible. In addition, crystals were also present in the bulk sample Figure 2.4a. These crystals were sparsely present, relatively large (grouped in areas of ~5 mm width), and easy to remove. The glass is emerald green and an approximately 1-mm rim of crystals between the bulk glass and the crucible was present. XRD patterns were taken from bulk glass samples and of the crystalline rim along the crucible interface (Figure 2.5). The XRD pattern from the bulk portion indicates that the glass is x-ray amorphous with a conservative crystalline detection limit of ~2 wt%. Similar to ORLEC28, nosean was found to be present in the crystals found near the crucible. In addition, sodalite ($\text{Na}_8\text{Al}_6\text{Si}_6\text{O}_{24}\text{Cl}_2$), the chloride-containing analogue of nosean, was identified. The anions Cl^- and SO_4^{2-} appear to have portioned to these sodalite group phases near the crucible surface but the amount of crystallinity appears to be below 2 wt%. The crystals were not included in the glass that was used in SPFT testing.

Figure 2.4. Images of ORLEC33 CCC a) in the crucible after CCC; b) showing glass from the crucible/glass interface; c) the same piece shown in b) but rotated to highlight the largely lime green, crystal-free bulk glass; and d) glass from the crucible/glass interface at a higher magnification than b).

Figure 2.5. XRD pattern of ORLEC33 (a) a sample taken from the bulk of the CCC sample and (b) a sample taken from the crucible/glass interface.

SEM images of ORLEC33 glass particle are provided in Figure 2.6. The image of the bulk sample demonstrates that the glass is largely homogeneous. However, similar to ORLEC28-CCC, dendritic crystals were observed for the sample near the crucible-glass interface. The crystals are most likely nosean, which were identified in the XRD pattern.

Figure 2.6. Backscatter electron SEM of the bulk ORLEC33-CCC glass (left) and a crystal phase, most likely sodalite, near the crucible-glass interface of the ORLEC33-CCC sample (right).

The crystals present at the crucible-glass interface were separated from the bulk glass, the latter which was used in SPFT testing. As was described in an earlier ILAW SPFT report (Neeway et al. 2017), the removal of the crystalline portion of the ORLEC28 and ORLEC33 can be justified for three reasons:

- 1) The crystals present in the CCC sample are largely located at the crucible-glass interface. The presence of the crystals is most likely an artifact of this interface, which acts as a nucleation site for crystal growth.
- 2) In an actual ILAW glass container, the portion of the glass melt that is subject to the exact CCC heat treatment profile will be largely confined to the center of the canister. Thus, possible crystal formation that results from the CCC heat treatment will be largely confined to the center of the canister and, based on these laboratory CCC heat treatments, will depend on the availability of nucleation sites (undissolved particles) in the bulk of the canister.
- 3) The purpose of SPFT testing is to understand the dissolution behavior of ILAW glass, the removal of these crystals, which are an artifact of the CCC heat treatment setup, is justified as their presence in the test may confound the experimental results.

Chemical analyses were performed on both glasses using a combination of flux fusion (FF) and microwave digestion (MD) techniques. The results of these analyses confirm that there was no large difference in composition for the major elements between the target composition and the glass after CCC heat treatment (Table 2.3).

Lastly, it was noted that one of the enhanced glasses tested in FY2016, ORPLG9, showed indications of multiple amorphous phases (Neeway et al. 2017). This was based partly on evidence of multiple phases from a sample that was examined by AFM. The same tests were performed on ORLEC28 and ORLEC33 glasses. Details of the method for examining the glass samples by AFM are provided in Neeway et al. (2017) and are briefly summarized here.

For the AFM imaging, glass was polished with 0.25 μm diamond compound [Structure Probe Inc. (SPI)] followed by chemical-mechanical polishing with 50 nm colloidal silica (Buehler MasterMet). The AFM images were taken on a Veeco Icon AFM in tapping mode using Bruker RTESPA-300 probes (8 nm nominal tip radius, 40 N/m nominal spring constant). The resulting AFM images from this process are

provided in Figure 2.7. In comparison to ORPLG9, the images are largely featureless suggesting that, to the scale at which the images were taken, the glass does not contain multiple amorphous phases. No transmission electron microscopy (TEM) images were taken of these glasses.

Figure 2.7. AFM images of chemically-mechanically polished samples of ORLEC28 and ORLEC33. a) Phase map of ORLEC28. b) Topology map of ORLEC28. c) Phase map of ORLEC33. d) Topology map of ORLEC33.

2.2.2.1 Preparation of Glass for SPFT Testing

The CCC glasses were prepared for SPFT testing by crushing with a tungsten carbide disc mill. After sieving the glass, the 149 μm to 74 μm (- 100 to + 200 mesh) fraction was collected. This size fraction was washed according to Section 19.6 of ASTM C1285-14 to remove fines and stored in a desiccator until use in SPFT testing. Figure 2.8 shows the prepared powders that were used for SPFT testing. The images show the absence of fines adhering to the glass surface.

Table 2.3. Target and measured composition of CCC samples of ORLEC28 and ORLEC33.

Oxide	<i>ORLEC28</i>		<i>ORLEC33</i>		Method^(c)
	Target	Measured wt%	Target	Measured wt%	
Al₂O₃	10.00	9.15	9.23	8.49	FF
B₂O₃	10.00	10.07	11.00	10.76	MD
CaO	1.95	2.04	2.50	2.28	FF
Cr₂O₃	0.44	0.47	0.08	0.08	MD
Fe₂O₃	0.60	0.57	0.20	0.19	FF
K₂O	3.36	2.83	0.50	0.50	MD
MgO	1.00	1.07	1.00	1.05	FF
Na₂O	22.11	21.58	23.00	22.12	FF
NiO	0.01	0.01 ^(a)	0.01	0.01 ^(a)	FF
PbO	0.01	0.01 ^(a)	0.01	0.01 ^(a)	FF
SiO₂	37.66	39.23	40.84	42.07	FF
SnO₂	2.33	2.17	0.00	0.01	FF
TiO₂	0.60	0.57	0.00	0.03	FF
V₂O₅	0.00	0.01	2.10	1.94	FF
ZnO	3.00	3.27	3.00	3.17	MD
ZrO₂	6.03	5.49	5.03	4.78	FF
Cl	0.20	0.20 ^(b)	0.20	0.20 ^(b)	---
F	0.08	0.08 ^(b)	0.08	0.08 ^(b)	---
P₂O₅	0.12	0.14	0.12	0.19	FF
SO₃	0.40	0.40	1.00	1.00	MD
Re₂O₇ spike	0.10	0.10	0.10	0.12	MD
Sum	100.00	99.45	100.00	98.52	

(a) Measured concentration below estimated quantification limit (EQL). Target value used.

(b) Analyte not measured. Target value used.

(c) FF = flux fusion, MD = microwave digestion

Figure 2.8. Secondary electron SEM of - 100 to + 200 mesh fraction sieved and cleaned particles of a) ORLEC28 and b) ORLEC33. The images show the general shape of the different particles and the absence of surface fines.

The specific surface area, S ($\text{m}^2 \text{g}^{-1}$), of the glass powder samples is estimated based on the following geometric formula (McGrail et al. 1997):

$$S = \frac{3}{\rho \cdot r} \quad \text{Eq. 2-5}$$

where: ρ = the glass density (g m^{-3})
 r = the average particle radius (m).

Eq. 2-5 assumes that the glass particles are spheres, though, as demonstrated in Figure 2.8, this assumption does not reflect the actual shape of the particles. Nevertheless, the use of the geometric surface area formula has shown to be more similar to the solution-derived dissolution rate than when the Brunauer-Emmett-Teller (BET) surface area was used in calculations (Icenhower and Steefel 2013). Thus, with the average particle radius for the - 100 to + 200 mesh fraction of $5.63 \times 10^{-5} \text{ m}$, the resulting specific surface area for ORLEC28 ($\rho = 2.6979 \text{ g cm}^{-3}$) and ORLEC33 ($\rho = 2.6381 \text{ g cm}^{-3}$) is 1.98×10^{-2} and $2.02 \times 10^{-2} \text{ m}^2 \text{g}^{-1}$, respectively.

2.2.3 Single-Pass Flow-Through (SPFT) Apparatus

The SPFT system is designed to enable a continuous flow of fresh solution into a vessel containing the material of interest. The method is governed by ASTM C1662-10. Collection of the effluent from the vessel allows for monitoring of release of elements from the material as a function of time. The work performed in this report utilizes a “well-mixed” reactor design commonly used in studies of glasses.

The SPFT apparatus is shown in Figure 2.9. A syringe pump (Norgren Kloehn, Las Vegas, NV, USA, Model 55022) is used to draw buffered solution from a reservoir and transfer it at a steady flow rate to the reactor vessels and effluent collection. All connections are made with polytetrafluoroethylene (PTFE) tubing. The 60-mL reactor vessels used in this study were TeflonTM reactors (Saville, Minnetonka, MN) with a 40.8-mm inner diameter and 63.6-mm height. The sieved glass is placed into the reactor and settles to form a thin layer at the bottom of the reactor. In accordance with ASTM C1662-10, these conditions

are designed to yield a well-mixed solution due to the relatively high flow rates and convection at elevated test temperatures.

Figure 2.9. Schematic of the single-pass flow-through (SPFT) apparatus for determining reaction rates of glass.

A testing matrix for the SPFT was designed to cover a range of temperature, pH, and inlet Si concentrations. Various test matrices are provided in Table 2.4 to Table 2.6. The raw data generated from each test are presented in Appendix B-D.

An initial set of tests was conducted to determine the test conditions that result in the forward rate of glass dissolution. To do this, the glasses were tested under a wide range of solution-flow-rate-to-glass-surface-area (q/S) ratios, referred to here as a q/S sweep. The q/S sweep was performed at pH(RT) 9 at 40 and 90 °C. The q/S values used at both test temperatures are provided in Table 2.4. The dissolution rates from this set of tests were used to determine the q/S value that was necessary to obtain dilute conditions. Because the glass dissolution rate changes as a function of temperature and pH, the concentration of elements released into solution will also change with these conditions. Therefore, an adjustment in the q/S value is necessary in order to maintain dilute conditions so that the forward rate of glass dissolution is measured. In general, the adjustment was made to increase the q/S value with increasing pH and temperature. At the same time, the range was chosen so that effluent elemental concentrations were above the instrument detection limit. The final test matrix is provided in Table 2.5 and all these tests were performed in duplicate. The table includes the computed *in situ* pH of the solution at the various temperatures. The values are taken from Pierce et al. (2004) and were computed from the chemical composition of the buffered solution with the EQ3NR thermodynamic software package (Wolery and Daveler 1992). The test conditions ranged from pH(RT) 7-12, where the pH was changed by 1 pH unit, and at temperatures of 23, 40, 70, and 90 °C.

Table 2.4. List of conditions used for q/S sweep used in SPFT testing. Measured test temperatures, glass masses, and flow rates are provided in Appendix A.

Temp	pH	glass mass	flow rate	q/S
°C	@23°C	g	mL/d	m/s
40	9	4.00	20	3.0E-09
		1.50	30	1.0E-08
		0.50	40	5.0E-08
		0.25	80	2.0E-07
		0.10	130	7.0E-07
90	9	0.80	20	1.0E-08
		0.30	30	6.0E-08
		0.10	40	2.0E-07
		0.50	80	1.0E-06
		0.025	130	4.0E-06

Table 2.5. List of SPFT conditions used for SPFT testing for test conditions from 22 °C to 90 °C and pH(RT) from 7 to 12. All tests were run in duplicate. Measured test temperatures are provided in Appendix A.

Temp	pH	pH	glass mass	flow rate	q/S
°C	@23°C	T	g	mL/d	m/s
23	7	7.01	1.20	40	2.0E-08
	8	8.05	1.20	40	2.0E-08
	9	8.99	1.20	40	2.0E-08
	10	9.99	1.20	40	2.0E-08
	11	11.00	0.20	40	1.2E-07
	12	12.02	0.10	40	2.3E-07
40	7	6.57	0.60	40	3.9E-08
	8	7.60	0.60	40	3.9E-08
	9	8.67	0.60	40	3.9E-08
	10	9.55	0.60	40	3.9E-08
	11	10.89	0.10	40	2.3E-08
	12	11.74	0.05	40	4.7E-07
70	7	5.91	0.40	40	5.9E-08
	8	6.94	0.40	40	5.9E-08
	9	8.08	0.40	40	5.9E-08
	10	8.88	0.20	40	1.2E-07
	11	10.43	0.20	40	1.2E-07
	12	11.08	0.04	40	5.9E-07
90	7	5.55	0.10	40	2.3E-07
	8	6.58	0.10	40	2.3E-07
	9	7.72	0.10	40	2.3E-07
	10	8.52	0.05	40	4.7E-07
	11	10.06	0.01	40	2.3E-06
	12	10.70	0.005	40	4.7E-06

In addition to tests where the forward rate of glass dissolution was determined at varying pH/temperature combinations, tests were performed at pH(RT) 9 with a fixed concentration of Si (1-100 ppm Si) added to the inlet solution. For the most part, the tests were carried out at the same q/S across the range of Si inlet concentrations to attempt to isolate the effect of Si, in particular orthosilicic acid (H_4SiO_4) on the glass dissolution rate. In some cases, particularly at the lower temperatures, the q/S value was lowered slightly in order to increase the effluent concentration of boron above the instrument detection limit. Additional tests were done in order to confirm the results of the initial test where the influent [Si] was lower than expected. The matrix of tests is presented in Table 2.6. The steady-state release concentrations, along with the values used to calculate the steady-state release rates, are provided in Appendix A.

During testing, the effluent samples were collected at regular intervals, where the frequency of sampling intervals depended on the testing conditions. Three blank effluent samples were collected from each reactor prior to the addition of the glass to determine background concentrations of the analytes. A blank reactor was not run with each experiment because, for solutions without Si added to the inlet solution, the blank effluent concentrations for Al, B, Na, and Si were well below values measured for the outlet solutions collected after the glass was added to the reactor vessels. Inlet reservoirs for experiments with Si added to the inlet were placed in ovens at the test temperature to avoid Si precipitation. The influent reservoir pH was checked twice per week to ensure that it was within ± 0.2 pH units of the target pH.

Flow rates were determined gravimetrically and the collected effluent was analyzed with inductively coupled plasma optical emission spectroscopy (ICP-OES) for Na, Si, Al, and B and by inductively coupled plasma mass spectroscopy (ICP-MS) for Re. Based on the dilution of the ICP-OES sample, an estimated quantification limit (EQL) was determined by the lowest calibration standard that can be reproducibly determined during an analytical run within 10% of the certified value multiplied by the dilution factor. For cases where the effluent concentration of the analyte of interest was below the EQL, the dissolution rate based on that element was calculated using the value of the EQL. The use of the EQL gives a maximum dissolution rate in those conditions. The calculated dissolution rates from EQL values are provided in Appendix A.

Effluent samples that varied from the average flow rate of the test by more than 10% were not used in calculations. A steady-state dissolution rate is defined as three samples collected near the end of the test that did not deviate by more than 15% of their mean. A surface area correction at each sampling interval was performed according to Appendix A of ASTM C1662-10. If more than 30% of the sample surface area was lost during the experiment, the samples collected after the loss of 30% were not used to calculate the steady-state release. We note that Section 6.3 of ASTM C1662-10 states “the particle size of crushed samples must be large enough that the decrease in surface area during the test is less than 15 mass percent.” From this statement, it is unclear if mass percent or percent surface area was intended. However, for certain experiments provided in Appendix B, it can be seen that the assignment of a 30%-maximum surface area loss is reasonable because release rates remain relatively constant until this threshold is reached.

For select experiments performed at pH (RT) 9, the influent solution Si concentration was varied from dilute to saturated with respect to amorphous silica [$\text{SiO}_2(\text{am})$] solubility at various temperatures. To produce the desired concentration of Si, analytical grade silicic acid powder (Fisher, $\text{SiO}_2 \cdot \text{H}_2\text{O}$) was dissolved in a solution of pH (RT) 9 and 0.05 M TRIS and the mixture was heated at 90 °C for three days to achieve saturation (~ 140 ppm). This solution was then diluted to the target Si concentration for the desired test. The measured Si values used in these calculations can be determined from the blank analyses in Appendix B.

Table 2.6. List of conditions used for SPFT tests conducted with Si added to the influent solution. Tests were performed from 22 °C to 90 °C and pH(RT) 9. Certain tests were performed in duplicate as shown in the table. Measured test temperatures are provided in Appendix A.

Temp	pH	nominal influent Si	glass mass	flow rate	q/S	Note
°C	@23°C	ppm	g	mL/d	m/s	
23	9	1	1.3	40	1.6E-08	duplicate
	9	5	1.3	40	1.6E-08	
	9	15	1.3	40	1.6E-08	
	9	15	2.5	40	8.7E-09	
	9	25	2.5	40	8.7E-09	
	9	35	2.5	40	8.7E-09	
40	9	1	0.67	40	3.3E-08	
	9	5	0.67	40	3.3E-08	
	9	15	1.00	40	2.2E-08	
	9	25	1.00	40	2.2E-08	
	9	35	1.00	40	2.2E-08	
	9	50	0.67	40	3.3E-08	
70	9	1	0.45	40	4.5E-08	
	9	5	0.45	40	4.5E-08	
	9	15	0.45	40	4.5E-08	
	9	25	0.45	40	4.5E-08	
	9	50	0.45	40	4.5E-08	
	9	75	0.45	40	4.5E-08	
90	9	1	0.12	40	1.7E-07	
	9	5	0.12	40	1.7E-07	
	9	15	0.12	40	1.7E-07	
	9	25	0.12	40	1.7E-07	
	9	50	0.12	40	1.7E-07	
	9	75	0.12	40	1.7E-07	
	9	100	0.12	40	1.7E-07	

2.2.4 Dissolution Rate, Ion Exchange Rate, and Error Calculations

In flow-through experiments with high solution residence times, the normalized dissolution rate can be calculated from two consecutive samplings, i and $i + 1$, from the following expression (Lasaga 1998):

$$r_{i+1} = \frac{\left(\frac{C_{i+1} - C_i}{(t_{i+1} - t_i)} \right) + \left(\frac{q}{V} \cdot C_{i+1} \right)}{f_i \cdot S / V} \quad \text{Eq. 2-6}$$

where

- r_{i+1} = the normalized leaching rate ($\text{g m}^{-2} \cdot \text{d}^{-1}$) at time t in days,
- q = the flow rate ($\text{m}^3 \text{d}^{-1}$),
- V = the volume of solution (m^3),
- S = the glass surface area available for leaching (m^2)
- C_i = the concentration of the element i in the solution (g m^{-3})
- f_i = the mass fraction of element i in the pristine glass (unitless)
- $(t_{i+1} - t_i)$ = the time difference between two samples (d)

When the system has reached a steady state (i.e., $C_{i+1} = C_i$), the first term in the numerator of Eq. 2-6 becomes zero. The steady-state dissolution rate, which also accounts for background concentrations of the analyte of interest, is then presented as:

$$r_i = \frac{(C_{i,s} - \bar{C}_{i,b}) \cdot q}{f_i \cdot S} \quad \text{Eq. 2-7}$$

where $C_{i,s}$ is the steady-state concentration of element i (g m^{-3}) and $\bar{C}_{i,b}$ is the average background concentration of element i in the blank solutions collected at the beginning of the experiment (g m^{-3}). The target concentration listed in Table 2.1 was used to calculate f_i . In the cases where the background concentration of an element was above the EQL, the average concentration of element i in the three blank samples was used as the value of $\bar{C}_{i,b}$. For the case where all three blank samples were below the EQL, a background of zero was assumed. This gives the most conservative calculation of the glass dissolution rate.

As an input to the IDF PA, the ion-exchange rate is calculated with the formalism developed by McGrail et al. (2001a). The ion-exchange rate can be calculated when the normalized rate of sodium is greater than the normalized rate of boron, where the excess sodium release rate is attributed to the ion exchange reaction. Up to this point, the ion exchange rate (r_{IEX}) was calculated with the following equation (Neeway et al. 2017):

$$r_{\text{IEX}} = \frac{(r_{\text{Na}} - r_{\text{B}})}{86400 \cdot MW_{\text{Na}}} \quad \text{Eq. 2-8}$$

where r_{Na} is the glass dissolution rate indexed by Na ($\text{g m}^{-2} \text{d}^{-1}$), r_{B} is the glass dissolution rate indexed by B ($\text{g m}^{-2} \text{d}^{-1}$), MW_{Na} is the molecular mass of Na ($22.9898 \text{ g mol}^{-1}$), and 86400 is a factor to convert seconds to days. However, there is an improper unit conversion in Eq. 2-8. This inconsistency was noted by Lonergan and Neeway (2017) who proposed the following correction:

$$r_{\text{IEX}}^* = (r_{\text{Na}} - r_{\text{B}}) \frac{m_{\text{Na}_2\text{O}} \cdot q}{86400 \cdot m_{\text{gls}} \cdot MW_{\text{Na}_2\text{O}}} \quad \text{Eq. 2-9}$$

where m_{Na_2O} is the mass of Na₂O in the glass (g), m_{gls} is the mass of the glass (g)^a, q is the stoichiometric ratio to convert the oxide moles in glass to elemental moles in glass (in this case $q = 2$, unitless), and MW_{Na_2O} is the molecular mass of Na₂O (g mol⁻¹). In general, the correction in the ion exchange term results in a reduction in r_{IEX} of roughly a factor of seven, with the exact reduction factor dependent on the quantity of Na₂O in the starting glass. In this report, we will use Eq. 2-9 to determine values of r_{IEX}^* . It should be noted that the assumption of a constant ion exchange rate may not be representative of the diffusion-controlled ion exchange reaction. This is discussed in more detail in Section 3.0.

Determination of the experimental uncertainty of the dissolution rate takes into account uncertainties of each parameter in Eq. 2-8. For uncorrelated random errors, the standard deviation of a function of the form $f(x_1, x_2, x_n)$ is estimated using the standard, first-order error propagation method:

$$\sigma_f = \sqrt{\sum_{i=1}^n \left(\frac{\partial f}{\partial x_i} \right)^2 \sigma_i^2} \quad \text{Eq. 2-10}$$

where

σ_f = standard deviation of the function f

x_i = parameter i

σ_i = standard deviation of parameter i

Substitution of Eq. 2-7 in Eq. 2-10 results in:

$$\sigma_{r_i} = \sqrt{\left(\left(\frac{q}{f_i^2 S} \right)^2 (\sigma_{C_{i,s}}^2 + \sigma_{\bar{C}_{i,b}}^2) + \left(\frac{C_{i,s} - \bar{C}_{i,b}}{f_i S} \right)^2 \sigma_q^2 + \left(\frac{(C_{i,s} - \bar{C}_{i,b})q}{f_i^2 S} \right)^2 \sigma_{f_i}^2 + \left(\frac{(C_{i,s} - \bar{C}_{i,b})q}{f_i S^2} \right)^2 \sigma_S^2 \right)} \quad \text{Eq. 2-11}$$

If the relative error, $\hat{\sigma}_{r_i} = \sigma_{r_i} / r_i$, is used in Eq. 2-11, the following equation is obtained:

$$\hat{\sigma}_{r_i} = \sqrt{\left(\frac{(\hat{\sigma}_{C_{i,s}} C_{i,s})^2 + (\hat{\sigma}_{\bar{C}_{i,b}} \bar{C}_{i,b})^2}{(C_{i,s} - \bar{C}_{i,b})^2} + \hat{\sigma}_q^2 + \hat{\sigma}_{f_i}^2 + \hat{\sigma}_S^2 \right)} \quad \text{Eq. 2-12}$$

Relative errors of 10%, 10%, 3%, and 15% are assigned to C_i , $\bar{C}_{i,b}$, f_i , and S , respectively. Although the absolute error in f_i is likely higher than 3%, this error is systematic and therefore does not contribute significantly to sample-to-sample uncertainty, which is the principal error of interest here. The 10% for C_i and $\bar{C}_{i,b}$, are from analytical uncertainty from ICP. In cases where all three blanks were below the EQL we have made the $\bar{C}_{i,b}$ term equal to the EQL.

A similar approach can be taken to calculate the uncertainty in the ion exchange term calculated in Eq. 2-9. When Eq. 2-10 is applied to Eq. 2-9, the resulting equation is:

^a More simply stated, the ratio of m_{Na_2O} to m_{gls} is the wt% of Na₂O, which for ORLEC28 and ORLEC33 is provided in Table 2.1.

$$\sigma_{r_{IEX}}^* = \sqrt{\frac{\sigma_{Na}^2 - \sigma_B^2}{\left(\frac{86400 \cdot m_{gls} \cdot MW_{Na_2O}}{m_{Na_2O} \cdot q}\right)^2}} \quad \text{Eq. 2-13}$$

If Eq. 2-13 is written in terms of the relative error, $\hat{\sigma}_{r_{IEX}}^* = \sigma_{r_{IEX}}^* / r_{IEX}^*$, then the relative uncertainty is:

$$\hat{\sigma}_{r_{IEX}}^* = \sqrt{\frac{\sigma_{Na}^2 + \sigma_B^2}{(r_{Na} - r_B)^2}} \quad \text{Eq. 2-14}$$

3.0 SPFT Results

3.1 Steady-state release and forward rate determination

To determine valid dissolution rates from an experiment, a steady-state glass dissolution rate must be obtained. As defined in Section 2.2.3, a steady-state dissolution rate is defined as three samples collected near the end of the test that did not deviate by more than 15% of their mean. Figure 3.1 shows the normalized concentrations of B, Al, Na, and Si from ORLEC28 as a function of time for select experiments conducted from relatively low and relatively high q/S tests at 40 and 90 °C. For all tests, there is an initial pulse of Na and B compared to Al and Si. The pulse of Na and B is likely a manifestation of the ion exchange reaction that occurs at short time periods before matrix dissolution becomes the rate-controlling reaction. The fact that B is a network former makes its participation in ion exchange with protons puzzling and highlights that the diffusion process in slightly basic media is more complex than simple ion exchange. Geneste et al. (2006) have tried to explain this phenomenon by suggesting that simple alkali-proton exchange cannot occur in the glass structure without causing a local reorganization as a result of incomplete charge compensation from the H^+ ion replacing that of Na^+ . However, after a short time period, the release rates for these species become invariant with increasing time. These types of observations are typical for all experiments.

Figure 3.1. Normalized concentrations of B, Na, Al, and Si as a function of time at pH(RT) 9 at 40 and 90 °C for ORLEC28. Measured test temperatures, flow rates, and effluent concentrations are provided in Appendix B. Axes are on different scales. Errors (not shown) are from ICP and are 10% relative to the measured concentration.

From Figure 3.1a and c, it is seen that the release of Al and Si deviate from that of B and Na at low q/S . At the low q/S , the release of Al and Si is nearly constant with time and B and Na have a relatively large initial release until their concentrations begin to decrease. It is unknown if the downward trend in Na and

B values would continue for longer experimental durations. The B concentration in Figure 3.1c did not reach a steady state, defined as when the relative standard deviation of three consecutive samples differs by less than 15%, and is used here as a qualitative example. Another feature of interest is that the release of Na is greater than the release of B at 40 °C and not to the same extent at 90 °C, which may be the dominance of the ion exchange reaction at relatively low temperatures. However, at the higher q/S values (Figure 3.1b and d), the release of all of the elements appears to be congruent after very short time periods. This general trend of tracer release behavior was also observed for the ORLEC33 glass.

Figure 3.2 and Figure 3.3 show the release of B, Al, Na, and Si for q/S tests performed with ORLEC28 and ORLEC33 at 40 and 90 °C. For both glasses, at 40 °C there is an increase of 4-6x in the release rate of all elements with increasing q/S . At 90 °C, the release rate of B and Na vary by a factor of roughly 1-1.5 compared to the release rate of Si and Al, which increase by a factor of 7 between the lowest q/S value and the highest q/S value. In general, as the q/S increases, the measured concentration of elements approaches the EQL and it is no longer possible to calculate a release rate from the experimental data. From these results, the pH(RT) 9 forward rate was assigned to be at a q/S value near the $3 \times 10^{-8} \text{ m s}^{-1}$ at 40 °C and $3 \times 10^{-7} \text{ m s}^{-1}$ at 90 °C for both glasses. These values were adjusted for other pH and temperature conditions so that dilute conditions were maintained.

Figure 3.2. Normalized release rates of B, Al, Na, and Si as a function of q/S at pH(RT) 9 at a) 40 and b) 90 °C for ORLEC28. Measured test temperatures, flow rates, and effluent concentrations are provided in Appendices A and B. Errors are 2σ from Eq. 2-12. Axes from a) and b) are on different scales.

Figure 3.3. Normalized release rates of B, Al, Na, and Si as a function of q/S at pH(RT) 9 at a) 40 and b) 90 °C for ORLEC33. Measured test temperatures, flow rates, and effluent concentrations are provided in Appendices A and B. Errors are 2σ from Eq. 2-12. Axes from a) and b) use different scales.

3.2 Calculation of η , k_0 , and E_a

The forward dissolution rates of ORLEC28 and ORLEC33 were determined at solution pH(RT) values varied by one pH unit between 7 and 12 at temperatures of 23, 40, 70, and 90 °C. The *in situ* solution pH was corrected by geochemical modeling. The choice of this pH range is informed from previous glass dissolution experiments that have been conducted as a function of varying pH. These studies typically show minima in the dissolution rate at near-neutral pH and increases in the dissolution rate as the pH becomes either more acidic or more alkaline (Inagaki et al. 2006, Inagaki et al. 2013). This “V-shaped” behavior is typically described with the use of Eq. 2.3 by changes in the sign of the η value from a positive to a negative value.

In nearly identical experimental conditions, the forward boron release rates for ORLEC33 is nearly identical to that of ORLEC28, where in similar conditions the release boron release rate from each glass is within a factor of 15% of one another. When referencing the glass compositions in Table 2.1, this can be expected because the composition of each glass is nearly identical apart from the higher amount of K₂O and the presence of SnO₂ in ORLEC28 and the presence of V₂O₅ in ORLEC33.

The data plotted in Figure 3.4 for ORLEC28 and ORLEC33 show both the effect of pH and temperature on glass dissolution. As expected, higher temperatures lead to higher glass dissolution rates whereas the effect of pH varies across the studied pH range. On the acidic side [pH(RT) < 9, identifiable by the unfilled markers in Figure 3.4], the glass dissolution rate increases with decreasing pH. This trend highlights the effect of the higher concentrations of the hydronium ion leading to higher dissolution rates. As will be described in Section 3.4, the dissolution rate of all the glass constituents is not congruent in this range and the increase in dissolution rates with increasing hydronium ion concentrations is due to the ion exchange reaction.

On the more basic side [pH(RT) ≥ 9, identifiable by the filled markers in Figure 3.4], the log dissolution rate linearly increases with increasing pH. This increase is thought to be due to the effect of the hydroxide ion on the dissolution of the glass network. The release rate of all the studied species is congruent in this pH range and the dissolution rate is presumed to be controlled by the breaking of the Si-O network. This is the region used to determine the rate model parameters, which will be presented later in this subsection.

Lastly, we note the possible presence of a plateau in dissolution rates in the near-neutral pH range. This feature is most visible for the room temperature tests where there appears to be little change in rate between the pH 8 and 10 samples. This plateau is not observed at the other test temperatures where a V-shaped trend in dissolution rates is observed. We highlight the trend in plateau because recent work has argued for a rate model that includes an effect of the hydroxide ion (like the model presented in Eq. 2-3), water molecule, and the hydronium ion (Strachan 2017). Though the model was not investigated for the dataset presented in the present report, it may be investigated in the future as a easily implemented model to replace the simplistic model in Eq. 2-3 that is only capable of explaining glass dissolution in the alkaline region.

Table 3.1. Forward dissolution rates for ORLEC28. Boron release rates from tests conducted at $\text{pH}(\text{RT}) \geq 9$ are used in Figure 3.4.

Mean Temperature °C	Nominal pH (RT)	B release rate $\text{g m}^{-2} \text{d}^{-1}$	Al release rate $\text{g m}^{-2} \text{d}^{-1}$	Na release rate $\text{g m}^{-2} \text{d}^{-1}$	Si release rate $\text{g m}^{-2} \text{d}^{-1}$
22.0	7	3.94E-03 ± 1.29E-03	3.61E-04* ± ---	3.80E-03 ± 1.39E-03	3.55E-04* ± ---
22.0	7	6.21E-03 ± 1.97E-03	5.00E-04* ± ---	5.66E-03 ± 1.97E-03	4.91E-04* ± ---
22.0	8	2.38E-03 ± 6.32E-04	6.76E-04 ± 1.77E-04	2.57E-03 ± 8.40E-04	5.12E-04* ± ---
22.0	8	2.28E-03 ± 6.04E-04	7.05E-04 ± 1.84E-04	2.37E-03 ± 7.66E-04	4.91E-04* ± ---
22.0	9	2.85E-03 ± 8.10E-04	2.57E-03 ± 8.44E-04	2.43E-03 ± 8.09E-04	1.66E-03 ± 5.13E-04
22.0	9	2.92E-03 ± 8.31E-04	2.63E-03 ± 8.62E-04	2.57E-03 ± 8.56E-04	1.67E-03 ± 5.14E-04
22.0	10	7.16E-03 ± 2.31E-03	6.31E-03 ± 2.19E-03	6.76E-03 ± 2.37E-03	6.41E-03 ± 2.23E-03
22.0	10	6.33E-03 ± 2.02E-03	5.63E-03 ± 1.94E-03	6.03E-03 ± 2.11E-03	5.56E-03 ± 1.92E-03
22.0	11	3.25E-02 ± 9.97E-03	2.65E-02 ± 8.88E-03	3.09E-02 ± 1.02E-02	3.00E-02 ± 1.01E-02
22.0	11	2.73E-02 ± 8.42E-03	2.19E-02 ± 7.49E-03	2.50E-02 ± 8.51E-03	2.21E-02 ± 7.58E-03
22.0	12	1.36E-01 ± 4.53E-02	1.19E-01 ± 4.20E-02	1.77E-01 ± 5.91E-02	1.24E-01 ± 4.37E-02
22.0	12	1.39E-01 ± 4.68E-02	1.40E-01 ± 4.96E-02	2.00E-01 ± 6.77E-02	1.31E-01 ± 4.62E-02
40.8	7	5.22E-02 ± 1.85E-02	9.18E-04* ± ---	4.93E-02 ± 1.78E-02	9.03E-04* ± ---
40.8	7	4.82E-02 ± 1.71E-02	9.00E-04* ± ---	4.67E-02 ± 1.69E-02	8.86E-04* ± ---
40.8	8	1.87E-02 ± 6.32E-03	3.22E-03 ± 9.85E-04	1.61E-02 ± 5.72E-03	1.56E-03 ± 4.19E-04
40.8	8	1.98E-02 ± 6.63E-03	2.66E-03 ± 7.65E-04	1.89E-02 ± 6.70E-03	1.68E-03 ± 4.44E-04
40.8	9	1.28E-02 ± 4.12E-03	1.12E-02 ± 3.86E-03	1.17E-02 ± 4.08E-03	1.15E-02 ± 3.98E-03
40.8	9	1.32E-02 ± 4.29E-03	1.15E-02 ± 3.98E-03	1.18E-02 ± 4.13E-03	1.19E-02 ± 4.13E-03
40.9	10	3.25E-02 ± 1.13E-02	2.89E-02 ± 1.04E-02	3.16E-02 ± 1.07E-02	3.28E-02 ± 1.16E-02
40.9	10	3.20E-02 ± 1.11E-02	2.90E-02 ± 1.03E-02	3.05E-02 ± 1.09E-02	3.22E-02 ± 1.15E-02
40.9	11	1.40E-01 ± 4.84E-02	1.15E-01 ± 4.15E-02	1.36E-01 ± 4.93E-02	1.46E-01 ± 5.28E-02
40.9	11	1.43E-01 ± 4.93E-02	1.17E-01 ± 4.21E-02	1.37E-01 ± 4.97E-02	1.48E-01 ± 5.33E-02
40.9	12	6.02E-01 ± 2.15E-01	6.04E-01 ± 2.22E-01	6.03E-01 ± 2.15E-01	6.47E-01 ± 2.30E-01
40.9	12	6.12E-01 ± 2.18E-01	6.06E-01 ± 2.23E-01	6.14E-01 ± 2.19E-01	6.56E-01 ± 2.33E-01
73.0	7	8.90E-01 ± 3.25E-01	3.89E-03 ± 1.06E-03	8.84E-01 ± 3.23E-01	3.46E-02 ± 1.22E-02
73.0	7	8.69E-01 ± 3.17E-01	4.04E-03 ± 1.11E-03	7.96E-01 ± 2.92E-01	3.29E-02 ± 1.16E-02

Mean Temperature	Nominal pH (RT)	B release rate	Al release rate	Na release rate	Si release rate
°C		g m ⁻² d ⁻¹	g m ⁻² d ⁻¹	g m ⁻² d ⁻¹	g m ⁻² d ⁻¹
73.0	8	4.01E-01 ± 1.46E-01	2.57E-02 ± 7.96E-03	3.84E-01 ± 1.40E-01	2.75E-02 ± 9.71E-03
73.0	8	4.24E-01 ± 1.55E-01	2.76E-02 ± 9.69E-03	4.15E-01 ± 1.52E-01	3.19E-02 ± 1.13E-02
73.0	9	7.72E-02 ± 2.73E-02	7.57E-02 ± 2.72E-02	7.66E-02 ± 2.77E-02	8.38E-02 ± 3.02E-02
73.0	9	5.28E-02 ± 1.84E-02	6.60E-02 ± 2.37E-02	6.97E-02 ± 2.52E-02	7.24E-02 ± 2.62E-02
70.3	10	1.95E-01 ± 7.54E-02	1.37E-01 ± 5.37E-02	1.75E-01 ± 6.89E-02	1.84E-01 ± 6.63E-02
70.3	11	9.16E-01 ± 3.26E-01	6.36E-01 ± 2.30E-01	9.64E-01 ± 3.51E-01	8.58E-01 ± 3.05E-01
70.3	11	9.61E-01 ± 3.41E-01	7.46E-01 ± 2.69E-01	1.05E+00 ± 3.81E-01	9.16E-01 ± 3.27E-01
70.6	12	3.50E+00 ± 1.26E+00	3.63E+00 ± 1.32E+00	3.68E+00 ± 1.32E+00	3.52E+00 ± 1.21E+00
70.6	12	3.50E+00 ± 1.25E+00	3.56E+00 ± 1.29E+00	3.80E+00 ± 1.36E+00	3.52E+00 ± 1.25E+00
89.8	7	6.96E-01 ± 2.51E-01	7.91E-03* ± ---	8.93E-01 ± 3.28E-01	1.45E-01 ± 5.18E-02
89.8	7	7.21E-01 ± 2.59E-01	8.28E-03* ± ---	9.38E-01 ± 3.42E-01	1.22E-01 ± 4.29E-02
89.8	8	3.89E-01 ± 1.48E-01	6.72E-02 ± 2.50E-02	5.97E-01 ± 2.30E-01	8.99E-02 ± 3.38E-02
89.8	8	3.54E-01 ± 1.28E-01	7.31E-02 ± 2.58E-02	5.38E-01 ± 1.99E-01	1.00E-01 ± 3.59E-02
89.8	9	1.37E-01 ± 4.63E-02	1.78E-01 ± 6.30E-02	2.29E-01 ± 8.23E-02	1.90E-01 ± 5.82E-02
90.4	10	1.10E+00 ± 3.98E-01	1.06E+00 ± 3.86E-01	9.99E-01 ± 3.66E-01	1.09E+00 ± 3.99E-01
90.4	10	1.06E+00 ± 3.80E-01	1.05E+00 ± 3.66E-01	9.48E-01 ± 3.44E-01	1.06E+00 ± 3.83E-01
90.6	11	2.79E+00 ± 1.02E+00	1.75E+00 ± 6.43E-01	2.54E+00 ± 9.42E-01	2.61E+00 ± 9.55E-01
90.6	11	3.95E+00 ± 1.43E+00	2.81E+00 ± 1.03E+00	3.60E+00 ± 1.33E+00	3.85E+00 ± 1.42E+00
91.1	12	1.14E+01 ± 4.14E+00	1.27E+01 ± 4.59E+00	1.10E+01 ± 3.98E+00	1.19E+01 ± 4.34E+00
91.1	12	1.14E+01 ± 4.08E+00	1.21E+01 ± 4.34E+00	1.07E+01 ± 3.79E+00	1.21E+01 ± 4.21E+00

* Value is calculated from the elemental EQL.

Table 3.2. Forward dissolution rates for ORLEC33. Boron release rates from tests conducted at $\text{pH(RT)} \geq 9$ are used in Figure 3.4.

Mean Temperature °C	Nominal pH (RT)	B release rate $\text{g m}^{-2} \text{d}^{-1}$	Al release rate $\text{g m}^{-2} \text{d}^{-1}$	Na release rate $\text{g m}^{-2} \text{d}^{-1}$	Si release rate $\text{g m}^{-2} \text{d}^{-1}$
22.0	7	1.71E-02 ± 6.00E-03	5.59E-04* ± ---	1.69E-02 ± 6.12E-03	4.68E-04* ± ---
22.0	7	1.38E-02 ± 5.20E-03	4.31E-04* ± ---	1.35E-02 ± 5.25E-03	3.61E-04* ± ---
22.0	8	3.80E-03 ± 1.14E-03	5.69E-04 ± 1.56E-04	3.59E-03 ± 1.22E-03	7.09E-04 ± 1.86E-04
22.0	8	3.69E-03 ± 1.15E-03	5.55E-04 ± 1.50E-04	3.48E-03 ± 1.23E-03	6.93E-04 ± 1.85E-04
22.0	9	2.64E-03 ± 7.64E-04	2.20E-03 ± 7.08E-04	2.54E-03 ± 8.60E-04	2.39E-03 ± 7.94E-04
22.0	9	2.61E-03 ± 7.39E-04	2.00E-03 ± 6.25E-04	2.37E-03 ± 7.84E-04	2.26E-03 ± 7.38E-04
22.0	10	4.37E-03 ± 1.34E-03	4.76E-03 ± 1.62E-03	4.89E-03 ± 1.70E-03	3.54E-03 ± 1.20E-03
22.0	10	6.65E-03 ± 2.18E-03	7.47E-03 ± 2.63E-03	7.84E-03 ± 2.80E-03	6.09E-03 ± 2.14E-03
22.0	11	3.40E-02 ± 1.20E-02	3.07E-02 ± 1.17E-02	2.96E-02 ± 1.10E-02	2.91E-02 ± 1.12E-02
22.0	11	3.15E-02 ± 1.00E-02	2.96E-02 ± 1.02E-02	2.82E-02 ± 9.28E-03	2.89E-02 ± 9.99E-03
22.0	12	1.53E-01 ± 5.23E-02	1.46E-01 ± 5.05E-02	1.41E-01 ± 4.75E-02	1.40E-01 ± 4.97E-02
22.0	12	1.40E-01 ± 4.86E-02	1.37E-01 ± 3.90E-02	1.39E-01 ± 4.75E-02	1.54E-01 ± (a)
40.7	7	1.44E-01 ± 5.20E-02	9.60E-04* ± ---	1.32E-01 ± 4.79E-02	1.76E-03 ± 4.84E-04
40.7	7	1.39E-01 ± 5.04E-02	1.04E-03* ± ---	1.19E-01 ± 4.33E-02	1.57E-03 ± 4.17E-04
40.7	8	4.70E-02 ± 1.67E-02	2.72E-03 ± 7.90E-04	4.17E-02 ± 1.51E-02	1.97E-03 ± 5.68E-04
40.7	8	3.74E-02 ± 1.32E-02	2.23E-03 ± 6.16E-04	3.29E-02 ± 1.19E-02	1.25E-03 ± 3.27E-04
40.7	9	1.09E-02 ± 3.48E-03	1.19E-02 ± 4.09E-03	1.12E-02 ± 3.88E-03	1.18E-02 ± 4.11E-03
40.7	9	1.20E-02 ± 3.85E-03	1.20E-02 ± 3.66E-03	1.11E-02 ± 3.84E-03	1.19E-02 ± 4.18E-03
40.9	10	3.37E-02 ± 1.20E-02	2.57E-02 ± 9.30E-03	2.78E-02 ± 1.01E-02	2.92E-02 ± 1.07E-02
40.9	10	2.79E-02 ± 9.83E-03	2.21E-02 ± 7.95E-03	2.41E-02 ± 8.77E-03	2.55E-02 ± 9.29E-03
40.9	11	1.44E-01 ± 4.99E-02	1.08E-01 ± 3.83E-02	1.29E-01 ± 4.67E-02	1.34E-01 ± 4.84E-02
40.9	11	1.47E-01 ± 5.07E-02	1.08E-01 ± 3.81E-02	1.36E-01 ± 4.88E-02	9.52E-02 ± 3.37E-02
40.9	12	8.64E-01 ± 3.12E-01	8.15E-01 ± 2.99E-01	7.71E-01 ± 2.76E-01	8.27E-01 ± 2.97E-01
40.9	12	8.49E-01 ± 3.05E-01	8.12E-01 ± 2.96E-01	7.75E-01 ± 2.75E-01	8.07E-01 ± 2.85E-01
73.0	7	1.48E+00 ± 5.41E-01	2.76E-03 ± 7.33E-04	1.28E+00 ± 4.67E-01	1.02E-01 ± 3.70E-02
73.0	7	1.01E+00 ± 3.69E-01	2.30E-03* ± ---	8.95E-01 ± 3.27E-01	5.56E-02 ± 1.99E-02

Mean Temperature	Nominal pH (RT)	B release rate	Al release rate	Na release rate	Si release rate
°C		$\text{g m}^{-2} \text{d}^{-1}$	$\text{g m}^{-2} \text{d}^{-1}$	$\text{g m}^{-2} \text{d}^{-1}$	$\text{g m}^{-2} \text{d}^{-1}$
73.0	8	5.79E-01 ± 2.11E-01	1.63E-02 ± 5.53E-03	5.13E-01 ± 1.88E-01	3.63E-02 ± 1.28E-02
73.0	8	5.90E-01 ± 2.15E-01	1.97E-02 ± 6.73E-03	5.14E-01 ± 1.88E-01	3.92E-02 ± 1.39E-02
73.0	9	8.40E-02 ± 2.99E-02	5.98E-02 ± 2.15E-02	6.73E-02 ± 2.43E-02	8.20E-02 ± 2.79E-02
73.0	9	8.08E-02 ± 2.88E-02	5.86E-02 ± 2.12E-02	6.64E-02 ± 2.41E-02	7.78E-02 ± 2.82E-02
70.3	10	1.72E-01 ± 6.16E-02	1.66E-01 ± 6.03E-02	1.47E-01 ± 5.34E-02	1.74E-01 ± 6.13E-02
70.3	10	1.61E-01 ± 5.75E-02	1.56E-01 ± 5.66E-02	1.45E-01 ± 5.28E-02	1.64E-01 ± 5.97E-02
70.3	11	7.94E-01 ± 2.80E-01	6.48E-01 ± 2.32E-01	8.10E-01 ± 2.93E-01	7.66E-01 ± 2.73E-01
70.3	11	8.99E-01 ± 3.20E-01	7.62E-01 ± 2.75E-01	9.27E-01 ± 3.37E-01	8.89E-01 ± 3.12E-01
70.6	12	3.66E+00 ± 1.32E+00	3.68E+00 ± 1.34E+00	3.66E+00 ± 1.31E+00	3.81E+00 ± 1.34E+00
70.6	12	3.62E+00 ± 1.30E+00	3.62E+00 ± 1.31E+00	3.62E+00 ± 1.30E+00	3.74E+00 ± 1.34E+00
89.8	7	1.24E+00 ± 4.49E-01	1.38E-02* ± ---	1.27E+00 ± 4.63E-01	4.27E-01 ± 1.54E-01
89.8	7	1.15E+00 ± 4.14E-01	1.16E-02* ± ---	1.14E+00 ± 4.18E-01	3.79E-01 ± 1.37E-01
89.8	8	7.43E-01 ± 2.67E-01	1.11E-01 ± 3.82E-02	1.00E+00 ± 3.66E-01	1.47E-01 ± 5.19E-02
89.8	8	6.18E-01 ± 2.22E-01	8.96E-02 ± 3.07E-02	8.48E-01 ± 3.09E-01	1.16E-01 ± 4.10E-02
89.8	9	2.24E-01 ± 7.78E-02	1.37E-01 ± 4.66E-02	2.95E-01 ± 1.07E-01	1.54E-01 ± 5.48E-02
90.4	10	9.44E-01 ± 3.39E-01	9.22E-01 ± 3.32E-01	8.87E-01 ± 3.24E-01	9.55E-01 ± 3.49E-01
90.4	10	8.97E-01 ± 3.23E-01	8.75E-01 ± 3.16E-01	8.52E-01 ± 3.10E-01	9.06E-01 ± 3.30E-01
90.6	11	4.17E+00 ± 1.15E+00	2.55E+00 ± 7.14E-01	3.75E+00 ± 1.03E+00	4.02E+00 ± 1.10E+00
90.6	11	3.83E+00 ± 1.37E+00	1.98E+00 ± 7.11E-01	3.41E+00 ± 1.24E+00	3.64E+00 ± 1.30E+00
91.1	12	1.06E+01 ± 3.42E+00	1.12E+01 ± 3.63E+00	9.83E+00 ± 3.18E+00	1.07E+01 ± 3.50E+00
91.1	12	1.15E+01 ± 4.12E+00	1.36E+01 ± 3.83E+00	1.10E+01 ± 3.91E+00	1.17E+01 ± 4.23E+00

* Value is calculated from the elemental EQL.

(a) Test had a background [Si] so error values becomes negative.

Figure 3.4. Normalized $\log_{10}$ boron release rates as a function of pH and temperature for a) ORLEC28 and b) ORLEC33. Data and uncertainties are provided for ORLEC28 in Table 3.1 and for ORLEC33 in Table 3.2. Measured test temperatures, flow rates, standard errors, and effluent concentrations are provided in Appendices A and C. Lines are regressions of data obtained from tests with $\text{pH}(\text{RT}) \geq 9$. Unfilled data points were not included in the regression.

Though the model presented by Strachan (2017) may explain some of the glass dissolution behavior in the near-neutral to acidic pH ranges, the goal of the present investigation is to provide inputs to the rate model provided in Eq. 2-3. To accomplish this, the three forward-rate parameters, k_0 , η , and E_a , are determined with a compilation of forward rate values obtained at various temperature and pH combinations in dilute systems. Because the forward rate is determined from dilute solutions [i.e. the chemical affinity term $1 - (Q/K) = 1$], Eq. 2-3 simplifies to:

$$r = k_0 10^{\eta[pH]} \exp\left(\frac{-E_a}{RT}\right) \quad \text{Eq. 3-1}$$

Note that the activity of H^+ from Eq. 2-3 is now expressed as a pH instead of hydrogen ion activity. Upon further rearrangement of Eq. 3-1 to a linear form the following expression is obtained:

$$\log(r) = \log k_0 + \eta[pH] - \log[e] \left(\frac{E_a}{R} \right) \left(\frac{1}{T} \right) \quad \text{Eq. 3-2}$$

When performing a linear regression with boron release rates on Eq. 3-2, the coefficients k_0 , η , and E_a , which must be solved by rearranging the various terms in Eq. 3-2, are determined. A global fit of the boron data leads to more robust uncertainty calculations because it allows for a calculation of coefficients without ignoring possible correlation among data and coefficients that may occur if the various parameters were to be fit separately (Neeway et al. 2018). The global fit results, along with the forward rate boron release rates across all examined temperature and pH values, are presented in Figure 3.4. The forward boron release rates used to perform the fit are provided in Appendix A and in Table 3.1 and Table 3.2 for ORLEC28 and ORLEC33, respectively.

From the regression, the parameter values for ORLEC28 are η of 0.55 ± 0.02 , $\log(k_0) = 6.4 \pm 0.3$ [$\text{g m}^{-2} \text{d}^{-1}$] and $E_a = 79 \pm 2 \text{ kJ mol}^{-1}$ with a correlation coefficient (R^2) of 0.99. The k_0 value with the common units for glass dissolution of $\text{g m}^{-2} \text{d}^{-1}$ is then given as $k_0 = 2.7 \times 10^6 \text{ g m}^{-2} \text{d}^{-1} \pm 5\%$. For ORLEC33, parameter values are an η of 0.56 ± 0.02 , $\log(k_0) = 6.6 \pm 0.3$ [$\text{g m}^{-2} \text{d}^{-1}$] and $E_a = 81 \pm 2 \text{ kJ mol}^{-1}$ with a correlation coefficient (R^2) of 0.99. The k_0 value with the common units for glass dissolution of $\text{g m}^{-2} \text{d}^{-1}$ is then given as $k_0 = 3.8 \times 10^6 \text{ g m}^{-2} \text{d}^{-1} \pm 4\%$. These values for ORLEC28 and ORLEC33 may be used for modeling of these glasses at the anticipated repository temperature of 15 °C.

The values of $\eta = 0.55 \pm 0.02$ and 0.56 ± 0.02 are slightly higher than the values obtained for other ILAW glasses (see Table 4.1) and other high-level waste (HLW) glass formulations (Abraitis et al. 2000a, Vernaz et al. 1988). The values in Table 4.1 show that in the alkaline range examined in this study, η values range for ILAW glasses are 0.28-0.49. However, the η value for ORLEC28 and ORLEC33 lies within the uncertainty range of the η values determined for ORPLB2 and LAWA44.

Though it is unknown exactly why the η values from the present study are greater than previous ILAW values, a discussion of the physical meaning behind the term may provide some insight into the difference. The importance of pH term on the glass dissolution reaction may be related to the sorption of H^+ and OH^- on the glass surface. However, a question that arises from this observation is why a fractional value is obtained (i.e. $0 < \eta < 1$). One possible reason was provided by Lasaga (1995) who proposed that the reason for the fractional value is that the dependence of the rate is not related to the bulk pH (i.e. solution activity of H_3O^+) but rather to the activity of H_3O^+ on the surface. Through titrations on mineral surfaces, investigators have noted that the proton-promoted, and by extension hydroxyl-promoted, dissolution is linear in proportion to the activity of the protonated surface sites (Blum and Lasaga 1988, Brady and Walther 1992). Therefore, one explanation of a higher η value for ORLEC28 and ORLEC33

may be a higher density of protonated surface sites on these glasses. It should be noted that the pH-dependent η values provided in Table 4.1 are only applicable in the alkaline pH range.

The values of k_0 ($2.7 \times 10^6 \text{ g m}^{-2} \text{ d}^{-1}$ and $3.8 \times 10^6 \text{ g m}^{-2} \text{ d}^{-1}$ for ORLEC28 and ORLEC33, respectively) are on the same order of magnitude as LD6-5412, LAWABP1, and IDF18-A161, one to three orders of magnitude greater than LAWA44, LAWB45, LAWC22, and ORPBL2, and two orders of magnitude lower than ORPLG9. The parameter k_0 is often referred to as the intrinsic rate constant as it is intrinsic to the solid and independent of solution composition and temperature (Strachan 2001). In a sensitivity analysis by Bacon and Pierce (2010), it was shown that the glass dissolution and resulting Tc flux into the near-field environment is insensitive to the k_0 parameter at field conditions of 15 °C and a water flux of 0.9 mm/yr. The k_0 parameter should depend solely on the composition of the glass and, though not the focus of this study, future studies could focus on the quantification the effect of changes in glass composition on this term.

The value of E_a (79 and 81 kJ mol⁻¹ for ORLEC28 and ORLEC33, respectively) is slightly higher than most ILAW glasses (see Table 4.1), and at the higher end of other SiO₂ polymorphs [quartz: 66-83 kJ mol⁻¹ (Dove 1994, Rimstidt et al. 2016), SiO₂(am): 74.5 kJ mol⁻¹ (Icenhower and Dove 2000), cristobalite: 69 kJ mol⁻¹ (Renders et al. 1995)] and simulated high-level waste (HLW) glasses [SON68: 76 kJ mol⁻¹ (Frugier et al. 2008), PNL 76-68: 74 kJ mol⁻¹ (Strachan 1983), ISG: 62-77 kJ mol⁻¹ (Inagaki et al. 2013)]. The values are apparent activation energies because several elementary reactions may be involved in the dissolution of complex glasses. Activation energies in the range presented here are typically associated with the rupture of Si-O bonds because they are too high to be associated with a diffusion-controlled process (Strachan 2001), where activation energies are found to be in the order of 30-50 kJ/mol (McGrail et al. 2001b, Ojovan et al. 2006, Shutthanandan et al. 2002). As noted by Neeway et al. (2016), if the diffusion-controlled reaction is ion-exchange/interdiffusion between H⁺ or H₃O⁺ and alkali in the glass, then a chemical reaction involving the dissociation of O-H bonds must be occurring as the alkali-alkali ion-exchange/interdiffusion process results in activation energies between 100 to 150 kJ mol⁻¹.

3.3 Effect of Silicon in the Influent Solution

The normalized release rates for B and Na for ORLEC28 as a function of $a[\text{H}_4\text{SiO}_4]$ for experiments performed at pH(RT) 9 are presented in Figure 3.5. The data used to make the plots in Figure 3.5 are provided in Appendix A. Values of $a[\text{H}_4\text{SiO}_4]$ were calculated from the measured Si in the effluent solution and not Si added to the influent solution. The value of $a[\text{H}_4\text{SiO}_4]$ was calculated from the silicic acid activity at the temperature and pH of these experiments being ~89% of the total Si species, the other major species being H₃SiO₄⁻ (~11%) and H₂SiO₄²⁻ (<<1%) (McGrail et al. 1997).

Overall, the general trend in Figure 3.5 for room temperature (nominally 23 °C), 40, 70, and 90 °C is a decreasing dissolution rate with increasing $a[\text{H}_4\text{SiO}_4]$ until the dissolution rate remains relatively constant as $a[\text{H}_4\text{SiO}_4]$ increases. However, there are several peculiarities in the data presented in Figure 3.5. In particular, for the data at 70 and 90 °C, there is a deviation from the commonly understood theory of glass dissolution that states that the glass dissolution rate will decrease with increasing Si concentrations in solution. For the 70 and 90 °C data, the dissolution rates increases to a certain Si concentration at which point the dissolution rate decreases once more. The fits to determine K_g at the individual temperatures were performed with B dissolution rates. The B dissolution rates were chosen from data points that fit the trend where an increase in $a[\text{H}_4\text{SiO}_4]$ resulted in a decrease in both B and Na release rates. The exception to this is at 70 °C where an additional data point was used so that the fit could be based on more than just two data points. The same criteria were used for the fits for ORLEC33 (see below).

This type of behavior has been observed in previous studies on glass dissolution (Abraitis et al. 2000b, McGrail et al. 2001a, Papathanassiou et al. 2011, Papathanassiou et al. 2017b). McGrail et al. (2001a) and Abraitis et al. (2000b) attempted to explain this behavior by noting that there were relatively higher concentrations of Al in solution at low Si concentrations. These higher concentrations of Al led to higher AlO_2^- solution activities, which were argued to be responsible for controlling the glass dissolution rate. Further, they argued that as Si was added to the inlet solution at higher concentrations, a hydrous gel formed at the glass surface interface, which decreased the activity of AlO_2^- and caused the glass dissolution rate to increase slightly. As more Si was added to the inlet solution, the activity of H_4SiO_4 increased and began to control the glass dissolution rate. Some authors have argued that a non-linear rate law that accounts for both AlO_2^- and H_4SiO_4 activity in solution is necessary to explain the dissolution of both natural (Gislason and Oelkers 2003) and waste glasses (Abraitis et al. 2000c, Gin 1996). However, at present, a rate model that accounts for both the contribution of AlO_2^- and H_4SiO_4 to glass dissolution rates has not been established for waste glasses.

In the present study, we observe relatively high Al concentrations, and thus AlO_2^- activities, at low Si inlet solution concentrations. As more Si is added to solution the measured concentrations of Al decreases and the glass dissolution rate increases to a maximum rate. After this maximum, the glass dissolution rate decreases in a linear fashion and solution Si appears to control the glass dissolution rate (see Appendix A). Past a certain Si concentration the glass dissolution rate appears to be invariant with further increases to the inlet Si concentration. These observations are consistent with the arguments laid out by McGrail et al. (2001a) and Abraitis et al. (2000b); however, the observations are not consistent with the presently used ILAW rate model. A more descriptive model would take into account the effect of Al in solution, among other elements, and would also need to account the role of surface alteration layers that are also known affect glass dissolution rates (Van Iseghem et al. 2006).

Figure 3.5. Normalized release rate with respect to B and Na as a function of SiO₂ activity at 23, 40, 70, and 90 °C for ORLEC28. Measured test temperatures, flow rates, standard errors, and effluent concentrations are provided in Appendices A and D. The SiO₂ activity is calculated from the measured Si in the effluent samples. Square data points for boron were used to perform the regression.

Despite the unexpected trends observed in the tests where Si was added to the solution, the data presented in Figure 3.5 are used to calculate both K_g and r_{LEX} at the assumed IDF temperature of 15 °C. In order to obtain K_g at 15 °C, we first calculate K_g at each individual temperature and then linearly extrapolate to the desired temperature. The data used to calculate K_g at each individual temperature are provided in Figure 3.5. The regression of K_g to 15 °C results in a value of 1.3×10^{-4} mol L⁻¹ with R² of 0.99^a. This value of K_g may be used for ORLEC28 at the IDF temperature.

^a Typically, an equilibrium constant (K) is reported without units but, since the K_g value associated with glass dissolution is described solely by the activity of H₄SiO₄, units of mol L⁻¹ can be applied.

Figure 3.6. $\ln K_g$ vs. inverse temperature for ORLEC28. The circles are from experimental data while the triangle is the $\ln K_g$ value calculated at 15 °C. The value of the triangle is the estimated value of $\ln K_g$ at 15 °C.

The results of the natural logarithm of the ion exchange rate plotted as a function of inverse temperature for ORLEC28 are presented in Figure 3.7. (McGrail et al. 2001a, Neeway et al. 2017, Papathanassiou et al. 2017b, Pierce et al. 2005). A linear regression was performed on the results from the ion exchange rate at 15 °C is calculated to be $2.7 \times 10^{-11} \text{ mol m}^{-2} \text{ s}^{-1}$ ^b. Through 1σ error propagation of the calculated r_{IEX} value, the lower bound of this value is $8.7 \times 10^{-12} \text{ mol m}^{-2} \text{ s}^{-1}$ and the upper bound of this value is $8.4 \times 10^{-11} \text{ mol m}^{-2} \text{ s}^{-1}$, indicating a high degree of uncertainty for this parameter. The r_{IEX} value of ORLEC28 fits well within the majority of the previously tested ILAW glasses, whether they are enhanced waste glass correlations or not. Tasks that take a more in-depth look into the physical meaning and calculation of the ion exchange rate for future ILAW glasses are underway (Lonergan and Neeway 2017, Papathanassiou et al. 2017a).

^b Without the correction described in Section 2.2.4, this value would be $1.6 \times 10^{-10} \text{ mol m}^{-2} \text{ s}^{-1}$.

Figure 3.7. The natural logarithm of the ion exchange rate as a function of inverse temperature for ORLEC28. Points in blue were used to determine r_{IEX} at 15 °C. Points in orange are calculated values of r_{IEX} at 70 °C but were excluded from the extrapolation of r_{IEX} at 15 °C because they were determined to be outliers.

The normalized release rates for B, Na, and Al as a function of $a[\text{H}_4\text{SiO}_4]$ for experiments performed at pH(RT) 9 and four different temperatures for ORLEC33 are presented in Figure 3.8. The K_g fits at each individual temperature were performed in a similar fashion as the fits for ORLEC33. In addition, an intermediate data point was excluded from the 40 °C fit as did not fit reasonably within the linear regression for that temperature. Similar to ORLEC28, there are many deviations from the commonly understood theory of glass dissolution in terms of there being unexpected increases and decreases of the glass dissolution rate with increasing Si concentrations in solution. These deviations also manifest themselves at the lower test temperature of 40 °C. Regardless, the data presented in Figure 3.8 are used to calculate both K_g and r_{IEX} at 15 °C. Figure 3.9 shows the regression of K_g to 15 °C results in a value of $1.1 \times 10^{-4} \text{ mol L}^{-1}$, which may be used as K_g for ORLEC33 at the IDF temperature.

Figure 3.8. Normalized release rate with respect to B and Na as a function of SiO₂ activity at 23, 40, 70, and 90 °C for ORLEC33. Measured test temperatures, flow rates, standard errors, and effluent concentrations are provided in Appendices A and D. The SiO₂ activity is calculated from the measured Si in the effluent samples. Square data points for boron were used to perform the regression.

Figure 3.9. $\ln K_g$ vs. inverse temperature for ORLEC33. The circles are from experimental data while the triangle is the $\ln K_g$ value calculated at 15 °C. The value of the triangle is the estimated value of $\ln K_g$ at 15 °C.

The results of the natural logarithm of r_{IEX} as a function of inverse temperature are presented in Figure 3.10. A linear regression was performed on the results from the tests performed in saturated conditions and r_{IEX} at 15 °C can be calculated to be $3.3 \times 10^{-11} \text{ mol m}^{-2} \text{ s}^{-1}$ ^c with an R^2 of 0.90. Through 1σ error propagation of the calculated r_{IEX} value, the lower bound of this value is $9.3 \times 10^{-12} \text{ mol m}^{-2} \text{ s}^{-1}$ and the upper bound of this value is $1.2 \times 10^{-10} \text{ mol m}^{-2} \text{ s}^{-1}$. Because the B release rate was greater than that of Na, it was not possible to determine an ion exchange rate at the intermediate temperatures of 70 °C. It is not known why there was no measurable value of r_{IEX} at 70 °C.

Figure 3.10. The natural logarithm of r_{IEX} as a function of inverse temperature for ORLEC33. The orange point was not used in the fit. Points in blue were used to determine r_{IEX} at 15 °C. Points in orange are calculated values of r_{IEX} at 70 °C but were excluded from the extrapolation of r_{IEX} at 15 °C because they were determined to be outliers.

Though K_g values for both ORLEC28 and ORLEC33 were determined, the SPFT method may not be the most practical method of determining a value of K_g for use in the IDF PA. Determination of K_g with the SPFT method is made difficult because of the scatter in the data and the assignment of data points that are considered to be “saturated” and “unsaturated”. Indeed, examining past exercises where K_g has been determined for ILAW glasses, it is observed that the use of data points to calculate K_g can be somewhat subjective and uncertainties in the determination of K_g at individual temperatures are not carried through in the regression to determine K_g at 15 °C. Another method may be to investigate the use static of dissolution tests that can be carried out at varying degrees of amorphous silica saturation to determine K_g (Ferrand et al. 2006). Examination of the possibility of determining K_g with an alternative method may help in understanding if difficulties in determining K_g from SPFT testing is a result of the test method or if the deviations are entirely the result of trying to fit SPFT to a rate model that poorly describes the data.

3.4 Behavior of Re

Rhenium is often used as a non-radioactive surrogate for Tc. Because Tc is a major contributor to the overall dose calculations in the IDF PA, it is thus important to understand the behavior of Tc as it is related to glass corrosion. For this reason, the release behavior of Re from ORLEC28 was evaluated in a select number of tests and compared to the release behavior of other elements such as B, Na, Si, and Al.

^c Without the correction described in Section 2.2.4, this value would be $1.9 \times 10^{-10} \text{ mol m}^{-2} \text{ s}^{-1}$.

Specifically, we present the results from tests conducted at room temperature and 90 °C for tests conducted with varying pH (7-12) and at different Si inlet concentrations. Tests conducted in these conditions bracket Re release in terms of both the tested temperature and pH ranges used in this suite of SPFT tests. The raw data for Re analyses are presented in Appendix D. It is noted that the absolute normalized concentrations of Re presented in Figure 3.11 and Figure 3.12 may have a higher degree of uncertainty compared to those of B, Na, Si, and Al because of the low concentration of Re in the starting glass (0.10 wt%).

Figure 3.11 shows the release of B, Na, Al, Si, and Re as a function of time for tests conducted at room temperature at various pH. Uncertainties in the normalized concentrations are not shown in the figure for simplicity. The figure shows that the relative normalized concentration of Re compared to the other glass tracer elements is dependent on the test pH. For tests conducted at pH 7-9 and at short time periods, Re appears to be released at a similar concentration to B and Na. However, as the reaction proceeds, Re release appears to decrease and becomes congruent with, although slightly greater than, the release of Al and Si. As conditions become more alkaline the release of all of the studied elements is nearly congruent. Figure 3.12 shows the release of Re compared to B, Na, and Al from tests performed with Si added to the inlet solution. The Si results are not shown in the figure because of the relatively high Si values from the Si addition. At room temperature, the normalized concentration of Re is indistinguishable from the other elements once a steady-state release from the glass is achieved. On the other hand, at 90 °C, the normalized concentration of Re remains similar to that of Al throughout the entirety of the experiment. This observation is in contrast to the results observed from the dilute condition tests presented in Figure 3.11.

The normalized release concentrations of Re compared to the other glass tracer elements is due either to Re solubility in solution or to the structural role of Re in the glass. A few studies have analyzed Re and Tc structure within waste glasses (McKeown et al. 2007, Weaver et al. 2017). Though analysis of the Re within the glass is not part of the scope of this study, further studies to analyze its role in waste glasses may help elucidate the release mechanism of this element from the glass.

Figure 3.11. Normalized concentrations of B, Na, Al, Si, and Re as a function of time at various pH at room temperature for ORLEC28. Measured test temperatures, flow rates, and effluent concentrations are provided in Appendices A, C, and E. Errors (not shown) are from ICP and uncertainty in the concentration of the tracer in the starting material and are roughly 20% relative to the measured concentration.

Figure 3.12. Normalized concentrations of B, Na, Al, and Re as a function of time at various inlet Si concentrations at a) room temperature and b) 90 °C for ORLEC28. Measured test temperatures, flow rates, and effluent concentrations are provided in Appendices A, D, and E. Errors (not shown) are from ICP and are 10% relative to the measured concentration.

4.0 Summary

This report provides SPFT results on two immobilized low-activity waste (ILAW) correlation glasses: ORLEC28 and ORLEC33. The resulting kinetic rate law parameters obtained from the testing are presented in Table 4.1. The values are nearly identical to one another and within the range, or within uncertainty, of previously tested ILAW glasses. A long-term goal of SPFT testing is to increase the coverage of the anticipated LAW compositional region to reduce uncertainty of long-term performance assessments. Therefore, we recommend further testing on ILAW glass compositions so that the corrosion behavior of ILAW glasses for the range of glass compositions that may be made at WTP can be confidently understood.

There were some difficulties in determining K_g and r_{IEX} for these glasses. This difficulty is inherent in the test method. We propose using a static test method to determine the value of K_g . Alternative methods or models are being investigated in another task in this project. In addition, it has been shown that Re, a surrogate for Tc, shows release behavior that is most similar to other glass formers such as Al and Si. Further studies would need to be performed to determine if Re is retained in the gel layer or if it is released into solution upon glass alteration.

Table 4.1. Summary of Rate Model Parameters Obtained for Select ILAW Glasses at 15°C

	k_0 (g/[m ² d])	K_g (T) (mol L ⁻¹)	η	E_a (kJ/mol)	$r_{IEX}^{(a)}$ (mol m ⁻² s ⁻¹)	Reference
LD6-5412	9.7×10^6	1.14×10^{-4}	0.40 ± 0.03	74.8 ± 1.0	1.74×10^{-11}	(McGrail et al. 1997)
LAWABP1	3.4×10^6	4.90×10^{-4}	0.35 ± 0.03	68 ± 3.0	3.4×10^{-11}	(McGrail et al. 2001a)
LAWA44	1.3×10^4 (R ² = 0.78)	1.87×10^{-3} (R ² = 0.95)	0.49 ± 0.08	60 ± 7	5.3×10^{-11}	(Pierce et al. 2004)
LAWB45	1.6×10^4 (R ² = 0.90)	1.79×10^{-3} (R ² = 0.78)	0.34 ± 0.03	53 ± 3	$0.0 \times 10^{0(c)}$	(Pierce et al. 2004)
LAWC22	1.0×10^5 (R ² = 0.98)	1.80×10^{-3} (R ² = 0.94)	0.42 ± 0.02	64 ± 2	1.2×10^{-10}	(Pierce et al. 2004)
ORPLB2	4.5×10^4	1.70×10^{-3}	0.49 ± 0.05	64 ± 4	3.4×10^{-10}	(Papathanassiu et al. 2011)
IDF7-E12	5.7×10^4	1.87×10^{-3}	0.32 ± 0.03	55 ± 5	$<1 \times 10^{-10}$	(Papathanassiu et al. 2017b)
IDF18-A161	5.9×10^6 (R ² = 0.89)	2.3×10^{-4} (R ² = 0.98)	0.28 ± 0.06	61 ± 6	7.6×10^{-11}	(Neeway et al. 2017)
ORPLG9	2.5×10^8 (R ² = 0.91)	Log K _g = 100 ^(b)	0.36 ± 0.07	81 ± 7	5.3×10^{-11}	(Neeway et al. 2017)
ORLEC28	2.7×10^6 (R ² = 0.99)	1.3×10^{-4}	0.55 ± 0.02	79 ± 2	$2.7 \times 10^{-11(d)}$	This report
ORLEC33	3.8×10^6 (R ² = 0.99)	1.1×10^{-4}	0.56 ± 0.02	81 ± 2	$3.3 \times 10^{-11(d)}$	This report

(a) Values as reported in the original document. See Lonergan and Neeway (2017) for a correction to the r_{IEX} calculation.

(b) See Neeway et al. (2017) for a discussion on the K_g value of ORPLG9.

(c) No detectable ion exchange rate for LAWB45.

(d) Values calculated as described in correction proposed in Lonergan and Neeway (2017). See Section 3.3 for a discussion of errors associated with these ion exchange values.

5.0 References

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Appendix A

Steady-State Single-Pass Flow-Through Results

When the average measured value is below the EQL, the EQL value is provided in brackets. The Instrument Detection Limit for the various tracers are 16.5 ppm, 25.2 ppm, 54.8 ppm, and 44.7 pm for Al, B, Si, and Na, respectively. If the EQL is given and no other value is provided for that sample, then the concentration of that analyte was below the Instrument Detection Limit. The EQL is used to calculate the dissolution rate. Tests where flow rate is listed in red were excluded from calculations.

Reactor	Glass Mass (g)	Steady-State q/S , m s^{-1}	[B] Steady State, $\mu\text{g L}^{-1}$	[Al] Steady State, $\mu\text{g L}^{-1}$	[Na] Steady State, $\mu\text{g L}^{-1}$	[Si] Steady State, $\mu\text{g L}^{-1}$	B steady-state rate, $\text{g m}^{-2} \text{d}^{-1}$	2 σ B rate error ^(a)	Avg. Flow Rate, $\text{m}^3 \text{d}^{-1}$ ^(b)	Deviation of Flow Rate ^(c)	Avg. Test Temp. ($^{\circ}\text{C}$) ^(d)	Temp. Dev.	Steady-state samples ^(e)
ORLEC28 40 $^{\circ}\text{C}$ pH(RT) 9, q/S													
Reac. 1	4.009	2.64E-09	3.94E+02	6.22E+02	4.23E+03	2.29E+03	2.89E-03	1.03E-03	1.80E-05	3.3%	39.3	0.4	
Reac. 2	1.504	1.20E-08	2.03E+02	3.79E+02	1.49E+03	1.42E+03	6.75E-03	2.27E-03	3.06E-05	1.8%	39.3	0.4	
Reac. 3	0.502	4.79E-08	6.95E+01	1.67E+02	6.45E+02	6.22E+02	9.27E-03	2.68E-03	4.10E-05	1.5%	39.3	0.4	
Reac. 4	0.253	1.84E-07	[25.2]	5.84E+01	2.36E+02	2.01E+02	1.29E-02	---	7.93E-05	1.0%	39.3	0.4	
Reac. 5	0.100	7.50E-07	[25.2]	[16.5]	7.91E+01	[54.8]	5.26E-02	---	1.26E-04	0.5%	39.3	0.4	
ORLEC28 90 $^{\circ}\text{C}$ pH(RT) 9, q/S													
Reac. 1	0.798	1.30E-08	6.29E+03	2.64E+03	3.92E+04	1.00E+04	2.27E-01	8.37E-02	1.67E-05	3.5%	90.1	0.1	
Reac. 2	0.299	6.36E-08	1.08E+03	1.25E+03	8.17E+03	4.51E+03	1.91E-01	6.67E-02	3.05E-05	1.6%	90.1	0.1	
Reac. 3	0.099	2.40E-07	3.20E+02	6.05E+02	2.57E+03	2.47E+03	2.13E-01	6.68E-02	3.79E-05	2.4%	90.1	0.1	
Reac. 4	0.051	1.01E-06	1.16E+02	2.37E+02	8.89E+02	9.67E+02	3.26E-01	8.51E-02	8.08E-05	1.0%	90.1	0.1	
Reac. 5	0.022	3.90E-06	[75.6]	[49.4] 28.3*	2.67E+02	1.90E+02	8.21E-01	---	1.25E-04	0.2%	90.1	0.1	
ORLEC33 40 $^{\circ}\text{C}$ pH(RT) 9, q/S													
Reac. 1	4.019	2.56E-09	4.51E+02	5.67E+02	4.70E+03	2.51E+03	2.91E-03	1.03E-03	1.79E-05	2.3%	39.3	0.4	
Reac. 2	1.500	1.15E-08	2.19E+02	3.41E+02	1.60E+03	1.57E+03	6.38E-03	2.15E-03	3.01E-05	1.0%	39.3	0.4	
Reac. 3	0.501	4.62E-08	7.35E+01	1.47E+02	6.49E+02	6.53E+02	8.59E-03	2.51E-03	4.03E-05	1.1%	39.3	0.4	
Reac. 4	0.251	1.78E-07	[25.2]	4.18E+01	2.23E+02	1.66E+02	1.14E-02	---	7.79E-05	1.5%	39.3	0.4	
Reac. 5	0.102	7.20E-07	[25.2]	[16.5]	8.88E+01	[54.8]	4.59E-02	---	1.27E-04	0.6%	39.3	0.4	
ORLEC33 90 $^{\circ}\text{C}$ pH(RT), 9, q/S													
Reac. 1	0.799	1.36E-08	1.10E+04	2.62E+03	5.58E+04	1.17E+04	3.79E-01	1.44E-01	1.75E-05	5.6%	89.9	1.6	
Reac. 2	0.319	6.00E-08	2.67E+03	1.21E+03	1.53E+04	5.56E+03	4.05E-01	1.50E-01	3.02E-05	4.7%	89.9	1.6	
Reac. 3	0.099	2.23E-07	5.92E+02	5.24E+02	3.67E+03	2.61E+03	3.34E-01	1.20E-01	3.54E-05	7.6%	89.9	1.6	
Reac. 4	0.051	1.06E-06	1.40E+02	1.17E+02	1.03E+03	7.04E+02	3.73E-01	1.01E-01	8.14E-05	4.2%	89.9	1.6	
Reac. 5	0.025	3.50E-06	[75.6]	[49.4]	4.40E+02	[164] 147*	6.68E-01	---	1.24E-04	1.1%	89.9	1.6	
ORLEC28 23 $^{\circ}\text{C}$ pH 7													

Reactor	Glass Mass (g)	Steady-State q/S , m s^{-1}	[B] Steady State, $\mu\text{g L}^{-1}$	[Al] Steady State, $\mu\text{g L}^{-1}$	[Na] Steady State, $\mu\text{g L}^{-1}$	[Si] Steady State, $\mu\text{g L}^{-1}$	B steady-state rate, $\text{g m}^{-2} \text{d}^{-1}$	2 σ B rate error ^(a)	Avg. Flow Rate, $\text{m}^3 \text{d}^{-1}$ ^(b)	Deviation of Flow Rate ^(c)	Avg. Test Temp. ($^{\circ}\text{C}$) ^(d)	Temp. Dev.	Steady-state samples ^(e)
Reac. A	1.997	1.34E-08	1.06E+02	[16.5]	5.38E+02	[54.8]	3.94E-03	1.29E-03	4.56E-05	7.0%	22.0	0.7	
Reac. B	1.200	1.85E-08	1.20E+02	[16.5]	5.80E+02	[54.8]	6.21E-03	1.97E-03	3.78E-05	1.5%	22.0	0.7	
ORLEC28 23 $^{\circ}\text{C}$ pH 8													
Reac. A	1.200	1.93E-08	4.42E+01	2.14E+01	2.53E+02	[54.8]	2.38E-03	6.32E-04	3.95E-05	2.2%	22.0	0.7	
Reac. B	1.200	1.85E-08	4.41E+01	2.33E+01	2.43E+02	[54.8]	2.28E-03	6.04E-04	3.79E-05	1.3%	22.0	0.7	
ORLEC28 23 $^{\circ}\text{C}$ pH 9													
Reac. A	1.200	1.65E-08	6.21E+01	9.55E+01	2.80E+02	2.05E+02	2.85E-03	8.10E-04	3.37E-05	3.3%	22.0	0.7	
Reac. B	1.201	1.71E-08	6.16E+01	9.43E+01	2.86E+02	1.99E+02	2.92E-03	8.31E-04	3.49E-05	3.2%	22.0	0.7	
ORLEC28 23 $^{\circ}\text{C}$ pH 10													
Reac. A	1.200	1.87E-08	1.37E+02	2.06E+02	5.25E+02	6.97E+02	7.16E-03	2.31E-03	3.83E-05	1.7%	22.0	0.7	
Reac. B	1.200	1.83E-08	1.24E+02	1.88E+02	4.72E+02	6.18E+02	6.33E-03	2.02E-03	3.75E-05	1.6%	22.0	0.7	
ORLEC28 23 $^{\circ}\text{C}$ pH 11													
Reac. A	0.200	1.22E-07	9.63E+01	1.33E+02	4.04E+02	5.04E+02	3.25E-02	9.97E-03	4.07E-05	0.6%	22.0	0.7	
Reac. B	0.200	1.12E-07	8.77E+01	1.20E+02	4.09E+02	4.03E+02	2.73E-02	8.42E-03	3.76E-05	4.7%	22.0	0.7	
ORLEC28 23 $^{\circ}\text{C}$ pH 12													
Reac. A	0.100	2.64E-07	1.84E+02	2.76E+02	1.27E+03	9.54E+02	1.36E-01	4.53E-02	4.19E-05	1.9%	22.0	0.7	
Reac. B	0.100	2.42E-07	2.07E+02	3.55E+02	1.57E+03	1.10E+03	1.39E-01	4.68E-02	3.82E-05	0.8%	22.0	0.7	
ORLEC28 40 $^{\circ}\text{C}$ pH 7													
Reac. A	0.660	3.41E-08	5.50E+02	[16.5]	2.74E+03	[54.8]	5.22E-02	1.85E-02	3.74E-05	0.7%	40.8	0.4	
Reac. B	0.660	3.34E-08	5.18E+02	[16.5]	2.65E+03	[54.8]	4.82E-02	1.71E-02	3.68E-05	1.4%	40.8	0.4	
ORLEC28 40 $^{\circ}\text{C}$ pH 8													
Reac. A	0.660	3.16E-08	2.12E+02	6.24E+01	9.65E+02	1.01E+02	1.87E-02	6.32E-03	3.52E-05	2.2%	40.8	0.4	
Reac. B	0.660	3.68E-08	1.93E+02	4.42E+01	9.74E+02	9.28E+01	1.98E-02	6.63E-03	4.11E-05	1.5%	40.8	0.4	
ORLEC28 40 $^{\circ}\text{C}$ pH 9													
Reac. A	0.660	3.30E-08	1.39E+02	2.07E+02	6.71E+02	7.08E+02	1.28E-02	4.12E-03	3.70E-05	1.2%	40.8	0.4	

Reactor	Glass Mass (g)	Steady-State q/S , m s^{-1}	[B] Steady State, $\mu\text{g L}^{-1}$	[Al] Steady State, $\mu\text{g L}^{-1}$	[Na] Steady State, $\mu\text{g L}^{-1}$	[Si] Steady State, $\mu\text{g L}^{-1}$	B steady-state rate, $\text{g m}^{-2} \text{d}^{-1}$	2 σ B rate error ^(a)	Avg. Flow Rate, $\text{m}^3 \text{d}^{-1}$ ^(b)	Deviation of Flow Rate ^(c)	Avg. Test Temp. ($^{\circ}\text{C}$) ^(d)	Temp. Dev.	Steady-state samples ^(e)
Reac. B	0.660	3.26E-08	1.46E+02	2.15E+02	6.87E+02	7.42E+02	1.32E-02	4.29E-03	3.66E-05	0.9%	40.8	0.4	
ORLEC28 40 $^{\circ}\text{C}$ pH 10													
Reac. A	0.599	3.50E-08	3.34E+02	5.06E+02	1.72E+03	1.91E+03	3.25E-02	1.13E-02	3.54E-05	1.7%	40.9	0.1	
Reac. B	0.606	3.75E-08	3.07E+02	4.73E+02	1.54E+03	1.75E+03	3.20E-02	1.11E-02	3.84E-05	0.6%	40.9	0.1	
ORLEC28 40 $^{\circ}\text{C}$ pH 11													
Reac. A	0.100	2.11E-07	2.39E+02	3.35E+02	1.22E+03	1.41E+03	1.40E-01	4.84E-02	3.39E-05	3.7%	40.9	0.1	
Reac. B	0.100	2.19E-07	2.34E+02	3.28E+02	1.19E+03	1.37E+03	1.43E-01	4.93E-02	3.52E-05	3.4%	40.9	0.1	
ORLEC28 40 $^{\circ}\text{C}$ pH 12													
Reac. A	0.050	5.12E-07	4.23E+02	7.23E+02	2.24E+03	2.58E+03	6.02E-01	2.15E-01	3.35E-05	3.7%	40.9	0.1	
Reac. B	0.050	5.59E-07	3.94E+02	6.65E+02	2.09E+03	2.39E+03	6.12E-01	2.18E-01	3.67E-05	3.9%	40.9	0.1	
ORLEC28 70 $^{\circ}\text{C}$ pH 7													
Reac. A	0.400	7.16E-08	4.47E+03	3.33E+01	2.34E+04	9.84E+02	8.90E-01	3.25E-01	3.78E-05	0.9%	73.0	0.6	
Reac. B	0.400	7.18E-08	4.35E+03	3.45E+01	2.11E+04	9.34E+02	8.69E-01	3.17E-01	3.82E-05	1.7%	73.0	0.6	
ORLEC28 70 $^{\circ}\text{C}$ pH 8													
Reac. A	0.400	5.28E-08	2.73E+03	2.98E+02	1.38E+04	1.06E+03	4.01E-01	1.46E-01	3.22E-05	1.3%	73.0	0.6	
Reac. B	0.400	6.43E-08	2.37E+03	2.63E+02	1.23E+04	1.01E+03	4.24E-01	1.55E-01	3.89E-05	1.6%	73.0	0.6	
ORLEC28 70 $^{\circ}\text{C}$ pH 9													
Reac. A	0.400	5.65E-08	4.91E+02	8.20E+02	2.57E+03	3.02E+03	7.72E-02	2.73E-02	3.79E-05	1.1%	73.0	0.6	
Reac. B	0.400	5.28E-08	3.60E+02	7.67E+02	2.51E+03	2.80E+03	5.28E-02	1.84E-02	3.54E-05	1.3%	73.0	0.6	
ORLEC28 70 $^{\circ}\text{C}$ pH 10													
Reac. A	0.227	1.07E-07	6.51E+02	7.81E+02	3.09E+03	3.49E+03	1.95E-01	7.54E-02	3.94E-05	8.0%	70.3	1.1	
Reac. B	0.225	1.07E-07	6.29E+02	7.98E+02	3.04E+03	3.41E+03	1.86E-01	1.55E-01	3.89E-05	39.1%	70.3	1.1	
ORLEC28 70 $^{\circ}\text{C}$ pH 11													
Reac. A	0.040	6.46E-07	5.10E+02	6.04E+02	2.83E+03	2.71E+03	9.16E-01	3.26E-01	3.48E-05	2.3%	70.3	1.1	
Reac. B	0.040	7.42E-07	4.65E+02	6.15E+02	2.68E+03	2.51E+03	9.61E-01	3.41E-01	3.92E-05	2.3%	70.3	1.1	

Reactor	Glass Mass (g)	Steady-State q/S , m s^{-1}	[B] Steady State, $\mu\text{g L}^{-1}$	[Al] Steady State, $\mu\text{g L}^{-1}$	[Na] Steady State, $\mu\text{g L}^{-1}$	[Si] Steady State, $\mu\text{g L}^{-1}$	B steady-state rate, $\text{g m}^{-2} \text{d}^{-1}$	2 σ B rate error ^(a)	Avg. Flow Rate, $\text{m}^3 \text{d}^{-1}$ ^(b)	Deviation of Flow Rate ^(c)	Avg. Test Temp. ($^{\circ}\text{C}$) ^(d)	Temp. Dev.	Steady-state samples ^(e)
ORLEC28 70 $^{\circ}\text{C}$ pH 12													
Reac. A	0.021	1.32E-06	9.49E+02	1.68E+03	5.27E+03	5.41E+03	3.50E+00	1.26E+00	3.54E-05	1.2%	70.3	1.1	2,3,4
Reac. B	0.021	1.45E-06	8.70E+02	1.51E+03	5.00E+03	4.97E+03	3.50E+00	1.25E+00	3.83E-05	0.1%	70.3	1.1	2,3,4
ORLEC28 90 $^{\circ}\text{C}$ pH 7													
Reac. A	0.100	2.94E-07	8.52E+02	[16.5]	5.77E+03	1.01E+03	6.96E-01	2.51E-01	3.40E-05	2.9%	89.8	0.4	
Reac. B	0.101	3.07E-07	8.43E+02	[16.5]	5.80E+03	8.12E+02	7.21E-01	2.59E-01	3.60E-05	1.6%	89.8	0.4	
ORLEC28 90 $^{\circ}\text{C}$ pH 8													
Reac. A	0.102	1.38E-07	1.01E+03	2.99E+02	8.22E+03	1.33E+03	3.89E-01	1.48E-01	1.94E-05	6.4%	89.8	0.4	
Reac. B	0.103	1.91E-07	6.68E+02	2.35E+02	5.36E+03	1.07E+03	3.54E-01	1.28E-01	2.90E-05	3.2%	89.8	0.4	
ORLEC28 90 $^{\circ}\text{C}$ pH 9													
Reac. A	0.101	2.35E-07	2.10E+02	4.64E+02	1.85E+03	1.64E+03	1.37E-01	4.63E-02	3.71E-05	1.2%	89.8	0.4	
ORLEC28 90 $^{\circ}\text{C}$ pH 10													
Reac. A	0.054	4.38E-07	9.02E+02	1.49E+03	4.33E+03	5.06E+03	1.10E+00	3.98E-01	3.33E-05	2.7%	90.4	0.8	
Reac. B	0.058	4.66E-07	8.17E+02	1.37E+03	3.86E+03	4.61E+03	1.06E+00	3.80E-01	3.83E-05	0.9%	90.4	0.8	
ORLEC28 23 $^{\circ}\text{C}$ pH 11													
Reac. A	0.013	1.77E-06	5.68E+02	6.07E+02	2.73E+03	3.01E+03	2.79E+00	1.02E+00	3.12E-05	4.3%	90.6	0.6	
Reac. B	0.014	2.20E-06	6.46E+02	7.84E+02	3.11E+03	3.57E+03	3.95E+00	1.43E+00	3.76E-05	3.8%	90.6	0.6	5,6,7
ORLEC28 23 $^{\circ}\text{C}$ pH 12													
Reac. A	0.005	5.16E-06	7.96E+02	1.51E+03	4.06E+03	4.70E+03	1.14E+01	4.14E+00	3.39E-05	2.9%	91.1	0.7	2,3
Reac. B	0.006	5.90E-06	6.97E+02	1.26E+03	3.44E+03	4.17E+03	1.14E+01	4.08E+00	3.93E-05	0.9%	91.1	0.7	2,3
ORLEC33 23 $^{\circ}\text{C}$ pH 7													
Reac. A	1.200	1.92E-08	3.54E+02	[16.5]	1.74E+03	[54.8]	1.71E-02	6.00E-03	3.97E-05	2.2%	22.0	0.7	
Reac. B	1.200	1.48E-08	3.69E+02	[16.5]	1.80E+03	[54.8]	1.38E-02	5.20E-03	3.07E-05	7.7%	22.0	0.7	
ORLEC33 23 $^{\circ}\text{C}$ pH 8													
Reac. A	1.200	1.81E-08	8.32E+01	1.78E+01	3.92E+02	8.68E+01	3.80E-03	1.14E-03	3.78E-05	1.4%	22.0	0.7	

Reactor	Glass Mass (g)	Steady-State q/S , m s^{-1}	[B] Steady State, $\mu\text{g L}^{-1}$	[Al] Steady State, $\mu\text{g L}^{-1}$	[Na] Steady State, $\mu\text{g L}^{-1}$	[Si] Steady State, $\mu\text{g L}^{-1}$	B steady-state rate, $\text{g m}^{-2} \text{d}^{-1}$	2 σ B rate error ^(a)	Avg. Flow Rate, $\text{m}^3 \text{d}^{-1}$ ^(b)	Deviation of Flow Rate ^(c)	Avg. Test Temp. ($^{\circ}\text{C}$) ^(d)	Temp. Dev.	Steady-state samples ^(e)
Reac. B	1.200	1.70E-08	8.56E+01	1.84E+01	4.03E+02	9.00E+01	3.69E-03	1.15E-03	3.56E-05	5.8%	22.0	0.7	
ORLEC33 23 $^{\circ}\text{C}$ pH 9													
Reac. A	1.200	1.61E-08	6.49E+01	7.72E+01	3.12E+02	3.27E+02	2.64E-03	7.64E-04	3.37E-05	4.0%	22.0	0.7	
Reac. B	1.200	1.70E-08	6.07E+01	6.66E+01	2.75E+02	2.94E+02	2.61E-03	7.39E-04	3.56E-05	3.0%	22.0	0.7	
ORLEC33 23 $^{\circ}\text{C}$ pH 10													
Reac. A	1.201	1.85E-08	9.37E+01	1.46E+02	5.24E+02	4.24E+02	4.37E-03	1.34E-03	3.86E-05	2.6%	22.0	0.7	
Reac. B	1.200	1.81E-08	1.45E+02	2.33E+02	8.56E+02	7.44E+02	6.65E-03	2.18E-03	3.78E-05	3.1%	22.0	0.7	
ORLEC33 23 $^{\circ}\text{C}$ pH 11													
Reac. A	0.200	1.13E-07	1.19E+02	1.54E+02	5.17E+02	5.68E+02	3.40E-02	1.20E-02	3.87E-05	9.8%	22.0	0.7	
Reac. B	0.200	1.01E-07	1.23E+02	1.66E+02	5.52E+02	6.32E+02	3.15E-02	1.00E-02	3.45E-05	1.9%	22.0	0.7	
ORLEC33 23 $^{\circ}\text{C}$ pH 12													
Reac. A	0.100	2.41E-07	2.52E+02	3.43E+02	1.16E+03	1.28E+03	1.53E-01	5.23E-02	3.87E-05	0.6%	22.0	0.7	
Reac. B	0.100	2.08E-07	2.66E+02	3.71E+02	1.31E+03	1.63E+03	1.40E-01	4.86E-02	3.36E-05	3.0%	22.0	0.7	
ORLEC33 40 $^{\circ}\text{C}$ pH 7													
Reac. A	0.660	3.29E-08	1.73E+03	[16.5]	7.91E+03	1.18E+02	1.44E-01	5.20E-02	3.53E-05	0.9%	40.7	1.2	
Reac. B	0.660	3.56E-08	1.55E+03	[16.5]	6.60E+03	9.72E+01	1.39E-01	5.04E-02	3.82E-05	1.4%	40.7	1.2	
ORLEC33 40 $^{\circ}\text{C}$ pH 8													
Reac. A	0.660	2.95E-08	6.29E+02	5.20E+01	2.79E+03	1.47E+02	4.70E-02	1.67E-02	3.33E-05	1.2%	40.7	1.2	
Reac. B	0.660	3.39E-08	4.36E+02	3.72E+01	1.92E+03	8.15E+01	3.74E-02	1.32E-02	3.83E-05	1.6%	40.7	1.2	
ORLEC33 40 $^{\circ}\text{C}$ pH 9													
Reac. A	0.660	3.36E-08	1.28E+02	1.99E+02	6.58E+02	7.75E+02	1.09E-02	3.48E-03	3.86E-05	0.9%	40.7	1.2	
Reac. B	0.660	3.19E-08	1.48E+02	2.13E+02	6.85E+02	8.26E+02	1.20E-02	3.85E-03	3.66E-05	1.2%	40.7	1.2	
ORLEC33 40 $^{\circ}\text{C}$ pH 10													
Reac. 3	0.660	3.35E-08	3.98E+02	4.35E+02	1.64E+03	1.93E+03	3.37E-02	1.20E-02	3.80E-05	3.4%	40.9	0.9	
Reac. 4	0.600	3.58E-08	3.09E+02	3.49E+02	1.33E+03	1.58E+03	2.79E-02	9.83E-03	3.70E-05	3.8%	40.9	0.9	

Reactor	Glass Mass (g)	Steady-State q/S , m s^{-1}	[B] Steady State, $\mu\text{g L}^{-1}$	[Al] Steady State, $\mu\text{g L}^{-1}$	[Na] Steady State, $\mu\text{g L}^{-1}$	[Si] Steady State, $\mu\text{g L}^{-1}$	B steady-state rate, $\text{g m}^{-2} \text{d}^{-1}$	2σ B rate error ^(a)	Avg. Flow Rate, $\text{m}^3 \text{d}^{-1}$ (b)	Deviation of Flow Rate (c)	Avg. Test Temp. ($^{\circ}\text{C}$) (d)	Temp. Dev.	Steady-state samples (e)
ORLEC33 40°C pH 11													
Reac. A	0.100	2.16E-07	2.64E+02	2.82E+02	1.18E+03	1.37E+03	1.44E-01	4.99E-02	3.55E-05	3.1%	40.9	0.9	
Reac. B	0.100	2.17E-07	2.68E+02	2.81E+02	1.24E+03	9.71E+02	1.47E-01	5.07E-02	3.55E-05	2.4%	40.9	0.9	
ORLEC33 40 °C pH 12													
Reac. A	0.050	5.73E-07	5.97E+02	8.04E+02	2.66E+03	3.19E+03	8.64E-01	3.12E-01	3.75E-05	3.5%	40.9	0.9	
Reac. B	0.050	5.76E-07	5.83E+02	7.97E+02	2.66E+03	3.10E+03	8.49E-01	3.05E-01	3.67E-05	2.9%	40.9	0.9	
ORLEC33 70 °C pH 7													
Reac. A	0.400	7.92E-08	7.40E+03	1.97E+01	3.19E+04	2.86E+03	1.48E+00	5.41E-01	3.70E-05	0.7%	71.6	0.4	
Reac. B	0.400	7.89E-08	5.06E+03	[16.5]	2.24E+04	1.56E+03	1.01E+00	3.69E-01	3.79E-05	1.1%	71.5	1.0	
ORLEC33 70 °C pH 8													
Reac. A	0.400	6.03E-08	3.79E+03	1.53E+02	1.68E+04	1.33E+03	5.79E-01	2.11E-01	3.40E-05	1.2%	71.5	1.0	
Reac. B	0.400	6.75E-08	3.46E+03	1.65E+02	1.50E+04	1.28E+03	5.90E-01	2.15E-01	3.78E-05	1.1%	71.5	1.0	
ORLEC33 70 °C pH 9													
Reac. A	0.400	5.41E-08	6.15E+02	6.26E+02	2.46E+03	3.35E+03	8.40E-02	2.99E-02	3.69E-05	1.0%	71.5	1.0	
Reac. B	0.400	5.41E-08	5.91E+02	6.13E+02	2.42E+03	3.18E+03	8.08E-02	2.88E-02	3.70E-05	2.0%	71.5	1.0	
ORLEC33 70 °C pH 10													
Reac. A	0.225	1.02E-07	6.67E+02	9.21E+02	2.84E+03	3.76E+03	1.72E-01	6.16E-02	3.79E-05	1.9%	70.2	2.0	
Reac. B	0.228	1.01E-07	6.29E+02	8.72E+02	2.84E+03	3.58E+03	1.61E-01	5.75E-02	3.82E-05	1.8%	70.2	2.0	
ORLEC33 70°C pH 11													
Reac. A	0.040	6.80E-07	4.62E+02	5.39E+02	2.35E+03	2.49E+03	7.94E-01	2.80E-01	3.83E-05	0.8%	70.2	2.0	
Reac. B	0.040	6.71E-07	5.30E+02	6.42E+02	2.73E+03	2.93E+03	8.99E-01	3.20E-01	3.69E-05	2.1%	70.2	2.0	
ORLEC33 70 °C pH 12													
Reac. A	0.021	1.40E-06	1.04E+03	1.49E+03	5.17E+03	6.03E+03	3.66E+00	1.32E+00	3.92E-05	0.6%	70.6	1.1	2,3
Reac. B	0.020	1.36E-06	1.05E+03	1.50E+03	5.25E+03	6.07E+03	3.62E+00	1.30E+00	3.62E-05	0.2%	70.6	1.1	2,3
ORLEC33 90 °C pH 7													

Reactor	Glass Mass (g)	Steady-State q/S , m s^{-1}	[B] Steady State, $\mu\text{g L}^{-1}$	[Al] Steady State, $\mu\text{g L}^{-1}$	[Na] Steady State, $\mu\text{g L}^{-1}$	[Si] Steady State, $\mu\text{g L}^{-1}$	B steady-state rate, $\text{g m}^{-2} \text{d}^{-1}$	2 σ B rate error ^(a)	Avg. Flow Rate, $\text{m}^3 \text{d}^{-1}$ ^(b)	Deviation of Flow Rate ^(c)	Avg. Test Temp. ($^{\circ}\text{C}$) ^(d)	Temp. Dev.	Steady-state samples ^(e)
Reac. A	0.100	4.72E-07	1.04E+03	[16.5]	5.30E+03	2.00E+03	1.24E+00	4.49E-01	3.82E-05	2.3%	89.8	0.4	
Reac. B	0.101	3.98E-07	1.14E+03	[16.5]	5.68E+03	2.11E+03	1.15E+00	4.14E-01	3.46E-05	1.6%	89.8	0.4	
ORLEC33 90 $^{\circ}\text{C}$ pH 8													
Reac. A	0.101	3.26E-07	9.00E+02	1.92E+02	6.07E+03	9.95E+02	7.43E-01	2.67E-01	3.44E-05	1.6%	89.8	0.4	
Reac. B	0.103	2.84E-07	8.60E+02	1.78E+02	5.90E+03	9.06E+02	6.18E-01	2.22E-01	3.47E-05	1.6%	89.8	0.4	
ORLEC33 90 $^{\circ}\text{C}$ pH 9													
Reac. A	0.100	2.57E-07	3.44E+02	3.02E+02	2.27E+03	1.32E+03	2.24E-01	7.78E-02	3.84E-05	1.1%	89.8	0.4	
ORLEC33 90 $^{\circ}\text{C}$ pH 10													
Reac. A	0.052	5.13E-07	7.27E+02	1.02E+03	3.41E+03	4.11E+03	9.44E-01	3.39E-01	3.92E-05	2.2%	90.4	0.8	
Reac. B	0.052	4.25E-07	8.34E+02	1.16E+03	3.96E+03	4.71E+03	8.97E-01	3.23E-01	3.31E-05	1.8%	90.4	0.8	
ORLEC28 23 $^{\circ}\text{C}$ Si													
Reac. A	0.013	2.26E-06	7.28E+02	6.36E+02	3.27E+03	3.93E+03	4.17E+00	1.15E+00	3.71E-05	1.5%	90.7	0.6	
Reac. B	0.014	2.02E-06	7.50E+02	5.55E+02	3.34E+03	3.98E+03	3.83E+00	1.37E+00	3.60E-05	1.5%	90.7	0.6	
ORLEC33 90 $^{\circ}\text{C}$ pH 12													
Reac. A	0.005	5.67E-06	7.38E+02	1.12E+03	3.43E+03	4.19E+03	1.06E+01	3.42E+00	3.71E-05	3.4%	91.1	0.6	2,3
Reac. B	0.005	5.70E-06	7.97E+02	1.35E+03	3.80E+03	4.54E+03	1.15E+01	4.12E+00	3.71E-05	1.5%	91.1	0.6	2,3
ORLEC28 23 $^{\circ}\text{C}$ Si													
Reactor 1	1.327	1.63E-08	3.12E+01	7.36E+01	2.38E+02	1.14E+03	8.32E-01	1.41E-03	3.73E-04	3.6%	23.1	1.2	
Reactor 2	1.326	1.71E-08	2.75E+01	5.74E+01	1.99E+02	4.75E+03	6.99E-01	1.31E-03	3.57E-04	1.9%	23.1	1.2	
Reactor 3	1.322	1.62E-08	[25.2]	4.79E+01	1.89E+02	1.45E+04	4.34E-01	1.14E-03	---	7.2%	23.1	1.2	
Reactor 4	2.500	8.89E-09	3.95E+01	5.86E+01	4.61E+02	1.32E+04	9.76E-04	2.56E-04	3.79E-05	1.7%	21.8	0.4	
Reactor 5	2.500	9.08E-09	3.61E+01	4.72E+01	4.94E+02	2.45E+04	9.11E-04	2.38E-04	3.88E-05	1.7%	21.8	0.4	
Reactor 6	2.500	8.88E-09	3.49E+01	3.79E+01	4.98E+02	2.35E+04	8.61E-04	2.25E-04	3.79E-05	1.8%	21.8	0.4	
ORLEC28 40 $^{\circ}\text{C}$ Si													
Reactor 1	0.668	3.32E-08	9.97E+01	1.50E+02	5.62E+02	1.52E+03	9.23E-03	2.85E-03	3.78E-05	2.0%	40.9	0.9	

Reactor	Glass Mass (g)	Steady-State q/S , m s^{-1}	[B] Steady State, $\mu\text{g L}^{-1}$	[Al] Steady State, $\mu\text{g L}^{-1}$	[Na] Steady State, $\mu\text{g L}^{-1}$	[Si] Steady State, $\mu\text{g L}^{-1}$	B steady-state rate, $\text{g m}^{-2} \text{d}^{-1}$	2σ B rate error ^(a)	Avg. Flow Rate, $\text{m}^3 \text{d}^{-1}$ ^(b)	Deviation of Flow Rate ^(c)	Avg. Test Temp. ($^{\circ}\text{C}$) ^(d)	Temp. Dev.	Steady-state samples ^(e)
Reactor 2	0.660	3.43E-08	9.29E+01	1.52E+02	5.40E+02	5.07E+03	8.87E-03	2.71E-03	3.85E-05	1.6%	40.9	0.9	
Reactor 3	1.000	2.28E-08	9.95E+01	1.18E+02	7.36E+02	1.34E+04	6.31E-03	1.95E-03	3.89E-05	1.5%	40.8	0.3	
Reactor 4	1.000	2.26E-08	1.04E+02	9.95E+01	7.82E+02	2.24E+04	6.54E-03	2.15E-03	3.86E-05	7.1%	40.8	0.3	
Reactor 5	1.000	2.25E-08	1.07E+02	9.49E+01	7.70E+02	3.43E+04	6.72E-03	2.10E-03	3.83E-05	1.1%	40.8	0.3	
Reactor 6	0.665	3.10E-08	8.43E+01	4.70E+01	5.70E+02	4.76E+04	7.28E-03	2.34E-03	3.51E-05	8.4%	40.9	0.9	
ORLEC28 70 $^{\circ}\text{C}$ Si													
Reactor 1	0.452	4.57E-08	4.71E+02	7.04E+02	2.28E+03	3.60E+03	5.99E-02	2.13E-02	3.44E-05	2.8%	71.3	1.1	
Reactor 2	0.499	4.25E-08	4.11E+02	6.20E+02	1.96E+03	7.04E+03	4.85E-02	1.71E-02	3.55E-05	2.5%	71.3	1.1	
Reactor 3	0.450	4.94E-08	1.53E+03	3.92E+02	8.11E+03	1.46E+04	2.10E-01	7.61E-02	3.69E-05	1.3%	72.0	0.7	
Reactor 4	0.450	4.42E-08	1.92E+03	3.94E+02	1.02E+04	2.37E+04	2.36E-01	8.58E-02	3.30E-05	1.8%	72.0	0.7	
Reactor 5	0.454	5.05E-08	8.29E+02	9.40E+01	4.42E+03	4.79E+04	1.16E-01	4.21E-02	3.71E-05	2.8%	71.3	1.1	
Reactor 6	0.450	6.11E-08	7.68E+02	7.94E+01	4.10E+03	7.31E+04	1.31E-01	4.96E-02	4.50E-05	6.7%	71.3	1.1	
ORLEC28 90 $^{\circ}\text{C}$ Si													
Reactor 1	0.122	1.90E-07	2.50E+02	5.08E+02	1.89E+03	2.57E+03	1.32E-01	4.52E-02	3.60E-05	1.7%	89.0	0.8	
Reactor 2	0.121	1.98E-07	2.97E+02	3.20E+02	2.21E+03	5.67E+03	1.63E-01	5.66E-02	3.65E-05	1.9%	89.0	0.8	
Reactor 3	0.110	2.25E-07	8.11E+02	3.80E+02	5.33E+03	2.13E+04	5.07E-01	1.82E-01	3.83E-05	1.0%	92.3	0.6	
Reactor 4	0.120	1.83E-07	4.67E+02	1.68E+02	3.44E+03	4.80E+04	2.38E-01	8.41E-02	3.31E-05	1.6%	89.0	0.8	
Reactor 5	0.119	2.44E-07	3.32E+02	1.06E+02	2.52E+03	7.31E+04	2.25E-01	7.85E-02	3.44E-05	1.7%	89.0	0.8	
Reactor 6	0.118	1.80E-07	3.64E+02	1.02E+02	2.90E+03	9.82E+04	1.83E-01	6.85E-02	3.17E-05	7.4%	89.0	0.8	
ORLEC33 23 $^{\circ}\text{C}$ Si													
Reactor 1	1.323	1.77E-08	2.90E+01	5.53E+01	2.24E+02	1.15E+03	1.30E-03	3.47E-04	4.08E-05	4.3%	23.1	1.2	
Reactor 2	1.326	1.61E-08	[25.2]	4.48E+01	1.91E+02	4.77E+03	1.03E-03	---	3.73E-05	7.1%	23.1	1.2	
Reactor 3	1.325	1.54E-08	[25.2]	3.47E+01	2.01E+02	1.46E+04	9.82E-04	---	3.56E-05	7.4%	23.1	1.2	
Reactor 4	2.500	9.07E-09	5.76E+01	3.78E+01	5.28E+02	1.31E+04	1.32E-03	3.68E-04	3.96E-05	1.9%	21.8	0.4	
Reactor 5	2.500	8.97E-09	5.81E+01	4.81E+01	6.14E+02	2.50E+04	1.32E-03	3.68E-04	3.92E-05	1.7%	21.8	0.4	

Reactor	Glass Mass (g)	Steady-State q/S , m s^{-1}	[B] Steady State, $\mu\text{g L}^{-1}$	[Al] Steady State, $\mu\text{g L}^{-1}$	[Na] Steady State, $\mu\text{g L}^{-1}$	[Si] Steady State, $\mu\text{g L}^{-1}$	B steady-state rate, $\text{g m}^{-2} \text{d}^{-1}$	2 σ B rate error ^(a)	Avg. Flow Rate, $\text{m}^3 \text{d}^{-1}$ ^(b)	Deviation of Flow Rate ^(c)	Avg. Test Temp. ($^{\circ}\text{C}$) ^(d)	Temp. Dev.	Steady-state samples ^(e)
Reactor 6	2.500	9.17E-09	4.16E+01	3.62E+01	5.13E+02	2.40E+04	9.66E-04	2.55E-04	4.00E-05	2.2%	21.8	0.4	
ORLEC33 40 $^{\circ}\text{C}$ Si													
Reactor 1	0.660	3.17E-08	8.27E+01	1.18E+02	4.74E+02	1.43E+03	6.62E-03	2.05E-03	3.64E-05	5.9%	40.9	0.9	
Reactor 2	0.661	3.20E-08	9.65E+01	1.24E+02	5.40E+02	5.04E+03	7.82E-03	2.19E-03	3.69E-05	2.6%	40.9	0.9	
Reactor 3	1.000	2.21E-08	1.79E+02	9.70E+01	1.02E+03	1.30E+04	9.98E-03	3.31E-03	3.84E-05	0.9%	40.8	0.3	
Reactor 4	1.000	2.15E-08	2.52E+02	1.04E+02	1.42E+03	2.23E+04	1.37E-02	4.71E-03	3.74E-05	2.6%	40.8	0.3	
Reactor 5	1.000	2.04E-08	3.26E+02	8.45E+01	1.68E+03	2.50E+04	1.69E-02	5.86E-03	3.56E-05	1.4%	40.8	0.3	
Reactor 6	0.661	3.15E-08	2.19E+02	4.60E+01	1.25E+03	4.79E+04	1.74E-02	6.09E-03	3.62E-05	5.0%	40.9	0.9	
ORLEC33 70 $^{\circ}\text{C}$ Si													
Reactor 1	0.453	4.50E-08	4.83E+02	5.80E+02	2.11E+03	3.59E+03	5.50E-02	1.95E-02	3.49E-05	2.2%	71.3	1.1	
Reactor 2	0.453	4.94E-08	1.46E+03	2.12E+02	6.69E+03	5.63E+03	1.82E-01	6.63E-02	3.61E-05	2.1%	71.3	1.1	
Reactor 3	0.450	4.93E-08	2.67E+03	5.49E+02	1.28E+04	1.56E+04	3.34E-01	1.24E-01	3.72E-05	3.7%	72.0	0.7	
Reactor 4	0.450	4.18E-08	3.44E+03	4.97E+02	1.59E+04	2.44E+04	3.64E-01	1.50E-01	3.14E-05	9.9%	72.0	0.7	
Reactor 5	0.453	5.12E-08	1.27E+03	6.63E+01	5.76E+03	4.77E+04	1.64E-01	5.95E-02	3.65E-05	1.8%	71.3	1.1	
Reactor 6	0.455	4.68E-08	1.90E+03	7.83E+01	9.18E+03	7.15E+04	2.25E-01	8.23E-02	3.42E-05	2.4%	71.3	1.1	
ORLEC28 90 $^{\circ}\text{C}$ Si													
Reactor 1	0.121	2.24E-07	5.30E+02	3.83E+02	3.05E+03	2.48E+03	3.00E-01	1.06E-01	3.90E-05	0.9%	89.0	0.8	
Reactor 2	0.119	2.32E-07	6.30E+02	2.56E+02	3.65E+03	6.58E+03	3.71E-01	1.32E-01	3.86E-05	0.7%	89.0	0.8	
Reactor 3	0.110	2.36E-07	1.44E+03	3.90E+02	7.72E+03	2.13E+04	8.60E-01	3.11E-01	3.91E-05	1.1%	92.3	0.6	
Reactor 4	0.119	2.37E-07	7.75E+02	1.46E+02	4.94E+03	4.98E+04	4.65E-01	1.67E-01	3.94E-05	1.2%	89.0	0.8	
Reactor 5	0.120	1.81E-07	7.87E+02	1.20E+02	5.11E+03	7.45E+04	3.59E-01	1.43E-01	2.96E-05	9.0%	89.0	0.8	
Reactor 6	0.119	2.52E-07	4.85E+02	8.82E+01	3.50E+03	1.00E+05	3.09E-01	1.10E-01	4.10E-05	1.8%	89.0	0.8	

- (a) When “---” is provided as the 2 σ B rate error, the corresponding B steady-state rate value is a maximum value calculated from the EQL. When a rate is a maximum value it is also italicized.
- (b) The average flow rate is calculated from the flow rate of the measured samples. It does not include blanks or the first measured sample in the experiment. Flow rates in red are for tests where the individual samples in the test varied by > 10%. For tests where the flow rate relative standard deviation was > 10%, the steady-state values that are presented are from the last three samplings from that reactor.
- (c) The deviation of the flow rate is determined as the standard deviation of the average flow rate and does not include blanks or the first measured sample in the experiment.

- (d) Average test temperature determined from hourly thermocouple readings.
- (e) Unless otherwise stated, the steady-state samples were the last three samples in an experiment. Reasons for not using the final three samples were the flow rate deviation for a sample was >10%, the glass lost >30% of the starting surface area, or the relative deviation of sample concentrations was >15%. This was done to be compliant with ASTM C1662-10. However, as seen in Appendix B, these criteria have very little effect on release rate calculated values of consecutive samples.

Appendix B

Steady-State Single-Pass Flow-Through Results for Tests at Various q/S Ratios

When the measured value is below the EQL, the EQL value is provided in brackets.

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
ORLEC28 40 °C pH(RT) 9 Reactor 1														
LEC28.40.9.20.Blank1	---	1.37E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9.20.Blank2	---	1.83E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9.20.Blank3	---	1.76E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9.20.2	---	1.79E-05	3.8	4.007	7.92E-02	440	1.88E-03	796	5.79E-03	1,850	2.37E-03	11,500	1.58E-02	8.29E-10
LEC28.40.9.20.4	---	1.74E-05	7.9	4.006	7.92E-02	583	2.42E-03	644	4.56E-03	2,270	2.84E-03	8,380	1.12E-02	5.52E-10
LEC28.40.9.20.6	---	1.74E-05	13.0	4.005	7.92E-02	611	2.54E-03	461	3.26E-03	2,300	2.87E-03	5,700	7.63E-03	3.61E-10
LEC28.40.9.20.7	---	1.76E-05	14.9	4.004	7.92E-02	611	2.56E-03	430	3.07E-03	2,310	2.91E-03	5,070	6.86E-03	3.13E-10
LEC28.40.9.20.8	---	1.84E-05	17.7	4.003	7.92E-02	616	2.70E-03	395	2.96E-03	2,280	3.01E-03	4,550	6.45E-03	2.88E-10
LEC28.40.9.20.9	---	1.87E-05	20.0	4.003	7.92E-02	622	2.78E-03	391	2.97E-03	2,310	3.10E-03	4,150	5.98E-03	2.48E-10
LEC28.40.9.20.10	---	1.90E-05	20.8	4.003	7.92E-02	628	2.84E-03	396	3.05E-03	2,290	3.11E-03	3,980	5.81E-03	2.28E-10
ORLEC28 40 °C pH(RT) 9 Reactor 2														
LEC28.40.9.30.Blank1	---	2.64E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9.30.Blank2	---	3.10E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9.30.Blank3	---	3.02E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9.30.2	---	3.07E-05	3.8	1.502	2.97E-02	251	4.91E-03	248	8.26E-03	1,000	5.88E-03	3,540	2.23E-02	1.16E-09
LEC28.40.9.30.4	---	3.13E-05	7.9	1.502	2.97E-02	342	6.82E-03	206	7.00E-03	1,340	8.03E-03	2,130	1.37E-02	5.53E-10
LEC28.40.9.30.6	---	3.11E-05	13.0	1.500	2.97E-02	371	7.35E-03	206	6.95E-03	1,420	8.45E-03	1,640	1.05E-02	2.91E-10
LEC28.40.9.30.7	---	3.08E-05	14.9	1.500	2.97E-02	377	7.39E-03	205	6.85E-03	1,420	8.37E-03	1,570	9.93E-03	2.55E-10
LEC28.40.9.30.8	---	2.95E-05	17.7	1.499	2.97E-02	379	7.11E-03	206	6.59E-03	1,440	8.13E-03	1,540	9.33E-03	2.26E-10
LEC28.40.9.30.9	---	3.05E-05	20.0	1.499	2.97E-02	379	7.36E-03	203	6.72E-03	1,420	8.30E-03	1,490	9.34E-03	2.16E-10
LEC28.40.9.30.10	---	3.05E-05	20.8	1.499	2.97E-02	379	7.36E-03	200	6.62E-03	1,400	8.17E-03	1,450	9.08E-03	2.04E-10
ORLEC28 40 °C pH(RT) 9 Reactor 3														
LEC28.40.9.40.Blank1	---	3.99E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9.40.Blank2	---	4.11E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9.40.Blank3	---	4.01E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9.40.2	---	4.11E-05	3.8	0.501	9.91E-03	124	9.71E-03	70	9.40E-03	473	1.11E-02	1,130	2.86E-02	1.58E-09
LEC28.40.9.40.4	---	4.13E-05	7.9	0.501	9.91E-03	174	1.37E-02	74	9.94E-03	670	1.59E-02	724	1.84E-02	6.98E-10
LEC28.40.9.40.6	---	4.13E-05	13.0	0.500	9.90E-03	178	1.40E-02	80	1.07E-02	685	1.62E-02	641	1.63E-02	4.62E-10
LEC28.40.9.40.7	---	4.12E-05	14.9	0.500	9.90E-03	179	1.41E-02	77	1.03E-02	669	1.58E-02	639	1.62E-02	4.86E-10
LEC28.40.9.40.8	---	3.94E-05	17.7	0.500	9.90E-03	175	1.32E-02	73	9.34E-03	649	1.47E-02	651	1.58E-02	5.35E-10
LEC28.40.9.40.9	---	4.12E-05	20.0	0.500	9.89E-03	164	1.29E-02	71	9.50E-03	611	1.45E-02	639	1.62E-02	5.56E-10
LEC28.40.9.40.10	---	4.11E-05	20.8	0.500	9.89E-03	162	1.27E-02	65	8.70E-03	606	1.43E-02	646	1.64E-02	6.33E-10
ORLEC28 40 °C pH(RT) 9 Reactor 4														

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (μg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (μg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (μg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (μg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC28.40.9.80.Blank1	---	7.89E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9.80.Blank2	---	7.90E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9.80.Blank3	---	7.99E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9.80.2	---	7.90E-05	3.8	0.252	4.99E-03	41	1.22E-02	[25.2]	1.28E-02	157	1.41E-02	354	3.41E-02	1.76E-09
LEC28.40.9.80.4	---	7.95E-05	7.9	0.252	4.99E-03	57	1.73E-02	[25.2]	1.29E-02	226	2.04E-02	218	2.12E-02	6.81E-10
LEC28.40.9.80.6	---	7.94E-05	13.0	0.252	4.99E-03	62	1.87E-02	[25.2]	1.29E-02	242	2.19E-02	221	2.15E-02	7.05E-10
LEC28.40.9.80.7	---	7.99E-05	14.9	0.252	4.98E-03	63	1.92E-02	[25.2]	1.30E-02	230	2.09E-02	250	2.44E-02	9.44E-10
LEC28.40.9.80.8	---	7.76E-05	17.7	0.252	4.98E-03	59	1.74E-02	[25.2]	1.26E-02	204	1.81E-02	250	2.38E-02	9.17E-10
LEC28.40.9.80.9	---	7.93E-05	20.0	0.251	4.98E-03	62	1.87E-02	[25.2]	1.29E-02	200	1.81E-02	238	2.31E-02	8.42E-10
LEC28.40.9.80.10	---	8.04E-05	20.8	0.251	4.98E-03	54	1.65E-02	[25.2]	1.31E-02	198	1.82E-02	219	2.16E-02	6.98E-10
ORLEC28 40 °C pH(RT) 9 Reactor 5														
LEC28.40.9.130.Blank1	---	1.21E-04	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9.130.Blank2	---	1.28E-04	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9.130.Blank3	---	1.25E-04	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9.130.2	---	1.26E-04	3.8	0.099	1.96E-03	[16.5]	2.01E-02	[25.2]	5.22E-02	[54.8]	1.97E-02	106	4.16E-02	< 0
LEC28.40.9.130.4	---	1.26E-04	7.9	0.099	1.96E-03	[16.5]	2.01E-02	[25.2]	5.22E-02	[54.8]	1.97E-02	61	2.40E-02	< 0
LEC28.40.9.130.6	---	1.26E-04	13.0	0.098	1.95E-03	[16.5]	2.01E-02	[25.2]	5.24E-02	[54.8]	1.98E-02	54	2.13E-02	< 0
LEC28.40.9.130.7	---	1.25E-04	14.9	0.098	1.95E-03	[16.5]	2.01E-02	[25.2]	5.22E-02	[54.8]	1.97E-02	82	3.20E-02	< 0
LEC28.40.9.130.8	---	1.27E-04	17.7	0.098	1.95E-03	[16.5]	2.04E-02	[25.2]	5.30E-02	[54.8]	2.00E-02	84	3.33E-02	< 0
LEC28.40.9.130.9	---	1.25E-04	20.0	0.098	1.94E-03	[16.5]	2.01E-02	[25.2]	5.22E-02	[54.8]	1.97E-02	79	3.08E-02	< 0
LEC28.40.9.130.10	---	1.26E-04	20.8	0.098	1.94E-03	[16.5]	2.02E-02	[25.2]	5.25E-02	[54.8]	1.99E-02	75	2.96E-02	< 0
ORLEC28 90 °C pH(RT) 9 Reactor 1														
ORL28.90.9.20.Blank1	---	1.45E-05	---	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL28.90.9.20.Blank2	---	1.51E-05	---	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL28.90.9.20.Blank3	---	1.43E-05	0.0	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL28.90.9.20.2	---	1.56E-05	3.8	0.769	1.54E-02	2,840	5.44E-02	11,200	3.65E-01	10,600	6.10E-02	58,100	3.59E-01	< 0
ORL28.90.9.20.4	---	1.69E-05	7.9	0.751	1.51E-02	2,920	6.14E-02	9,560	3.43E-01	10,900	6.89E-02	53,200	3.61E-01	1.52E-09
ORL28.90.9.20.5	---	1.68E-05	10.8	0.738	1.50E-02	2,780	5.90E-02	7,660	2.77E-01	10,500	6.70E-02	45,000	3.08E-01	2.57E-09
ORL28.90.9.20.6	---	1.72E-05	13.0	0.733	1.49E-02	2,600	5.66E-02	5,950	2.21E-01	9,890	6.48E-02	38,600	2.71E-01	4.16E-09
ORL28.90.9.20.7	---	1.72E-05	13.8	0.733	1.49E-02	2,550	5.55E-02	5,260	1.95E-01	9,750	6.37E-02	34,100	2.39E-01	3.66E-09
ORLEC28 90 °C pH(RT) 9 Reactor 2														
ORL28.90.9.30.Blank1	---	2.73E-05	---	---	---	142	---	[75.6] 65.5*	---	[164] 58.7*	---	[134] 59.5*	---	---
ORL28.90.9.30.Blank2	---	3.19E-05	---	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL28.90.9.30.Blank3	---	2.68E-05	0.0	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
ORL28.90.9.30.2	---	3.12E-05	3.8	0.282	5.68E-03	1,380	1.43E-01	3,410	6.03E-01	5,320	1.66E-01	19,600	6.57E-01	4.40E-09
ORL28.90.9.30.4	---	3.05E-05	7.9	0.277	5.62E-03	1,300	1.33E-01	1,970	3.44E-01	4,980	1.54E-01	12,700	4.20E-01	6.27E-09
ORL28.90.9.30.5	---	3.08E-05	10.8	0.272	5.56E-03	1,310	1.37E-01	1,410	2.51E-01	4,630	1.46E-01	9,750	3.29E-01	6.42E-09
ORL28.90.9.30.6	---	3.02E-05	13.0	0.271	5.54E-03	1,300	1.34E-01	1,010	1.77E-01	4,470	1.38E-01	7,600	2.52E-01	6.21E-09
ORL28.90.9.30.7	---	2.98E-05	13.8	0.271	5.54E-03	1,150	1.17E-01	816	1.41E-01	4,440	1.36E-01	7,170	2.35E-01	7.75E-09
ORLEC28 90 °C pH(RT) 9 Reactor 3														
ORL28.90.9.40.Blank1	---	3.67E-05	---	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL28.90.9.40.Blank2	---	3.81E-05	---	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL28.90.9.40.Blank3	---	2.93E-05	0.0	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL28.90.9.40.2	---	3.79E-05	3.8	0.092	1.87E-03	596	2.29E-01	966	6.32E-01	2,410	2.78E-01	6,080	7.53E-01	1.00E-08
ORL28.90.9.40.4	---	3.88E-05	7.9	0.091	1.85E-03	593	2.34E-01	434	2.92E-01	2,400	2.85E-01	3,390	4.32E-01	1.16E-08
ORL28.90.9.40.5	---	3.80E-05	10.8	0.090	1.83E-03	601	2.35E-01	347	2.32E-01	2,430	2.86E-01	2,790	3.53E-01	9.99E-09
ORL28.90.9.40.6	---	3.85E-05	13.0	0.089	1.83E-03	603	2.40E-01	309	2.10E-01	2,460	2.95E-01	2,490	3.20E-01	9.12E-09
ORL28.90.9.40.7	---	3.62E-05	13.8	0.089	1.83E-03	612	2.29E-01	303	1.94E-01	2,510	2.83E-01	2,420	2.93E-01	8.19E-09
ORLEC28 90 °C pH(RT) 9 Reactor 4														
ORL28.90.9.80.Blank1	---	7.80E-05	---	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL28.90.9.80.Blank2	---	8.03E-05	---	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL28.90.9.80.Blank3	---	7.68E-05	0.0	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL28.90.9.80.2	---	8.07E-05	3.8	0.047	9.52E-04	199	3.19E-01	267	7.28E-01	849	4.09E-01	1,920	9.92E-01	2.17E-08
ORL28.90.9.80.4	---	8.17E-05	7.9	0.046	9.43E-04	204	3.34E-01	126	3.52E-01	872	4.30E-01	990	5.23E-01	1.42E-08
ORL28.90.9.80.5	---	8.06E-05	10.8	0.045	9.30E-04	220	3.60E-01	109	3.04E-01	932	4.59E-01	941	4.97E-01	1.59E-08
ORL28.90.9.80.6	---	8.15E-05	13.0	0.045	9.21E-04	259	4.33E-01	127	3.62E-01	968	4.87E-01	859	4.63E-01	8.39E-09
ORL28.90.9.80.7	---	7.95E-05	13.8	0.045	9.21E-04	233	3.80E-01	111	3.08E-01	1,000	4.90E-01	868	4.57E-01	1.22E-08
ORLEC28 90 °C pH(RT) 9 Reactor 5														
ORL28.90.9.130.Blank1	---	1.23E-04	---	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL28.90.9.130.Blank2	---	1.26E-04	---	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL28.90.9.130.Blank3	---	1.20E-04	0.0	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL28.90.9.130.2	---	1.25E-04	3.8	0.020	4.06E-04	23.6* [49.4]	2.88E-01	71.6* [75.6]	7.51E-01	194	3.40E-01	719	1.35E+00	4.97E-08
ORL28.90.9.130.4	---	1.25E-04	7.9	0.019	3.91E-04	18.6* [49.4]	2.98E-01	[75.6]	7.77E-01	174	3.15E-01	344	6.69E-01	< 0
ORL28.90.9.130.5	---	1.25E-04	10.8	0.018	3.76E-04	19.7* [49.4]	3.10E-01	[75.6]	8.09E-01	178	3.36E-01	290	5.87E-01	< 0
ORL28.90.9.130.6	---	1.25E-04	13.0	0.017	3.68E-04	44.8* [49.4]	3.16E-01	[75.6]	8.25E-01	203	3.91E-01	245	5.06E-01	< 0
ORL28.90.9.130.7	---	1.25E-04	13.8	0.017	3.68E-04	20.5* [49.4]	3.18E-01	[75.6]	8.29E-01	189	3.66E-01	265	5.50E-01	< 0
ORLEC33 40 °C pH(RT) 9 Reactor 1														

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
ORL33.40.9.20.Blank1	---	1.29E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
ORL33.40.9.20.Blank2	---	1.77E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
ORL33.40.9.20.Blank3	---	1.77E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
ORL33.40.9.20.2	---	1.76E-05	3.8	4.016	8.12E-02	345	1.53E-03	1,280	8.11E-03	2,080	2.36E-03	13,200	1.67E-02	7.42E-10
ORL33.40.9.20.4	---	1.79E-05	7.9	4.014	8.12E-02	511	2.31E-03	975	6.30E-03	2,660	3.07E-03	9,530	1.23E-02	5.18E-10
ORL33.40.9.20.6	---	1.72E-05	13.0	4.013	8.12E-02	557	2.42E-03	643	3.99E-03	2,600	2.89E-03	6,500	8.08E-03	3.51E-10
ORL33.40.9.20.7	---	1.84E-05	14.9	4.012	8.12E-02	553	2.57E-03	557	3.70E-03	2,570	3.06E-03	5,750	7.65E-03	3.39E-10
ORL33.40.9.20.8	---	1.85E-05	17.7	4.011	8.12E-02	562	2.62E-03	492	3.27E-03	2,530	3.01E-03	5,090	6.78E-03	3.01E-10
ORL33.40.9.20.9	---	1.80E-05	20.0	4.011	8.11E-02	564	2.56E-03	435	2.83E-03	2,480	2.88E-03	4,690	6.10E-03	2.81E-10
ORL33.40.9.20.10	---	1.78E-05	20.8	4.011	8.11E-02	575	2.58E-03	425	2.73E-03	2,520	2.90E-03	4,310	5.55E-03	2.42E-10
ORLEC33 40 °C pH(RT) 9 Reactor 2														
ORL33.40.9.30.Blank1	---	2.67E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
ORL33.40.9.30.Blank2	---	2.91E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
ORL33.40.9.30.Blank3	---	2.91E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
ORL33.40.9.30.2	---	2.97E-05	3.8	1.498	3.03E-02	173	3.47E-03	377	1.08E-02	868	4.46E-03	4,220	2.43E-02	1.15E-09
ORL33.40.9.30.4	---	3.02E-05	7.9	1.497	3.03E-02	245	5.00E-03	203	5.93E-03	1,170	6.12E-03	2,390	1.40E-02	6.91E-10
ORL33.40.9.30.6	---	3.02E-05	13.0	1.497	3.03E-02	279	5.69E-03	185	5.40E-03	1,340	7.00E-03	1,680	9.81E-03	3.79E-10
ORL33.40.9.30.7	---	3.01E-05	14.9	1.496	3.03E-02	315	6.42E-03	212	6.18E-03	1,500	7.82E-03	1,650	9.62E-03	2.96E-10
ORL33.40.9.30.8	---	3.07E-05	17.7	1.496	3.03E-02	338	7.02E-03	224	6.66E-03	1,580	8.40E-03	1,650	9.82E-03	2.71E-10
ORL33.40.9.30.9	---	3.02E-05	20.0	1.495	3.03E-02	340	6.95E-03	215	6.28E-03	1,550	8.10E-03	1,580	9.24E-03	2.54E-10
ORL33.40.9.30.10	---	2.99E-05	20.8	1.495	3.03E-02	345	6.97E-03	217	6.27E-03	1,570	8.12E-03	1,560	9.03E-03	2.37E-10
ORLEC33 40 °C pH(RT) 9 Reactor 3														
ORL33.40.9.40.Blank1	---	3.27E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
ORL33.40.9.40.Blank2	---	4.05E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
ORL33.40.9.40.Blank3	---	3.71E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
ORL33.40.9.40.2	---	4.00E-05	3.8	0.500	1.01E-02	81	6.52E-03	88	1.01E-02	405	8.39E-03	1,220	2.83E-02	1.56E-09
ORL33.40.9.40.4	---	3.99E-05	7.9	0.500	1.01E-02	142	1.15E-02	92	1.07E-02	700	1.45E-02	784	1.81E-02	6.41E-10
ORL33.40.9.40.6	---	4.02E-05	13.0	0.499	1.01E-02	189	1.54E-02	111	1.29E-02	746	1.56E-02	686	1.60E-02	2.64E-10
ORL33.40.9.40.7	---	3.97E-05	14.9	0.499	1.01E-02	161	1.30E-02	91	1.04E-02	740	1.53E-02	690	1.59E-02	4.72E-10
ORL33.40.9.40.8	---	4.07E-05	17.7	0.498	1.01E-02	156	1.29E-02	81	9.59E-03	701	1.48E-02	694	1.64E-02	5.84E-10
ORL33.40.9.40.9	---	4.04E-05	20.0	0.498	1.01E-02	147	1.20E-02	73	8.53E-03	644	1.35E-02	642	1.51E-02	5.61E-10
ORL33.40.9.40.10	---	4.11E-05	20.8	0.498	1.01E-02	137	1.14E-02	67	7.92E-03	615	1.31E-02	610	1.46E-02	5.69E-10
ORLEC33 40 °C pH(RT) 9 Reactor 4														
ORL33.40.9.80.Blank1	---	7.46E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
ORL33.40.9.80.Blank2	---	7.99E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
ORL33.40.9.80.Blank3	---	8.06E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
ORL33.40.9.80.2	---	7.77E-05	3.8	0.250	5.06E-03	30	9.51E-03	[25.2]	1.13E-02	146	1.17E-02	364	3.27E-02	1.84E-09
ORL33.40.9.80.4	---	7.69E-05	7.9	0.250	5.06E-03	49	1.52E-02	[25.2]	1.12E-02	235	1.87E-02	227	2.02E-02	7.74E-10
ORL33.40.9.80.6	---	7.77E-05	13.0	0.250	5.06E-03	52	1.65E-02	[25.2]	1.13E-02	251	2.02E-02	225	2.03E-02	7.67E-10
ORL33.40.9.80.7	---	7.76E-05	14.9	0.250	5.06E-03	55	1.72E-02	[25.2]	1.13E-02	234	1.88E-02	242	2.18E-02	8.98E-10
ORL33.40.9.80.8	---	7.87E-05	17.7	0.250	5.05E-03	49	1.56E-02	[25.2]	1.15E-02	194	1.58E-02	241	2.20E-02	9.03E-10
ORL33.40.9.80.9	---	7.76E-05	20.0	0.249	5.05E-03	40	1.25E-02	[25.2]	1.13E-02	160	1.29E-02	221	1.99E-02	7.35E-10
ORL33.40.9.80.10	---	7.64E-05	20.8	0.249	5.05E-03	37	1.15E-02	[25.2]	1.12E-02	145	1.15E-02	207	1.83E-02	6.18E-10
ORLEC33 40 °C pH(RT) 9 Reactor 5														
ORL33.40.9.130.Blank1	---	1.23E-04	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
ORL33.40.9.130.Blank2	---	1.28E-04	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
ORL33.40.9.130.Blank3	---	1.26E-04	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
ORL33.40.9.130.2	---	1.27E-04	3.8	0.102	2.06E-03	[16.5]	2.09E-02	[25.2]	4.56E-02	[54.8]	1.75E-02	99	3.57E-02	< 0
ORL33.40.9.130.4	---	1.28E-04	7.9	0.101	2.05E-03	[16.5]	2.11E-02	[25.2]	4.61E-02	[54.8]	1.77E-02	62	2.28E-02	< 0
ORL33.40.9.130.6	---	1.27E-04	13.0	0.101	2.04E-03	[16.5]	2.10E-02	[25.2]	4.59E-02	[54.8]	1.76E-02	57	2.06E-02	< 0
ORL33.40.9.130.7	---	1.27E-04	14.9	0.101	2.04E-03	[16.5]	2.10E-02	[25.2]	4.58E-02	[54.8]	1.76E-02	79	2.87E-02	< 0
ORL33.40.9.130.8	---	1.26E-04	17.7	0.100	2.04E-03	[16.5]	2.09E-02	[25.2]	4.57E-02	[54.8]	1.75E-02	92	3.34E-02	< 0
ORL33.40.9.130.9	---	1.27E-04	20.0	0.100	2.04E-03	[16.5]	2.10E-02	[25.2]	4.60E-02	[54.8]	1.76E-02	85	3.12E-02	< 0
ORL33.40.9.130.10	---	1.25E-04	20.8	0.100	2.04E-03	[16.5]	2.08E-02	[25.2]	4.54E-02	[54.8]	1.74E-02	89	3.21E-02	< 0
ORLEC33 90 °C pH(RT) 9 Reactor 1														
ORL33.90.9.20.Blank1	---	1.28E-05	---	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL33.90.9.20.Blank2	---	1.64E-05	---	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL33.90.9.20.Blank3	---	1.22E-05	0.0	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL33.90.9.20.2	---	1.58E-05	3.8	0.764	1.57E-02	3,110	6.44E-02	14,800	4.38E-01	14,200	7.52E-02	70,400	4.17E-01	< 0
ORL33.90.9.20.4	---	1.72E-05	7.9	0.736	1.53E-02	3,000	6.92E-02	14,700	4.85E-01	13,200	7.80E-02	71,600	4.73E-01	< 0
ORL33.90.9.20.5	---	1.81E-05	10.8	0.714	1.50E-02	2,700	6.68E-02	12,400	4.39E-01	12,100	7.66E-02	62,200	4.40E-01	1.63E-10
ORL33.90.9.20.6	---	1.87E-05	13.0	0.705	1.49E-02	2,590	6.69E-02	10,700	3.95E-01	11,500	7.60E-02	54,100	4.00E-01	4.18E-10
ORL33.90.9.20.7	---	1.75E-05	13.8	0.705	1.49E-02	2,570	6.20E-02	9,970	3.44E-01	11,500	7.10E-02	51,200	3.54E-01	8.34E-10
ORLEC33 90 °C pH(RT) 9 Reactor 2														
ORL33.90.9.30.Blank1	---	2.49E-05	---	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL33.90.9.30.Blank2	---	3.00E-05	---	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL33.90.9.30.Blank3	---	3.33E-05	0.0	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL33.90.9.30.2	---	2.88E-05	3.8	0.296	6.14E-03	1,660	1.60E-01	5,170	7.10E-01	7,530	1.85E-01	27,200	7.48E-01	3.26E-09

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
ORL33.90.9.30.4	---	2.95E-05	7.9	0.285	5.98E-03	1,400	1.42E-01	4,110	5.95E-01	6,400	1.66E-01	22,300	6.46E-01	4.41E-09
ORL33.90.9.30.5	---	3.00E-05	10.8	0.275	5.85E-03	1,270	1.33E-01	3,250	4.88E-01	5,850	1.57E-01	18,000	5.41E-01	4.56E-09
ORL33.90.9.30.6	---	2.98E-05	13.0	0.272	5.80E-03	1,180	1.24E-01	2,560	3.85E-01	5,540	1.49E-01	14,700	4.43E-01	4.96E-09
ORL33.90.9.30.7	---	2.96E-05	13.8	0.272	5.81E-03	1,170	1.22E-01	2,190	3.27E-01	5,300	1.42E-01	13,200	3.94E-01	5.81E-09
ORLEC33 90 °C pH(RT) 9 Reactor 3														
ORL33.90.9.40.Blank1	---	2.27E-05	---	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL33.90.9.40.Blank2	---	2.47E-05	---	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL33.90.9.40.Blank3	---	2.28E-05	0.2	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL33.90.9.40.4	---	3.08E-05	8.1	0.090	1.88E-03	708	2.37E-01	1,140	5.47E-01	3,480	2.99E-01	6,710	6.44E-01	8.38E-09
ORL33.90.9.40.5	---	3.67E-05	11.0	0.088	1.84E-03	563	2.30E-01	728	4.24E-01	2,780	2.90E-01	4,490	5.24E-01	8.56E-09
ORL33.90.9.40.6	---	3.68E-05	13.2	0.087	1.83E-03	508	2.09E-01	550	3.23E-01	2,540	2.67E-01	3,410	4.01E-01	6.71E-09
ORL33.90.9.40.7	---	3.73E-05	14.0	0.087	1.83E-03	502	2.09E-01	498	2.96E-01	2,500	2.66E-01	3,100	3.69E-01	6.27E-09
ORLEC33 90 °C pH(RT) 9 Reactor 4														
ORL33.90.9.80.Blank1	---	7.54E-05	---	---	---	[49.4] 35.7*	---	[75.6] 47.3*	---	595	---	473	---	---
ORL33.90.9.80.Blank2	---	8.18E-05	---	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL33.90.9.80.Blank3	---	7.37E-05	0.0	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL33.90.9.80.2	---	8.26E-05	3.8	0.043	9.23E-04	205	3.76E-01	631	1.65E+00	1,090	5.11E-01	3,700	1.94E+00	2.47E-08
ORL33.90.9.80.4	---	8.30E-05	7.9	0.043	9.14E-04	128	2.38E-01	227	6.04E-01	759	3.61E-01	1,540	8.20E-01	1.86E-08
ORL33.90.9.80.5	---	8.29E-05	10.8	0.041	8.97E-04	117	2.21E-01	160	4.33E-01	710	3.44E-01	1,170	6.33E-01	1.72E-08
ORL33.90.9.80.6	---	8.32E-05	13.0	0.041	8.90E-04	118	2.26E-01	135	3.70E-01	705	3.46E-01	990	5.43E-01	1.49E-08
ORL33.90.9.80.7	---	8.27E-05	13.8	0.041	8.90E-04	117	2.23E-01	124	3.37E-01	696	3.39E-01	944	5.14E-01	1.52E-08
ORLEC33 90 °C pH(RT) 9 Reactor 5														
ORL33.90.9.130.Blank1	---	0.00E+00	---	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL33.90.9.130.Blank2	---	7.30E-05	---	---	---	[49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL33.90.9.130.Blank3	---	1.21E-04	0.2	---	---	[49.4] [49.4]	---	[75.6]	---	[164]	---	[134]	---	---
ORL33.90.9.130.2	---	1.25E-04	4.0	0.020	4.32E-04	29.5*	2.92E-01	261	2.20E+00	288	4.35E-01	1,640	2.77E+00	4.89E-08
ORL33.90.9.130.4	---	1.25E-04	8.1	0.020	4.30E-04	[49.4]	2.95E-01	80	6.86E-01	169	2.58E-01	713	1.22E+00	4.58E-08
ORL33.90.9.130.5	---	1.24E-04	11.0	0.019	4.16E-04	[49.4]	3.02E-01	[75.6] 51.1*	6.60E-01	[164] 150*	2.56E-01	524	9.16E-01	2.20E-08
ORL33.90.9.130.6	---	1.25E-04	13.2	0.018	4.09E-04	[49.4]	3.08E-01	[75.6] 27.0*	6.75E-01	[164] 141*	2.62E-01	406	7.26E-01	4.36E-09
ORL33.90.9.130.7	---	1.25E-04	14.0	0.018	4.08E-04	[49.4]	3.09E-01	[75.6] [164] 150*	6.77E-01	[164] 150*	2.63E-01	390	6.99E-01	1.91E-09

* Indicates that the value is below the EQL (the value in brackets) but above the Instrument Detection Limit (for [Al] = 16.5 ppm, [B] = 25.2 ppm, [Si] = 54.8 ppm, and [Na] = 44.7 ppm). If the EQL is given and no other value is provided for that sample, then the concentration of that analyte was also below the Instrument Detection Limit. The EQL is used to calculate the dissolution rate.

Appendix C

Single-Pass Flow-Through (SPFT) Results for Tests at Various pH

When the average measured value is below the EQL, the EQL value is provided in brackets. For the samples provided in this appendix, the EQL value is equal to the instrument detection limit.

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
ORLEC28 23 °C pH(RT) 7 Reactor A														
LEC28.23.7A.Blank1		3.24E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.7A.Blank2		4.03E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.7A.Blank3		4.12E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	63	---	---
LEC28.23.7A.2		4.21E-05	6.9	1.994	3.94E-02	[16.5]	3.33E-04	218	7.50E-03	[54.8]	3.28E-04	1,500	9.77E-03	1.87E-10
LEC28.23.7A.4		4.43E-05	13.8	1.993	3.94E-02	[16.5]	3.50E-04	174	6.30E-03	[54.8]	3.45E-04	953	6.53E-03	1.93E-11
LEC28.23.7A.6		4.62E-05	20.9	1.992	3.94E-02	[16.5]	3.66E-04	123	4.65E-03	[54.8]	3.60E-04	644	4.61E-03	< 0
LEC28.23.7A.7		4.99E-05	23.9	1.991	3.94E-02	[16.5]	3.94E-04	116	4.73E-03	[54.8]	3.88E-04	610	4.71E-03	< 0
LEC28.23.7A.8		5.27E-05	27.8	1.990	3.94E-02	[16.5]	4.17E-04	99	4.25E-03	[54.8]	4.10E-04	519	4.23E-03	< 0
LEC28.23.7A.9		4.36E-05	30.8	1.990	3.94E-02	[16.5]	3.45E-04	108	3.85E-03	[54.8]	3.39E-04	569	3.84E-03	< 0
LEC28.23.7A.10		4.20E-05	34.9	1.989	3.94E-02	[16.5]	3.33E-04	122	4.19E-03	[54.8]	3.27E-04	598	3.89E-03	< 0
LEC28.23.7A.11		4.55E-05	38.1	1.989	3.94E-02	[16.5]	3.60E-04	111	4.13E-03	[54.8]	3.55E-04	549	3.87E-03	< 0
LEC28.23.7A.12		4.46E-05	41.9	1.988	3.94E-02	[16.5]	3.53E-04	107	3.90E-03	[54.8]	3.48E-04	546	3.77E-03	< 0
LEC28.23.7A.13		4.52E-05	44.9	1.988	3.94E-02	[16.5]	3.58E-04	99	3.66E-03	[54.8]	3.52E-04	518	3.63E-03	< 0
ORLEC28 23 °C pH(RT) 7 Reactor B														
LEC28.23.7B.Blank1		2.84E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.7B.Blank2		3.77E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.7B.Blank3		3.75E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.7B.2		3.79E-05	6.9	1.197	2.37E-02	[16.5]	4.98E-04	216	1.11E-02	[54.8]	4.90E-04	1,530	1.49E-02	3.13E-10
LEC28.23.7B.4		3.74E-05	13.8	1.196	2.37E-02	[16.5]	4.93E-04	193	9.83E-03	[54.8]	4.85E-04	1,050	1.01E-02	2.44E-11
LEC28.23.7B.6		3.80E-05	20.9	1.195	2.36E-02	[16.5]	5.01E-04	145	7.50E-03	[54.8]	4.93E-04	759	7.44E-03	< 0
LEC28.23.7B.7		3.69E-05	23.9	1.194	2.36E-02	[16.5]	4.87E-04	141	7.09E-03	[54.8]	4.79E-04	736	7.01E-03	< 0
LEC28.23.7B.8		3.78E-05	27.8	1.193	2.36E-02	[16.5]	4.98E-04	133	6.85E-03	[54.8]	4.90E-04	663	6.46E-03	< 0
LEC28.23.7B.9		3.91E-05	30.8	1.193	2.36E-02	[16.5]	5.16E-04	123	6.55E-03	[54.8]	5.07E-04	594	5.99E-03	< 0
LEC28.23.7B.10		3.82E-05	34.9	1.192	2.36E-02	[16.5]	5.04E-04	129	6.72E-03	[54.8]	4.96E-04	616	6.07E-03	< 0
LEC28.23.7B.11		3.83E-05	38.1	1.192	2.36E-02	[16.5]	5.05E-04	118	6.16E-03	[54.8]	4.97E-04	578	5.71E-03	< 0
LEC28.23.7B.12		3.76E-05	41.9	1.191	2.36E-02	[16.5]	4.96E-04	122	6.26E-03	[54.8]	4.88E-04	606	5.88E-03	< 0
LEC28.23.7B.13		3.71E-05	44.9	1.191	2.36E-02	[16.5]	4.91E-04	121	6.13E-03	[54.8]	4.83E-04	555	5.33E-03	< 0
ORLEC28 23 °C pH(RT) 8 Reactor A														
LEC28.23.8A.Blank1		2.45E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.8A.Blank2		3.90E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.8A.Blank3		3.95E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.8A.2		4.09E-05	6.9	1.199	2.37E-02	29	9.32E-04	92	5.09E-03	[54.8]	5.29E-04	936	9.84E-03	3.92E-10
LEC28.23.8A.4		4.01E-05	13.8	1.199	2.37E-02	30	9.66E-04	52	2.81E-03	[54.8]	5.19E-04	402	4.15E-03	1.10E-10

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC28.23.8A.6		3.97E-05	20.9	1.198	2.37E-02	27	8.41E-04	50	2.69E-03	[54.8]	5.13E-04	338	3.45E-03	6.27E-11
LEC28.23.8A.7		4.01E-05	23.9	1.198	2.37E-02	26	8.22E-04	48	2.61E-03	[54.8]	5.20E-04	324	3.35E-03	6.06E-11
LEC28.23.8A.8		3.99E-05	27.8	1.198	2.37E-02	23	7.20E-04	47	2.53E-03	[54.8]	5.17E-04	306	3.14E-03	5.08E-11
LEC28.23.8A.9		4.01E-05	30.8	1.198	2.37E-02	20	6.27E-04	44	2.38E-03	[54.8]	5.20E-04	274	2.83E-03	3.68E-11
LEC28.23.8A.10		3.91E-05	34.9	1.198	2.37E-02	22	6.98E-04	49	2.62E-03	[54.8]	5.06E-04	296	2.98E-03	2.96E-11
LEC28.23.8A.11		3.88E-05	38.1	1.197	2.37E-02	21	6.56E-04	45	2.36E-03	[54.8]	5.02E-04	260	2.60E-03	1.93E-11
LEC28.23.8A.12		3.87E-05	41.9	1.197	2.37E-02	20	6.20E-04	47	2.47E-03	[54.8]	5.01E-04	262	2.61E-03	1.18E-11
LEC28.23.8A.13		3.79E-05	44.9	1.197	2.37E-02	23	6.96E-04	41	2.11E-03	[54.8]	4.91E-04	237	2.31E-03	1.65E-11
ORLEC28 23 °C pH(RT) 8 Reactor B														
LEC28.23.8B.Blank1		3.40E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.8B.Blank2		3.86E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.8B.Blank3		3.84E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.8B.2		3.71E-05	6.9	1.199	2.37E-02	35	1.03E-03	96	4.83E-03	[54.8]	4.80E-04	995	9.49E-03	3.84E-10
LEC28.23.8B.4		3.86E-05	13.8	1.198	2.37E-02	24	7.29E-04	52	2.71E-03	[54.8]	4.99E-04	435	4.31E-03	1.32E-10
LEC28.23.8B.6		3.81E-05	20.9	1.198	2.37E-02	26	7.87E-04	47	2.41E-03	[54.8]	4.93E-04	329	3.22E-03	6.75E-11
LEC28.23.8B.7		3.79E-05	23.9	1.198	2.37E-02	25	7.53E-04	46	2.36E-03	[54.8]	4.91E-04	305	2.98E-03	5.08E-11
LEC28.23.8B.8		3.79E-05	27.8	1.198	2.37E-02	24	7.16E-04	50	2.55E-03	[54.8]	4.90E-04	285	2.78E-03	1.85E-11
LEC28.23.8B.9		3.77E-05	30.8	1.198	2.37E-02	28	8.34E-04	45	2.29E-03	[54.8]	4.89E-04	272	2.64E-03	2.92E-11
LEC28.23.8B.10		3.85E-05	34.9	1.197	2.37E-02	27	8.28E-04	48	2.53E-03	[54.8]	4.98E-04	277	2.74E-03	1.79E-11
LEC28.23.8B.11		3.79E-05	38.1	1.197	2.37E-02	27	8.29E-04	44	2.26E-03	[54.8]	4.91E-04	243	2.37E-03	9.41E-12
LEC28.23.8B.12		3.86E-05	41.9	1.197	2.37E-02	23	6.96E-04	45	2.35E-03	[54.8]	5.00E-04	247	2.45E-03	8.52E-12
LEC28.23.8B.13		3.72E-05	44.9	1.197	2.37E-02	20	5.91E-04	44	2.21E-03	[54.8]	4.82E-04	238	2.28E-03	5.70E-12
ORLEC28 23 °C pH(RT) 9 Reactor A														
LEC28.23.9A.Blank1		3.04E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.9A.Blank2		3.49E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.9A.Blank3		3.43E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.9A.2		3.40E-05	6.9	1.199	2.37E-02	77	2.07E-03	77	3.54E-03	130	1.06E-03	836	7.30E-03	3.10E-10
LEC28.23.9A.4		3.44E-05	13.8	1.199	2.37E-02	104	2.85E-03	82	3.82E-03	222	1.83E-03	592	5.23E-03	1.16E-10
LEC28.23.9A.6		3.36E-05	20.9	1.198	2.37E-02	92	2.46E-03	60	2.75E-03	169	1.36E-03	346	2.99E-03	1.96E-11
LEC28.23.9A.7		3.33E-05	23.9	1.198	2.37E-02	91	2.42E-03	62	2.80E-03	202	1.61E-03	336	2.88E-03	7.18E-12
LEC28.23.9A.8		3.35E-05	27.8	1.198	2.37E-02	91	2.44E-03	63	2.85E-03	213	1.71E-03	309	2.66E-03	< 0
LEC28.23.9A.9		3.19E-05	30.8	1.198	2.37E-02	89	2.26E-03	63	2.73E-03	229	1.75E-03	311	2.56E-03	< 0
LEC28.23.9A.10		3.36E-05	34.9	1.197	2.37E-02	98	2.62E-03	67	3.07E-03	246	1.98E-03	317	2.74E-03	< 0
LEC28.23.9A.11		3.54E-05	38.1	1.197	2.37E-02	98	2.75E-03	61	2.94E-03	219	1.86E-03	277	2.52E-03	< 0

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{LEX} (mol Na ⁻² s ⁻¹)
LEC28.23.9A.12		3.53E-05	41.9	1.197	2.37E-02	97	2.72E-03	62	2.97E-03	206	1.74E-03	285	2.59E-03	< 0
LEC28.23.9A.13		3.20E-05	44.9	1.197	2.37E-02	92	2.36E-03	63	2.75E-03	190	1.46E-03	279	2.30E-03	< 0
ORLEC28 23 °C pH(RT) 9 Reactor B														
LEC28.23.9B.Blank1		2.52E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.9B.Blank2		3.69E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.9B.Blank3		3.74E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.9B.2		3.48E-05	6.9	1.200	2.37E-02	80	2.22E-03	76	3.59E-03	123	1.02E-03	831	7.43E-03	3.17E-10
LEC28.23.9B.4		3.64E-05	13.8	1.199	2.37E-02	97	2.82E-03	78	3.85E-03	224	1.95E-03	607	5.68E-03	1.51E-10
LEC28.23.9B.6		3.53E-05	20.9	1.199	2.37E-02	91	2.55E-03	57	2.74E-03	168	1.42E-03	327	2.97E-03	1.87E-11
LEC28.23.9B.7		3.44E-05	23.9	1.199	2.37E-02	91	2.50E-03	61	2.84E-03	200	1.65E-03	318	2.81E-03	< 0
LEC28.23.9B.8		3.46E-05	27.8	1.198	2.37E-02	89	2.46E-03	61	2.87E-03	212	1.76E-03	307	2.73E-03	< 0
LEC28.23.9B.9		3.39E-05	30.8	1.198	2.37E-02	90	2.42E-03	61	2.80E-03	219	1.78E-03	300	2.62E-03	< 0
LEC28.23.9B.10		3.49E-05	34.9	1.198	2.37E-02	96	2.68E-03	69	3.29E-03	234	1.96E-03	352	3.16E-03	< 0
LEC28.23.9B.11		3.60E-05	38.1	1.197	2.37E-02	99	2.83E-03	63	3.06E-03	207	1.79E-03	286	2.65E-03	< 0
LEC28.23.9B.12		3.63E-05	41.9	1.197	2.37E-02	93	2.70E-03	63	3.09E-03	202	1.76E-03	290	2.71E-03	< 0
LEC28.23.9B.13		3.26E-05	44.9	1.197	2.37E-02	91	2.37E-03	60	2.64E-03	189	1.48E-03	282	2.36E-03	< 0
ORLEC28 23 °C pH(RT) 10 Reactor A														
LEC28.23.10A.Blank1		3.17E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.10A.Blank2		3.95E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.10A.Blank3		3.93E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.10A.2		3.95E-05	6.9	1.199	2.37E-02	151	4.76E-03	95	5.11E-03	516	4.89E-03	570	5.79E-03	5.69E-11
LEC28.23.10A.4		3.95E-05	13.8	1.198	2.37E-02	206	6.49E-03	138	7.41E-03	724	6.85E-03	508	5.16E-03	< 0
LEC28.23.10A.6		3.80E-05	20.9	1.197	2.37E-02	211	6.39E-03	134	6.91E-03	725	6.60E-03	525	5.13E-03	< 0
LEC28.23.10A.7		3.78E-05	23.9	1.196	2.37E-02	206	6.22E-03	133	6.84E-03	708	6.43E-03	512	4.99E-03	< 0
LEC28.23.10A.8		3.84E-05	27.8	1.196	2.37E-02	211	6.46E-03	136	7.10E-03	749	6.90E-03	527	5.21E-03	< 0
LEC28.23.10A.9		3.78E-05	30.8	1.195	2.37E-02	203	6.13E-03	130	6.69E-03	711	6.45E-03	526	5.12E-03	< 0
LEC28.23.10A.10		3.78E-05	34.9	1.194	2.37E-02	211	6.37E-03	141	7.26E-03	747	6.78E-03	528	5.15E-03	< 0
LEC28.23.10A.11		3.83E-05	38.1	1.194	2.36E-02	210	6.42E-03	139	7.24E-03	704	6.47E-03	519	5.12E-03	< 0
LEC28.23.10A.12		3.79E-05	41.8	1.193	2.36E-02	212	6.42E-03	137	7.07E-03	706	6.43E-03	538	5.26E-03	< 0
LEC28.23.10A.13		3.79E-05	44.9	1.193	2.36E-02	197	5.96E-03	136	7.01E-03	681	6.20E-03	519	5.07E-03	< 0
ORLEC28 23 °C pH(RT) 10 Reactor B														
LEC28.23.10B.Blank1		3.38E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.10B.Blank2		3.79E-05	---	---	---	594	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.23.10B.Blank3		3.78E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{LEX} (mol Na ⁻² s ⁻¹)
LEC28.23.10B.2		3.81E-05	6.9	1.199	2.37E-02	145	4.40E-03	89	4.57E-03	448	4.08E-03	628	6.14E-03	1.30E-10
LEC28.23.10B.4		3.77E-05	13.8	1.198	2.37E-02	188	5.65E-03	119	6.10E-03	622	5.62E-03	491	4.76E-03	< 0
LEC28.23.10B.6		3.81E-05	20.9	1.197	2.37E-02	186	5.65E-03	117	6.05E-03	600	5.48E-03	483	4.73E-03	< 0
LEC28.23.10B.7		3.72E-05	23.9	1.197	2.37E-02	190	5.64E-03	125	6.32E-03	653	5.83E-03	472	4.52E-03	< 0
LEC28.23.10B.8		3.81E-05	27.8	1.196	2.37E-02	187	5.68E-03	119	6.16E-03	617	5.63E-03	468	4.59E-03	< 0
LEC28.23.10B.9		3.79E-05	30.8	1.196	2.37E-02	183	5.54E-03	115	5.93E-03	570	5.18E-03	456	4.45E-03	< 0
LEC28.23.10B.10		3.68E-05	34.9	1.195	2.37E-02	192	5.65E-03	120	6.01E-03	639	5.65E-03	474	4.50E-03	< 0
LEC28.23.10B.11		3.63E-05	38.1	1.195	2.37E-02	194	5.62E-03	128	6.32E-03	646	5.63E-03	478	4.47E-03	< 0
LEC28.23.10B.12		3.70E-05	41.8	1.194	2.36E-02	193	5.71E-03	128	6.45E-03	634	5.64E-03	489	4.67E-03	< 0
LEC28.23.10B.13		3.77E-05	44.9	1.194	2.36E-02	177	5.33E-03	116	5.95E-03	573	5.18E-03	448	4.35E-03	< 0
ORLEC28 23 °C pH(RT) 11 Reactor A														
LEC28.23.11A.Blank1		3.88E-05	---	---	---	[16.5]	---	[25.2]	---	82	---	78	---	---
LEC28.23.11A.Blank2		4.04E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	71	---	---
LEC28.23.11A.Blank3		4.01E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	67	---	---
LEC28.23.11A.2		4.08E-05	6.9	0.199	3.94E-03	124	2.42E-02	108	3.60E-02	562	3.30E-02	548	3.46E-02	< 0
LEC28.23.11A.4		4.05E-05	13.8	0.198	3.93E-03	137	2.67E-02	108	3.58E-02	528	3.09E-02	496	3.12E-02	< 0
LEC28.23.11A.6		4.07E-05	20.9	0.197	3.92E-03	145	2.85E-02	106	3.55E-02	559	3.30E-02	470	2.98E-02	< 0
LEC28.23.11A.7		4.04E-05	23.9	0.197	3.91E-03	151	2.95E-02	109	3.62E-02	578	3.39E-02	475	2.99E-02	< 0
LEC28.23.11A.8		4.07E-05	27.8	0.196	3.90E-03	145	2.86E-02	103	3.46E-02	548	3.25E-02	456	2.90E-02	< 0
LEC28.23.11A.9		4.10E-05	30.8	0.196	3.90E-03	117	2.33E-02	96	3.25E-02	493	2.95E-02	445	2.85E-02	< 0
LEC28.23.11A.10		4.07E-05	34.9	0.195	3.89E-03	139	2.75E-02	101	3.40E-02	516	3.07E-02	428	2.73E-02	< 0
LEC28.23.11A.11		4.13E-05	38.1	0.195	3.89E-03	129	2.59E-02	90	3.09E-02	466	2.82E-02	406	2.63E-02	< 0
LEC28.23.11A.12		4.06E-05	41.8	0.194	3.88E-03	141	2.79E-02	101	3.41E-02	540	3.21E-02	413	2.64E-02	< 0
LEC28.23.11A.13		4.07E-05	44.9	0.194	3.87E-03	130	2.58E-02	98	3.30E-02	505	3.01E-02	392	2.51E-02	< 0
ORLEC28 23 °C pH(RT) 11 Reactor B														
LEC28.23.11B.Blank1		3.35E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	62	---	---
LEC28.23.11B.Blank2		3.56E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	65	---	---
LEC28.23.11B.Blank3		3.56E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	60	---	---
LEC28.23.11B.2		3.26E-05	6.9	0.199	3.94E-03	77	1.20E-02	135	3.59E-02	682	3.20E-02	580	2.92E-02	< 0
LEC28.23.11B.6		3.83E-05	20.9	0.197	3.92E-03	135	2.49E-02	100	3.14E-02	475	2.63E-02	427	2.54E-02	< 0
LEC28.23.11B.7		3.83E-05	23.9	0.197	3.92E-03	134	2.48E-02	95	3.00E-02	479	2.67E-02	413	2.47E-02	< 0
LEC28.23.11B.8		3.83E-05	27.8	0.196	3.91E-03	120	2.22E-02	93	2.93E-02	458	2.55E-02	391	2.34E-02	< 0
LEC28.23.11B.9		3.84E-05	30.8	0.196	3.90E-03	114	2.12E-02	91	2.87E-02	435	2.43E-02	407	2.44E-02	< 0
LEC28.23.11B.10		3.82E-05	34.9	0.196	3.90E-03	121	2.24E-02	87	2.74E-02	382	2.13E-02	390	2.33E-02	< 0

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (μg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (μg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (μg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (μg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{LEX} (mol Na ⁻² s ⁻¹)
LEC28.23.11B.11		3.80E-05	38.1	0.195	3.89E-03	113	2.08E-02	82	2.58E-02	358	1.99E-02	410	2.44E-02	< 0
LEC28.23.11B.12		3.78E-05	41.8	0.195	3.89E-03	118	2.17E-02	90	2.82E-02	428	2.37E-02	397	2.35E-02	< 0
LEC28.23.11B.13		3.80E-05	44.9	0.195	3.88E-03	129	2.39E-02	91	2.87E-02	423	2.35E-02	419	2.50E-02	< 0
ORLEC28 23 °C pH(RT) 12 Reactor A														
LEC28.23.12A.Blank1		3.86E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	180	---	---
LEC28.23.12A.Blank2		3.97E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	169	---	---
LEC28.23.12A.Blank3		4.29E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	187	---	---
LEC28.23.12A.2		4.21E-05	6.9	0.098	1.95E-03	132	5.38E-02	177	1.23E-01	851	1.04E-01	1,150	1.51E-01	2.34E-09
LEC28.23.12A.4		4.32E-05	13.8	0.096	1.93E-03	265	1.12E-01	187	1.35E-01	956	1.22E-01	1,280	1.75E-01	3.29E-09
LEC28.23.12A.6		4.22E-05	20.9	0.094	1.90E-03	263	1.10E-01	188	1.34E-01	1,010	1.27E-01	1,220	1.65E-01	2.53E-09
LEC28.23.12A.7		4.18E-05	23.9	0.094	1.90E-03	278	1.16E-01	187	1.33E-01	973	1.22E-01	1,200	1.61E-01	2.36E-09
LEC28.23.12A.8		4.23E-05	27.8	0.093	1.88E-03	266	1.13E-01	181	1.31E-01	944	1.21E-01	1,180	1.62E-01	2.54E-09
LEC28.23.12A.9		4.05E-05	30.8	0.092	1.87E-03	274	1.12E-01	186	1.29E-01	967	1.19E-01	1,200	1.58E-01	2.37E-09
LEC28.23.12A.10		4.29E-05	34.9	0.091	1.86E-03	286	1.25E-01	188	1.40E-01	997	1.31E-01	1,320	1.86E-01	3.81E-09
LEC28.23.12A.11		4.17E-05	38.1	0.090	1.85E-03	277	1.18E-01	181	1.32E-01	946	1.21E-01	1,320	1.82E-01	4.14E-09
LEC28.23.12A.12		4.17E-05	41.8	0.089	1.83E-03	277	1.19E-01	185	1.35E-01	944	1.22E-01	1,250	1.73E-01	3.12E-09
LEC28.23.12A.13		4.08E-05	44.9	0.089	1.82E-03	274	1.16E-01	187	1.35E-01	972	1.23E-01	1,250	1.70E-01	2.95E-09
ORLEC28 23 °C pH(RT) 12 Reactor B														
LEC28.23.12B.Blank1		1.48E-05	---	---	---	18	---	[25.2]	---	[54.8]	---	168	---	---
LEC28.23.12B.Blank2		3.83E-05	---	---	---	[16.5]	---	[25.2]	---	56	---	166	---	---
LEC28.23.12B.Blank3		3.81E-05	0.0	---	---	[16.5]	---	[25.2]	---	68	---	172	---	---
LEC28.23.12B.2		3.82E-05	6.9	0.098	1.95E-03	299	1.11E-01	187	1.18E-01	991	1.10E-01	1,210	1.45E-01	2.19E-09
LEC28.23.12B.4		3.84E-05	13.8	0.096	1.92E-03	343	1.30E-01	216	1.39E-01	1,180	1.34E-01	1,500	1.83E-01	3.62E-09
LEC28.23.12B.6		3.83E-05	20.9	0.094	1.90E-03	343	1.31E-01	213	1.38E-01	1,160	1.33E-01	1,540	1.89E-01	4.22E-09
LEC28.23.12B.7		3.75E-05	23.9	0.093	1.89E-03	352	1.32E-01	221	1.41E-01	1,170	1.32E-01	1,490	1.80E-01	3.23E-09
LEC28.23.12B.8		3.82E-05	27.8	0.092	1.87E-03	346	1.33E-01	208	1.36E-01	1,160	1.34E-01	1,500	1.86E-01	4.12E-09
LEC28.23.12B.9		3.85E-05	30.8	0.092	1.86E-03	359	1.40E-01	214	1.42E-01	1,180	1.38E-01	1,400	1.76E-01	2.80E-09
LEC28.23.12B.10		3.86E-05	34.9	0.090	1.85E-03	348	1.37E-01	205	1.38E-01	1,080	1.28E-01	1,470	1.87E-01	4.07E-09
LEC28.23.12B.11		3.80E-05	38.1	0.090	1.84E-03	361	1.41E-01	202	1.34E-01	1,080	1.27E-01	1,450	1.83E-01	3.99E-09
LEC28.23.12B.12		3.78E-05	41.8	0.089	1.82E-03	359	1.40E-01	212	1.41E-01	1,160	1.36E-01	1,580	1.99E-01	4.80E-09
LEC28.23.12B.13		3.82E-05	44.9	0.088	1.82E-03	345	1.37E-01	207	1.40E-01	1,070	1.28E-01	1,670	2.14E-01	6.11E-09
ORLEC28 40 °C pH(RT) 7 Reactor A														
LEC28.40.7A.Blank1		3.52E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.7A.Blank2		3.80E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC28.40.7A.Blank3		3.78E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.7A.1		3.78E-05	4.0	0.655	1.30E-02	[16.5]	9.09E-04	747	7.01E-02	115	1.90E-03	4,730	8.41E-02	1.15E-09
LEC28.40.7A.2		3.75E-05	7.0	0.652	1.29E-02	[16.5]	9.04E-04	833	7.78E-02	90	1.49E-03	4,690	8.29E-02	4.24E-10
LEC28.40.7A.5		3.74E-05	18.0	0.643	1.28E-02	[16.5]	9.08E-04	677	6.35E-02	[54.8]	8.94E-04	3,740	6.64E-02	2.41E-10
LEC28.40.7A.6		3.75E-05	21.0	0.642	1.28E-02	[16.5]	9.14E-04	585	5.52E-02	[54.8]	8.99E-04	3,150	5.63E-02	8.91E-11
LEC28.40.7A.7		3.76E-05	25.0	0.639	1.28E-02	[16.5]	9.18E-04	560	5.31E-02	[54.8]	9.03E-04	2,750	4.93E-02	< 0
LEC28.40.7A.8		3.75E-05	28.0	0.637	1.27E-02	[16.5]	9.18E-04	564	5.35E-02	[54.8]	9.03E-04	2,860	5.13E-02	< 0
LEC28.40.7A.9		3.68E-05	32.0	0.634	1.27E-02	[16.5]	9.04E-04	550	5.14E-02	[54.8]	8.90E-04	2,710	4.79E-02	< 0
LEC28.40.7A.10		3.76E-05	35.1	0.632	1.27E-02	[16.5]	9.25E-04	536	5.12E-02	[54.8]	9.10E-04	2,660	4.81E-02	< 0
ORLEC28 40 °C pH(RT) 7 Reactor B														
LEC28.40.7B.Blank1		3.34E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	45	---	---
LEC28.40.7B.Blank2		3.77E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.7B.Blank3		3.77E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.7B.1		3.74E-05	4.0	0.656	1.30E-02	[16.5]	8.97E-04	667	6.18E-02	102	1.67E-03	3,900	6.84E-02	5.46E-10
LEC28.40.7B.2		3.80E-05	7.0	0.653	1.30E-02	[16.5]	9.14E-04	766	7.23E-02	78	1.30E-03	3,950	7.06E-02	< 0
LEC28.40.7B.5		3.64E-05	18.0	0.645	1.28E-02	[16.5]	8.83E-04	646	5.89E-02	[54.8]	8.69E-04	3,340	5.77E-02	< 0
LEC28.40.7B.6		3.65E-05	21.0	0.643	1.28E-02	[16.5]	8.87E-04	550	5.04E-02	[54.8]	8.73E-04	2,890	5.01E-02	< 0
LEC28.40.7B.7		3.66E-05	25.0	0.640	1.28E-02	[16.5]	8.91E-04	525	4.83E-02	[54.8]	8.77E-04	2,660	4.64E-02	< 0
LEC28.40.7B.8		3.65E-05	28.0	0.639	1.28E-02	[16.5]	8.92E-04	527	4.86E-02	[54.8]	8.78E-04	2,800	4.89E-02	2.41E-11
LEC28.40.7B.9		3.65E-05	32.0	0.636	1.27E-02	[16.5]	8.95E-04	517	4.78E-02	[54.8]	8.80E-04	2,610	4.57E-02	< 0
LEC28.40.7B.10		3.69E-05	35.1	0.634	1.27E-02	[16.5]	9.05E-04	511	4.78E-02	[54.8]	8.91E-04	2,550	4.51E-02	< 0
ORLEC28 40 °C pH(RT) 8 Reactor A														
LEC28.40.8A.Blank1		3.26E-05	---	---	---	17	---	[25.2]	---	[54.8]	---	51	---	---
LEC28.40.8A.Blank2		3.52E-05	---	---	---	18	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.8A.Blank3		3.45E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.8A.1		3.43E-05	4.0	0.658	1.30E-02	56	2.79E-03	251	2.13E-02	174	2.61E-03	2,040	3.28E-02	9.49E-10
LEC28.40.8A.2		3.41E-05	7.0	0.657	1.30E-02	68	3.37E-03	321	2.71E-02	207	3.08E-03	1,770	2.83E-02	9.85E-11
LEC28.40.8A.4		3.41E-05	14.0	0.654	1.30E-02	66	3.27E-03	345	2.92E-02	189	2.82E-03	1,730	2.77E-02	< 0
LEC28.40.8A.5		3.49E-05	18.0	0.653	1.30E-02	57	2.90E-03	256	2.22E-02	136	2.08E-03	1,280	2.10E-02	< 0
LEC28.40.8A.6		3.54E-05	21.0	0.652	1.29E-02	53	2.72E-03	237	2.09E-02	124	1.93E-03	1,190	1.98E-02	< 0
LEC28.40.8A.7		3.62E-05	25.0	0.651	1.29E-02	50	2.67E-03	226	2.04E-02	116	1.85E-03	1,150	1.96E-02	< 0
LEC28.40.8A.8		3.54E-05	28.0	0.651	1.29E-02	50	2.60E-03	225	1.98E-02	113	1.76E-03	1,160	1.94E-02	< 0
LEC28.40.8A.9		3.57E-05	32.0	0.649	1.29E-02	49	2.57E-03	219	1.95E-02	112	1.76E-03	1,110	1.87E-02	< 0
LEC28.40.8A.10		3.61E-05	35.1	0.649	1.29E-02	88	4.65E-03	193	1.74E-02	77	1.22E-03	625	1.07E-02	< 0

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{LEX} (mol Na ⁻² s ⁻¹)
ORLEC28 40 °C pH(RT) 8 Reactor B														
LEC28.40.8B.Blank1		3.59E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	54	---	---
LEC28.40.8B.Blank2		4.08E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.8B.Blank3		3.99E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.8B.1		3.96E-05	4.0	0.658	1.30E-02	53	3.04E-03	233	2.28E-02	160	2.76E-03	1,860	3.45E-02	9.63E-10
LEC28.40.8B.2		4.05E-05	7.0	0.657	1.30E-02	62	3.64E-03	269	2.70E-02	172	3.04E-03	1,550	2.94E-02	2.03E-10
LEC28.40.8B.4		3.97E-05	14.0	0.654	1.30E-02	66	3.80E-03	309	3.05E-02	170	2.96E-03	1,550	2.90E-02	< 0
LEC28.40.8B.5		4.12E-05	18.0	0.653	1.30E-02	49	2.93E-03	213	2.18E-02	109	1.97E-03	1,040	2.02E-02	< 0
LEC28.40.8B.6		4.15E-05	21.0	0.652	1.29E-02	47	2.83E-03	204	2.11E-02	101	1.84E-03	1,020	1.99E-02	< 0
LEC28.40.8B.7		4.12E-05	25.0	0.651	1.29E-02	45	2.69E-03	197	2.02E-02	97	1.76E-03	1,040	2.02E-02	< 0
LEC28.40.8B.8		4.19E-05	28.0	0.651	1.29E-02	45	2.76E-03	200	2.09E-02	97	1.78E-03	1,010	2.00E-02	< 0
LEC28.40.8B.9		4.14E-05	32.0	0.649	1.29E-02	44	2.69E-03	194	2.00E-02	94	1.71E-03	982	1.92E-02	< 0
LEC28.40.8B.10		4.09E-05	35.1	0.649	1.29E-02	43	2.60E-03	186	1.90E-02	88	1.59E-03	931	1.80E-02	< 0
ORLEC28 40 °C pH(RT) 9 Reactor A														
LEC28.40.9A.Blank1		3.54E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9A.Blank2		3.82E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9A.Blank3		3.80E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9A.1		2.73E-05	4.0	0.659	1.30E-02	134	5.30E-03	133	8.96E-03	415	4.93E-03	1,660	2.12E-02	1.01E-09
LEC28.40.9A.2		3.62E-05	7.0	0.658	1.30E-02	219	1.15E-02	163	1.46E-02	755	1.19E-02	1,230	2.09E-02	5.17E-10
LEC28.40.9A.5		3.67E-05	18.0	0.656	1.30E-02	226	1.21E-02	148	1.35E-02	774	1.24E-02	782	1.35E-02	5.03E-13
LEC28.40.9A.6		3.77E-05	21.0	0.656	1.30E-02	205	1.12E-02	136	1.27E-02	711	1.17E-02	677	1.20E-02	< 0
LEC28.40.9A.7		3.70E-05	25.0	0.655	1.30E-02	200	1.08E-02	133	1.22E-02	687	1.11E-02	641	1.11E-02	< 0
LEC28.40.9A.8		3.67E-05	28.0	0.655	1.30E-02	207	1.11E-02	138	1.26E-02	710	1.14E-02	672	1.16E-02	< 0
LEC28.40.9A.9		3.75E-05	32.0	0.654	1.30E-02	207	1.13E-02	137	1.27E-02	702	1.15E-02	694	1.22E-02	< 0
LEC28.40.9A.10		3.70E-05	35.1	0.654	1.30E-02	207	1.12E-02	142	1.31E-02	713	1.16E-02	646	1.13E-02	< 0
ORLEC28 40 °C pH(RT) 9 Reactor B														
LEC28.40.9B.Blank1		3.45E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9B.Blank2		3.71E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9B.Blank3		3.66E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.9B.1		2.61E-05	4.0	0.660	1.30E-02	138	5.21E-03	137	8.81E-03	429	4.87E-03	1,650	2.01E-02	9.32E-10
LEC28.40.9B.2		3.67E-05	7.0	0.659	1.30E-02	218	1.16E-02	162	1.47E-02	763	1.22E-02	1,280	2.20E-02	6.02E-10
LEC28.40.9B.5		3.63E-05	18.0	0.657	1.30E-02	231	1.22E-02	151	1.36E-02	789	1.25E-02	768	1.31E-02	< 0
LEC28.40.9B.6		3.63E-05	21.0	0.657	1.30E-02	218	1.15E-02	142	1.28E-02	744	1.18E-02	731	1.24E-02	< 0
LEC28.40.9B.7		3.70E-05	25.0	0.656	1.30E-02	212	1.14E-02	144	1.32E-02	724	1.17E-02	716	1.24E-02	< 0

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{LEX} (mol Na ⁻² s ⁻¹)
LEC28.40.9B.8		3.67E-05	28.0	0.655	1.30E-02	212	1.13E-02	145	1.32E-02	738	1.18E-02	688	1.19E-02	< 0
LEC28.40.9B.9		3.61E-05	32.0	0.655	1.30E-02	217	1.14E-02	147	1.32E-02	745	1.18E-02	698	1.18E-02	< 0
LEC28.40.9B.10		3.69E-05	35.1	0.654	1.30E-02	217	1.17E-02	145	1.33E-02	742	1.20E-02	675	1.17E-02	< 0
ORLEC28 40 °C pH(RT) 10 Reactor A														
LEC28.40.10A.Blank1		3.48E-05	---	---	---	17	---	[25.2]	---	112	---	161	---	---
LEC28.40.10A.Blank2		3.58E-05	---	---	---	18	---	[25.2]	---	78	---	287	---	---
LEC28.40.10A.Blank3		3.40E-05	---	---	---	17	---	[25.2]	---	74	---	118	---	---
LEC28.40.10A.1		2.12E-05	9.9	0.595	1.18E-02	557	1.89E-02	377	2.18E-02	2,070	2.11E-02	2,560	2.80E-02	5.15E-10
LEC28.40.10A.2		3.64E-05	10.8	0.596	1.18E-02	573	3.34E-02	372	3.69E-02	2,120	3.71E-02	1,940	3.64E-02	< 0
LEC28.40.10A.3		3.57E-05	13.8	0.595	1.18E-02	548	3.13E-02	354	3.45E-02	2,050	3.53E-02	1,820	3.36E-02	< 0
LEC28.40.10A.4		3.57E-05	17.9	0.593	1.18E-02	515	2.95E-02	337	3.29E-02	1,920	3.31E-02	1,730	3.20E-02	< 0
LEC28.40.10A.5		3.44E-05	20.9	0.592	1.17E-02	522	2.89E-02	339	3.19E-02	1,940	3.23E-02	1,730	3.09E-02	< 0
LEC28.40.10A.6		3.51E-05	24.9	0.590	1.17E-02	500	2.83E-02	332	3.20E-02	1,920	3.27E-02	1,770	3.23E-02	2.50E-11
LEC28.40.10A.7		3.53E-05	28.0	0.589	1.17E-02	497	2.83E-02	331	3.21E-02	1,870	3.20E-02	1,650	3.03E-02	< 0
ORLEC28 40 °C pH(RT) 10 Reactor B														
LEC28.40.10B.Blank1		3.68E-05	---	---	---	18	---	[25.2]	---	77	---	56	---	---
LEC28.40.10B.Blank2		3.89E-05	---	---	---	17	---	[25.2]	---	57	---	47	---	---
LEC28.40.10B.Blank3		3.86E-05	---	---	---	17	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.10B.1		2.29E-05	9.9	0.602	1.19E-02	521	1.89E-02	351	2.17E-02	1,930	2.11E-02	2,260	2.65E-02	3.93E-10
LEC28.40.10B.2		3.84E-05	10.8	0.602	1.19E-02	523	3.18E-02	345	3.58E-02	1,950	3.57E-02	1,750	3.44E-02	< 0
LEC28.40.10B.3		3.83E-05	13.8	0.601	1.19E-02	502	3.05E-02	335	3.47E-02	1,900	3.47E-02	1,640	3.21E-02	< 0
LEC28.40.10B.4		3.83E-05	17.9	0.599	1.19E-02	480	2.93E-02	313	3.25E-02	1,780	3.26E-02	1,590	3.13E-02	< 0
LEC28.40.10B.5		3.86E-05	20.9	0.598	1.19E-02	486	2.98E-02	317	3.32E-02	1,780	3.29E-02	1,580	3.13E-02	< 0
LEC28.40.10B.6		3.88E-05	24.9	0.596	1.19E-02	470	2.91E-02	302	3.19E-02	1,730	3.22E-02	1,570	3.14E-02	< 0
LEC28.40.10B.7		3.82E-05	28.0	0.595	1.18E-02	464	2.83E-02	301	3.13E-02	1,730	3.17E-02	1,470	2.89E-02	< 0
ORLEC28 40 °C pH(RT) 11 Reactor A														
LEC28.40.11A.Blank1		3.60E-05	---	---	---	[16.5]	---	[25.2]	---	56	---	[44.7]	---	---
LEC28.40.11A.Blank2		3.60E-05	---	---	---	[16.5]	---	[25.2]	---	58	---	[44.7]	---	---
LEC28.40.11A.Blank3		3.35E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	46	---	---
LEC28.40.11A.1		3.48E-05	3.9	0.099	1.96E-03	301	1.01E-01	193	1.10E-01	1,140	1.15E-01	987	1.07E-01	< 0
LEC28.40.11A.2		3.47E-05	6.9	0.098	1.95E-03	259	8.70E-02	251	1.44E-01	1,440	1.45E-01	1,280	1.39E-01	< 0
LEC28.40.11A.3		3.44E-05	10.9	0.097	1.94E-03	403	1.35E-01	255	1.46E-01	1,540	1.55E-01	1,290	1.40E-01	< 0
LEC28.40.11A.4		3.40E-05	13.9	0.096	1.93E-03	402	1.34E-01	259	1.47E-01	1,550	1.55E-01	1,280	1.38E-01	< 0
LEC28.40.11A.5		3.43E-05	17.9	0.095	1.91E-03	370	1.25E-01	235	1.36E-01	1,390	1.42E-01	1,190	1.30E-01	< 0

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC28.40.11A.6		3.56E-05	20.9	0.094	1.90E-03	353	1.25E-01	224	1.35E-01	1,340	1.42E-01	1,100	1.26E-01	< 0
LEC28.40.11A.7		3.46E-05	24.9	0.093	1.89E-03	363	1.26E-01	230	1.36E-01	1,380	1.44E-01	1,160	1.30E-01	< 0
LEC28.40.11A.8		3.39E-05	27.9	0.093	1.88E-03	242	8.26E-02	233	1.36E-01	1,360	1.40E-01	1,200	1.32E-01	< 0
LEC28.40.11A.9		3.32E-05	31.9	0.091	1.86E-03	374	1.26E-01	235	1.35E-01	1,400	1.42E-01	1,210	1.31E-01	< 0
LEC28.40.11A.10		3.09E-05	35.0	0.091	1.85E-03	389	1.22E-01	249	1.33E-01	1,470	1.39E-01	1,260	1.28E-01	< 0
ORLEC28 40 °C pH(RT) 11 Reactor B														
LEC28.40.11B.Blank1		3.66E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.11B.Blank2		3.91E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.40.11B.Blank3		3.78E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	45	---	---
LEC28.40.11B.1		3.76E-05	3.9	0.099	1.96E-03	310	1.12E-01	197	1.22E-01	1,150	1.25E-01	1,030	1.20E-01	< 0
LEC28.40.11B.2		3.68E-05	6.9	0.098	1.95E-03	256	9.15E-02	248	1.51E-01	1,410	1.52E-01	1,260	1.45E-01	< 0
LEC28.40.11B.3		3.57E-05	10.9	0.096	1.93E-03	382	1.34E-01	249	1.48E-01	1,460	1.54E-01	1,250	1.41E-01	< 0
LEC28.40.11B.4		3.58E-05	13.9	0.096	1.92E-03	380	1.34E-01	241	1.45E-01	1,430	1.51E-01	1,230	1.40E-01	< 0
LEC28.40.11B.5		3.55E-05	17.9	0.095	1.90E-03	376	1.33E-01	240	1.44E-01	1,400	1.48E-01	1,210	1.38E-01	< 0
LEC28.40.11B.6		3.62E-05	20.9	0.094	1.90E-03	357	1.29E-01	228	1.40E-01	1,350	1.47E-01	1,170	1.36E-01	< 0
LEC28.40.11B.7		3.54E-05	24.9	0.093	1.88E-03	331	1.18E-01	236	1.43E-01	1,410	1.51E-01	1,190	1.37E-01	< 0
LEC28.40.11B.8		3.45E-05	27.9	0.092	1.87E-03	244	8.50E-02	240	1.42E-01	1,370	1.43E-01	1,210	1.36E-01	< 0
LEC28.40.11B.9		3.43E-05	31.9	0.091	1.85E-03	370	1.29E-01	233	1.39E-01	1,380	1.45E-01	1,200	1.35E-01	< 0
LEC28.40.11B.10		3.25E-05	35.0	0.090	1.85E-03	370	1.23E-01	230	1.31E-01	1,360	1.36E-01	1,150	1.24E-01	< 0
ORLEC28 40 °C pH(RT) 12 Reactor A														
LEC28.40.12A.Blank1		3.23E-05	---	---	---	[16.5]	---	[25.2]	---	133	---	145	---	---
LEC28.40.12A.Blank2		3.56E-05	---	---	---	[16.5]	---	[25.2]	---	196	---	149	---	---
LEC28.40.12A.Blank3		3.34E-05	0.0	---	---	[16.5]	---	[25.2]	---	187	---	141	---	---
LEC28.40.12A.1		3.30E-05	3.9	0.048	9.64E-04	603	3.90E-01	337	3.72E-01	2,120	4.12E-01	1,860	3.88E-01	1.38E-09
LEC28.40.12A.3		3.08E-05	10.9	0.044	9.10E-04	943	6.04E-01	534	5.82E-01	3,260	6.27E-01	2,890	5.97E-01	1.19E-09
LEC28.40.12A.4		3.23E-05	13.9	0.042	8.85E-04	1,020	7.03E-01	601	7.06E-01	3,740	7.75E-01	3,140	6.98E-01	< 0
LEC28.40.12A.5		3.39E-05	17.9	0.040	8.53E-04	844	6.33E-01	491	6.28E-01	2,960	6.67E-01	2,680	6.49E-01	1.74E-09
LEC28.40.12A.6		3.43E-05	20.9	0.039	8.35E-04	812	6.30E-01	469	6.20E-01	2,850	6.65E-01	2,530	6.34E-01	1.10E-09
LEC28.40.12A.7		3.47E-05	24.9	0.036	8.02E-04	780	6.37E-01	450	6.27E-01	2,740	6.73E-01	2,390	6.30E-01	2.91E-10
LEC28.40.12A.8		3.44E-05	27.9	0.035	7.85E-04	750	6.21E-01	433	6.11E-01	2,650	6.60E-01	2,300	6.15E-01	2.90E-10
LEC28.40.12A.9		3.43E-05	31.9	0.033	7.54E-04	728	6.27E-01	427	6.26E-01	2,580	6.68E-01	2,270	6.30E-01	3.40E-10
LEC28.40.12A.10		3.36E-05	35.0	0.032	7.37E-04	690	5.95E-01	409	6.01E-01	2,500	6.48E-01	2,140	5.95E-01	< 0
ORLEC28 40 °C pH(RT) 12 Reactor B														
LEC28.40.12B.Blank1		3.60E-05	---	---	---	[16.5]	---	[25.2]	---	146	---	137	---	---

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{LEX} (mol Na ⁻² s ⁻¹)
LEC28.40.12B.Blank2		3.86E-05	---	---	---	[16.5]	---	[25.2]	---	162	---	142	---	---
LEC28.40.12B.Blank3		3.69E-05	0.0	---	---	[16.5]	---	[25.2]	---	199	---	140	---	---
LEC28.40.12B.1		3.50E-05	3.9	0.048	9.66E-04	546	3.73E-01	320	3.73E-01	1,970	4.05E-01	1,690	3.73E-01	< 0
LEC28.40.12B.2		3.63E-05	6.9	0.047	9.44E-04	782	5.68E-01	448	5.55E-01	2,740	5.99E-01	2,410	5.65E-01	8.51E-10
LEC28.40.12B.3		3.36E-05	10.9	0.044	9.12E-04	840	5.85E-01	490	5.82E-01	2,980	6.24E-01	2,580	5.80E-01	< 0
LEC28.40.12B.4		3.49E-05	13.9	0.043	8.92E-04	851	6.29E-01	492	6.20E-01	3,010	6.69E-01	2,590	6.18E-01	< 0
LEC28.40.12B.5		3.75E-05	17.9	0.040	8.57E-04	799	6.60E-01	452	6.37E-01	2,800	6.96E-01	2,410	6.43E-01	5.02E-10
LEC28.40.12B.6		3.77E-05	20.9	0.039	8.39E-04	757	6.43E-01	439	6.36E-01	2,670	6.82E-01	2,330	6.39E-01	2.60E-10
LEC28.40.12B.7		3.76E-05	24.9	0.037	8.05E-04	724	6.39E-01	428	6.44E-01	2,570	6.82E-01	2,270	6.47E-01	2.25E-10
LEC28.40.12B.8		3.70E-05	27.9	0.035	7.88E-04	695	6.17E-01	412	6.23E-01	2,480	6.62E-01	2,170	6.22E-01	< 0
LEC28.40.12B.9		3.77E-05	31.9	0.033	7.56E-04	658	6.19E-01	390	6.26E-01	2,360	6.68E-01	2,080	6.32E-01	5.08E-10
LEC28.40.12B.10		3.80E-05	35.0	0.032	7.38E-04	642	6.25E-01	379	6.28E-01	2,340	6.84E-01	2,010	6.31E-01	2.16E-10
ORLEC28 70 °C pH(RT) 7 Reactor A														
LEC28.70.7A.Blank1		1.75E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.70.7A.Blank2		3.81E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.70.7A.Blank3		3.80E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.70.7A.1		3.77E-05	2.0	0.373	7.55E-03	37	3.48E-03	7,360	1.18E+00	872	2.47E-02	37,000	1.13E+00	< 0
LEC28.70.7A.2		3.73E-05	4.0	0.350	7.23E-03	54	5.28E-03	9,000	1.49E+00	1,130	3.31E-02	45,700	1.44E+00	< 0
LEC28.70.7A.3		3.85E-05	6.8	0.321	6.83E-03	50	5.35E-03	7,490	1.36E+00	1,210	3.87E-02	36,300	1.25E+00	< 0
LEC28.70.7A.4		3.78E-05	9.1	0.308	6.64E-03	42	4.49E-03	6,320	1.16E+00	1,170	3.78E-02	33,300	1.15E+00	< 0
LEC28.70.7A.5		3.78E-05	11.0	0.298	6.50E-03	39	4.31E-03	5,550	1.04E+00	1,090	3.60E-02	29,100	1.03E+00	< 0
LEC28.70.7A.6		3.77E-05	13.8	0.279	6.21E-03	37	4.24E-03	4,950	9.67E-01	992	3.42E-02	25,800	9.54E-01	< 0
LEC28.70.7A.7		3.78E-05	16.1	0.269	6.07E-03	32	3.79E-03	4,340	8.71E-01	949	3.36E-02	23,300	8.85E-01	1.19E-09
LEC28.70.7A.8		3.79E-05	16.9	0.269	6.07E-03	31	3.62E-03	4,120	8.30E-01	1,010	3.59E-02	21,200	8.08E-01	< 0
ORLEC28 70 °C pH(RT) 7 Reactor B														
LEC28.70.7B.Blank1		1.79E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	45	---	---
LEC28.70.7B.Blank2		3.84E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.70.7B.Blank3		3.82E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.70.7B.1		3.75E-05	2.0	0.373	7.55E-03	39	3.68E-03	7,460	1.19E+00	857	2.42E-02	37,900	1.15E+00	< 0
LEC28.70.7B.2		3.73E-05	4.0	0.351	7.24E-03	55	5.33E-03	8,770	1.45E+00	1,050	3.07E-02	42,700	1.34E+00	< 0
LEC28.70.7B.3		3.83E-05	6.8	0.323	6.86E-03	46	4.87E-03	7,300	1.31E+00	1,140	3.62E-02	33,900	1.16E+00	< 0
LEC28.70.7B.4		3.79E-05	9.1	0.310	6.68E-03	36	3.88E-03	6,070	1.11E+00	1,120	3.62E-02	28,600	9.91E-01	< 0
LEC28.70.7B.5		3.82E-05	11.0	0.300	6.53E-03	38	4.22E-03	5,410	1.02E+00	1,030	3.42E-02	25,500	9.08E-01	< 0
LEC28.70.7B.6		3.84E-05	13.8	0.281	6.25E-03	38	4.42E-03	4,810	9.51E-01	952	3.32E-02	23,100	8.65E-01	< 0

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{LEX} (mol Na ⁻² s ⁻¹)
LEC28.70.7B.7		3.78E-05	16.1	0.272	6.12E-03	33	3.85E-03	4,150	8.25E-01	882	3.09E-02	20,300	7.64E-01	< 0
LEC28.70.7B.8		3.95E-05	16.9	0.272	6.11E-03	32	3.94E-03	4,090	8.51E-01	968	3.55E-02	19,800	7.80E-01	< 0
ORLEC28 70 °C pH(RT) 8 Reactor A														
LEC28.70.8A.Blank1		2.95E-05	---	---	---	60	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.70.8A.Blank2		3.09E-05	---	---	---	76	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.70.8A.Blank3		3.31E-05	0.0	---	---	83	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.70.8A.1		3.32E-05	2.0	0.389	7.76E-03	248	2.00E-02	3,640	5.01E-01	908	2.20E-02	17,700	4.61E-01	< 0
LEC28.70.8A.2		3.30E-05	4.0	0.377	7.60E-03	329	2.70E-02	4,890	6.83E-01	1,240	3.05E-02	23,200	6.13E-01	< 0
LEC28.70.8A.3		3.26E-05	6.8	0.363	7.42E-03	323	2.68E-02	4,290	6.06E-01	1,210	3.02E-02	20,300	5.43E-01	< 0
LEC28.70.8A.4		3.19E-05	9.1	0.356	7.32E-03	318	2.61E-02	3,720	5.21E-01	1,150	2.84E-02	18,200	4.83E-01	< 0
LEC28.70.8A.5		3.23E-05	11.0	0.351	7.25E-03	314	2.65E-02	3,290	4.72E-01	1,110	2.81E-02	16,500	4.49E-01	< 0
LEC28.70.8A.6		3.20E-05	13.8	0.342	7.12E-03	303	2.58E-02	2,920	4.23E-01	1,060	2.71E-02	15,000	4.12E-01	< 0
LEC28.70.8A.7		3.16E-05	16.1	0.336	7.04E-03	299	2.53E-02	2,730	3.94E-01	1,080	2.75E-02	13,700	3.74E-01	< 0
LEC28.70.8A.8		3.24E-05	16.9	0.336	7.04E-03	291	2.53E-02	2,540	3.76E-01	1,040	2.71E-02	12,700	3.56E-01	< 0
ORLEC28 70 °C pH(RT) 8 Reactor B														
LEC28.70.8B.Blank1		3.72E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.70.8B.Blank2		4.09E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.70.8B.Blank3		3.89E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.70.8B.1		3.72E-05	2.0	0.387	7.74E-03	221	2.01E-02	3,630	5.62E-01	976	2.67E-02	18,100	5.31E-01	< 0
LEC28.70.8B.2		3.84E-05	4.0	0.375	7.57E-03	303	2.91E-02	4,600	7.52E-01	1,250	3.61E-02	22,600	7.00E-01	< 0
LEC28.70.8B.3		3.87E-05	6.8	0.360	7.37E-03	297	2.95E-02	3,910	6.61E-01	1,170	3.49E-02	18,800	6.02E-01	< 0
LEC28.70.8B.4		3.88E-05	9.1	0.353	7.27E-03	282	2.85E-02	3,240	5.57E-01	1,080	3.28E-02	16,600	5.40E-01	< 0
LEC28.70.8B.5		3.88E-05	11.0	0.347	7.20E-03	281	2.87E-02	2,960	5.14E-01	1,090	3.34E-02	14,900	4.90E-01	< 0
LEC28.70.8B.6		3.93E-05	13.8	0.336	7.05E-03	273	2.87E-02	2,610	4.68E-01	1,050	3.32E-02	13,600	4.62E-01	< 0
LEC28.70.8B.7		3.85E-05	16.1	0.331	6.97E-03	262	2.73E-02	2,330	4.14E-01	1,000	3.13E-02	11,700	3.94E-01	< 0
LEC28.70.8B.8		3.94E-05	16.9	0.331	6.97E-03	254	2.71E-02	2,180	3.97E-01	982	3.15E-02	11,500	3.97E-01	< 0
ORLEC28 70 °C pH(RT) 9 Reactor A														
LEC28.70.9A.Blank1		1.93E-05	---	---	---	26	---	[25.2]	---	110	---	49	---	---
LEC28.70.9A.Blank2		3.72E-05	---	---	---	21	---	[25.2]	---	58	---	[44.7]	---	---
LEC28.70.9A.Blank3		3.76E-05	0.0	---	---	19	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.70.9A.1		3.75E-05	2.0	0.397	7.87E-03	507	4.56E-02	874	1.34E-01	1,780	4.82E-02	6,340	1.84E-01	4.14E-09
LEC28.70.9A.2		3.85E-05	4.0	0.395	7.85E-03	694	6.44E-02	817	1.29E-01	2,460	6.86E-02	5,780	1.73E-01	3.62E-09
LEC28.70.9A.3		3.78E-05	6.8	0.393	7.82E-03	711	6.49E-02	521	8.10E-02	2,560	7.02E-02	3,940	1.16E-01	2.89E-09
LEC28.70.9A.4		3.82E-05	9.1	0.393	7.81E-03	743	6.87E-02	380	5.99E-02	2,680	7.45E-02	3,150	9.40E-02	2.82E-09

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{LEX} (mol Na ⁻² s ⁻¹)
LEC28.70.9A.5		3.83E-05	11.0	0.392	7.80E-03	779	7.22E-02	361	5.70E-02	2,840	7.92E-02	2,650	7.93E-02	1.84E-09
LEC28.70.9A.6		3.80E-05	13.8	0.390	7.78E-03	795	7.33E-02	418	6.56E-02	2,900	8.04E-02	2,530	7.52E-02	7.92E-10
LEC28.70.9A.7		3.76E-05	16.1	0.389	7.76E-03	820	7.51E-02	503	7.85E-02	3,050	8.40E-02	2,570	7.60E-02	< 0
LEC28.70.9A.8		3.72E-05	16.9	0.389	7.76E-03	845	7.66E-02	552	8.53E-02	3,110	8.47E-02	2,620	7.66E-02	< 0
ORLEC28 70 °C pH(RT) 9 Reactor B														
LEC28.70.9B.Blank1		1.71E-05	---	---	---	22	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.70.9B.Blank2		3.56E-05	---	---	---	19	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.70.9B.Blank3		3.55E-05	0.0	---	---	21	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.70.9B.1		3.53E-05	2.0	0.397	7.86E-03	497	4.22E-02	929	1.34E-01	1,730	4.42E-02	6,730	1.84E-01	4.13E-09
LEC28.70.9B.2		3.48E-05	4.0	0.394	7.83E-03	709	5.95E-02	968	1.38E-01	2,500	6.31E-02	6,650	1.80E-01	3.44E-09
LEC28.70.9B.3		3.53E-05	6.8	0.392	7.81E-03	709	6.06E-02	642	9.35E-02	2,530	6.50E-02	4,750	1.31E-01	3.09E-09
LEC28.70.9B.4		3.57E-05	9.1	0.392	7.80E-03	719	6.22E-02	440	6.48E-02	2,590	6.73E-02	3,590	1.00E-01	2.92E-09
LEC28.70.9B.5		3.53E-05	11.0	0.391	7.79E-03	734	6.29E-02	347	5.06E-02	2,640	6.80E-02	2,940	8.12E-02	2.53E-09
LEC28.70.9B.6		3.50E-05	13.8	0.390	7.77E-03	751	6.39E-02	319	4.63E-02	2,740	7.01E-02	2,590	7.11E-02	2.05E-09
LEC28.70.9B.7		3.55E-05	16.1	0.389	7.76E-03	765	6.61E-02	355	5.22E-02	2,770	7.19E-02	2,450	6.83E-02	1.32E-09
LEC28.70.9B.8		3.63E-05	16.9	0.389	7.76E-03	784	6.92E-02	406	6.11E-02	2,880	7.65E-02	2,480	7.07E-02	7.90E-10
ORLEC28 70 °C pH(RT) 10 Reactor A														
LEC28.70.10.A.Blank1		4.60E-05	---	---	---	[16.5]	---	[25.2]	---	964	---	[44.7]	---	---
LEC28.70.10.A.Blank2		4.43E-05	---	---	---	[16.5]	---	[25.2]	---	252	---	[44.7]	---	---
LEC28.70.10.A.Blank3		4.19E-05	0.0	---	---	[16.5]	---	[25.2]	---	175	---	[44.7]	---	---
LEC28.70.10.A.1		4.57E-05	1.0	0.227	4.49E-03	396	7.62E-02	359	1.18E-01	1,910	1.11E-01	2,150	1.34E-01	1.30E-09
LEC28.70.10.A.2		4.46E-05	3.8	0.223	4.43E-03	867	1.65E-01	688	2.23E-01	3,660	2.09E-01	3,610	2.22E-01	< 0
LEC28.70.10.A.3		4.33E-05	6.1	0.221	4.41E-03	901	1.67E-01	697	2.20E-01	3,740	2.08E-01	3,470	2.08E-01	< 0
LEC28.70.10.A.4		4.21E-05	8.0	0.219	4.39E-03	872	1.58E-01	680	2.10E-01	3,650	1.99E-01	3,450	2.02E-01	< 0
LEC28.70.10.A.6		3.65E-05	13.0	0.213	4.31E-03	1,120	1.79E-01	916	2.50E-01	4,800	2.31E-01	4,390	2.27E-01	< 0
LEC28.70.10.A.7		3.69E-05	15.0	0.212	4.29E-03	817	1.33E-01	691	1.91E-01	3,690	1.80E-01	3,150	1.65E-01	< 0
LEC28.70.10.A.8		3.66E-05	17.9	0.210	4.26E-03	789	1.28E-01	659	1.82E-01	3,530	1.72E-01	3,140	1.64E-01	< 0
LEC28.70.10.A.9		3.73E-05	20.1	0.208	4.24E-03	778	1.29E-01	639	1.81E-01	3,450	1.73E-01	3,060	1.64E-01	< 0
LEC28.70.10.A.10		3.77E-05	20.9	0.208	4.24E-03	776	1.31E-01	656	1.88E-01	3,480	1.76E-01	3,070	1.67E-01	< 0
LEC28.70.10.A.1		4.57E-05	1.0	0.227	4.49E-03	396	7.62E-02	359	1.18E-01	1,910	1.11E-01	2,150	1.34E-01	1.30E-09
LEC28.70.10.A.2		4.46E-05	3.8	0.223	4.43E-03	867	1.65E-01	688	2.23E-01	3,660	2.09E-01	3,610	2.22E-01	< 0
ORLEC28 70 °C pH(RT) 10 Reactor B														
LEC28.70.10.B.Blank1	---	5.77E-05	---	---	---	[16.5]	---	[25.2]	---	158	---	[44.7]	---	---
LEC28.70.10.B.Blank2	---	5.58E-05	---	---	---	[16.5]	---	[25.2]	---	121	---	47	---	---

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC28.70.10.B.Blank3	---	5.60E-05	0.0	---	---	[16.5]	---	[25.2]	---	97	---	[44.7]	---	---
LEC28.70.10.B.1	---	5.50E-05	1.0	0.224	4.43E-03	441	1.04E-01	380	1.52E-01	2,000	1.41E-01	2,210	1.68E-01	1.27E-09
LEC28.70.10.B.2	---	5.06E-05	3.8	0.219	4.37E-03	798	1.75E-01	640	2.39E-01	3,360	2.21E-01	3,150	2.22E-01	< 0
LEC28.70.10.B.3	---	5.52E-05	6.1	0.217	4.35E-03	727	1.74E-01	587	2.40E-01	3,120	2.25E-01	2,850	2.21E-01	< 0
LEC28.70.10.B.4	---	5.43E-05	8.0	0.216	4.32E-03	672	1.59E-01	568	2.30E-01	3,070	2.19E-01	2,860	2.19E-01	< 0
LEC28.70.10.B.5	---	1.02E-06	10.9	0.217	4.33E-03	1,270	5.62E-03	993	7.49E-03	5,260	7.00E-03	5,030	7.19E-03	< 0
LEC28.70.10.B.6	---	3.63E-05	13.0	0.213	4.29E-03	1,100	1.76E-01	867	2.36E-01	4,510	2.17E-01	4,450	2.30E-01	< 0
LEC28.70.10.B.7	---	3.79E-05	15.0	0.212	4.27E-03	826	1.38E-01	657	1.88E-01	3,540	1.78E-01	3,080	1.67E-01	< 0
LEC28.70.10.B.8	---	3.78E-05	17.9	0.210	4.24E-03	818	1.38E-01	640	1.84E-01	3,460	1.75E-01	3,050	1.66E-01	< 0
LEC28.70.10.B.9	---	3.78E-05	20.1	0.208	4.22E-03	786	1.33E-01	623	1.80E-01	3,390	1.72E-01	3,040	1.66E-01	< 0
LEC28.70.10.B.10	---	3.93E-05	20.9	0.208	4.22E-03	789	1.39E-01	624	1.87E-01	3,380	1.79E-01	3,040	1.73E-01	< 0
ORLEC28 70 °C pH(RT) 11 Reactor A														
LEC28.70.11.A.Blank1	---	3.87E-05	---	---	---	[16.5]	---	[25.2]	---	160	---	[44.7]	---	---
LEC28.70.11.A.Blank2	---	3.74E-05	---	---	---	[16.5]	---	[25.2]	---	134	---	[44.7]	---	---
LEC28.70.11.A.Blank3	---	3.46E-05	0.0	---	---	[16.5]	---	[25.2]	---	104	---	[44.7]	---	---
LEC28.70.11.A.1	---	3.44E-05	1.0	0.040	7.83E-04	318	2.64E-01	251	3.55E-01	1,510	3.76E-01	1,390	3.72E-01	1.42E-09
LEC28.70.11.A.2	---	3.59E-05	3.8	0.037	7.51E-04	532	4.80E-01	506	7.78E-01	2,810	7.63E-01	2,810	8.18E-01	3.31E-09
LEC28.70.11.A.3	---	3.51E-05	6.1	0.036	7.35E-04	617	5.56E-01	546	8.38E-01	2,920	7.91E-01	3,050	8.87E-01	3.99E-09
LEC28.70.11.A.4	---	3.59E-05	8.0	0.035	7.20E-04	317	2.99E-01	543	8.72E-01	2,770	7.85E-01	3,010	9.16E-01	3.57E-09
LEC28.70.11.A.5	---	3.55E-05	10.9	0.033	6.90E-04	479	4.65E-01	549	9.08E-01	2,940	8.58E-01	2,980	9.33E-01	2.08E-09
LEC28.70.11.A.6	---	3.35E-05	13.0	0.032	6.77E-04	544	5.10E-01	529	8.44E-01	2,850	8.03E-01	2,930	8.86E-01	3.40E-09
LEC28.70.11.A.7	---	3.40E-05	15.0	0.031	6.61E-04	710	6.90E-01	528	8.74E-01	2,900	8.47E-01	2,980	9.34E-01	4.95E-09
LEC28.70.11.A.8	---	3.45E-05	17.9	0.029	6.34E-04	668	6.87E-01	520	9.11E-01	2,800	8.65E-01	2,890	9.59E-01	3.94E-09
LEC28.70.11.A.9	---	3.41E-05	20.1	0.028	6.18E-04	685	7.15E-01	513	9.12E-01	2,760	8.66E-01	2,830	9.53E-01	3.35E-09
LEC28.70.11.A.10	---	3.44E-05	20.9	0.028	6.17E-04	458	4.82E-01	496	8.89E-01	2,560	8.09E-01	2,780	9.43E-01	4.50E-09
ORLEC28 70 °C pH(RT) 11 Reactor B														
LEC28.70.11.B.Blank1	---	3.87E-05	---	---	---	[16.5]	---	[25.2]	---	127	---	[44.7]	---	---
LEC28.70.11.B.Blank2	---	3.78E-05	---	---	---	[16.5]	---	[25.2]	---	101	---	[44.7]	---	---
LEC28.70.11.B.Blank3	---	3.75E-05	0.0	---	---	24	---	[25.2]	---	99	---	51	---	---
LEC28.70.11.B.1	---	3.66E-05	1.0	0.039	7.83E-04	268	2.37E-01	247	3.72E-01	1,480	3.93E-01	1,420	4.05E-01	2.72E-09
LEC28.70.11.B.2	---	3.89E-05	3.8	0.037	7.48E-04	479	4.71E-01	517	8.67E-01	2,760	8.16E-01	2,910	9.24E-01	4.71E-09
LEC28.70.11.B.3	---	3.85E-05	6.1	0.036	7.31E-04	627	6.24E-01	529	8.97E-01	2,830	8.47E-01	2,990	9.60E-01	5.20E-09
LEC28.70.11.B.4	---	3.95E-05	8.0	0.034	7.13E-04	701	7.33E-01	540	9.62E-01	2,850	8.96E-01	3,060	1.03E+00	5.80E-09
LEC28.70.11.B.5	---	3.89E-05	10.9	0.032	6.84E-04	646	6.95E-01	510	9.35E-01	2,710	8.76E-01	2,870	9.96E-01	5.06E-09

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC28.70.11.B.6	---	3.80E-05	13.0	0.031	6.69E-04	666	7.15E-01	499	9.13E-01	2,690	8.68E-01	2,780	9.63E-01	4.14E-09
LEC28.70.11.B.7	---	3.91E-05	15.0	0.030	6.52E-04	677	7.67E-01	495	9.56E-01	2,660	9.06E-01	2,810	1.03E+00	5.91E-09
LEC28.70.11.B.8	---	3.90E-05	17.9	0.028	6.23E-04	665	7.87E-01	482	9.72E-01	2,600	9.25E-01	2,770	1.06E+00	7.08E-09
LEC28.70.11.B.9	---	3.95E-05	20.1	0.027	6.06E-04	652	8.03E-01	461	9.67E-01	2,490	9.22E-01	2,660	1.06E+00	7.39E-09
LEC28.70.11.B.10	---	4.14E-05	20.9	0.027	6.05E-04	529	6.84E-01	453	9.99E-01	2,450	9.53E-01	2,610	1.09E+00	7.50E-09
ORLEC28 70 °C pH(RT) 12 Reactor A														
LEC28.70.12.A.Blank1	---	3.25E-05	---	---	---	17	---	[25.2]	---	405	---	134	---	---
LEC28.70.12.A.Blank2	---	3.59E-05	---	---	---	[16.5]	---	[25.2]	---	965	---	131	---	---
LEC28.70.12.A.Blank3	---	3.68E-05	0.0	---	---	[16.5]	---	[25.2]	---	147	---	139	---	---
LEC28.70.12.A.1	---	3.62E-05	1.0	0.020	4.03E-04	644	1.09E+00	391	1.13E+00	2,350	1.20E+00	2,190	1.20E+00	5.66E-09
LEC28.70.12.A.2	---	3.59E-05	3.8	0.016	3.40E-04	1,660	3.32E+00	948	3.23E+00	5,480	3.29E+00	5,220	3.37E+00	1.14E-08
LEC28.70.12.A.3	---	3.54E-05	6.1	0.014	3.09E-04	1,660	3.60E+00	972	3.60E+00	5,530	3.61E+00	5,350	3.75E+00	1.25E-08
LEC28.70.12.A.4	---	3.49E-05	8.0	0.012	2.81E-04	1,710	4.02E+00	926	3.71E+00	5,230	3.70E+00	5,230	3.97E+00	2.13E-08
LEC28.70.12.A.5	---	3.50E-05	10.9	0.009	2.30E-04	1,500	4.32E+00	833	4.08E+00	4,860	4.20E+00	4,750	4.41E+00	2.69E-08
LEC28.70.12.A.6	---	3.39E-05	13.0	0.007	2.05E-04	1,290	4.04E+00	765	4.08E+00	4,410	4.15E+00	4,170	4.22E+00	1.08E-08
LEC28.70.12.A.7	---	3.24E-05	15.0	0.006	1.81E-04	1,160	3.91E+00	692	3.98E+00	4,030	4.08E+00	3,820	4.16E+00	1.48E-08
LEC28.70.12.A.8	---	3.21E-05	17.9	0.004	1.41E-04	998	4.29E+00	594	4.35E+00	3,520	4.55E+00	3,300	4.57E+00	1.86E-08
LEC28.70.12.A.10	---	3.40E-05	20.9	0.002	9.08E-05	1,300	9.21E+00	767	9.26E+00	4,500	9.58E+00	4,280	9.78E+00	4.32E-08
ORLEC28 70 °C pH(RT) 12 Reactor B														
LEC28.70.12.B.Blank1	---	3.63E-05	---	---	---	[16.5]	---	[25.2]	---	168	---	138	---	---
LEC28.70.12.B.Blank2	---	3.70E-05	---	---	---	[16.5]	---	[25.2]	---	209	---	137	---	---
LEC28.70.12.B.Blank3	---	3.66E-05	0.0	---	---	[16.5]	---	[25.2]	---	171	---	141	---	---
LEC28.70.12.B.1	---	3.62E-05	1.0	0.020	3.99E-04	628	1.08E+00	386	1.13E+00	2,250	1.16E+00	2,110	1.17E+00	3.26E-09
LEC28.70.12.B.2	---	3.84E-05	3.8	0.016	3.38E-04	1,540	3.31E+00	861	3.15E+00	4,940	3.19E+00	4,890	3.39E+00	1.96E-08
LEC28.70.12.B.3	---	3.83E-05	6.1	0.013	3.06E-04	1,510	3.58E+00	902	3.64E+00	5,080	3.62E+00	4,990	3.81E+00	1.43E-08
LEC28.70.12.B.4	---	3.83E-05	8.0	0.012	2.78E-04	1,480	3.86E+00	847	3.76E+00	4,880	3.82E+00	5,110	4.29E+00	4.42E-08
LEC28.70.12.B.5	---	3.85E-05	10.9	0.009	2.27E-04	1,300	4.17E+00	758	4.14E+00	4,350	4.19E+00	4,300	4.45E+00	2.53E-08
LEC28.70.12.B.6	---	3.81E-05	13.0	0.007	2.02E-04	1,160	4.13E+00	672	4.08E+00	3,920	4.20E+00	3,830	4.40E+00	2.66E-08
LEC28.70.12.B.7	---	3.92E-05	15.0	0.006	1.79E-04	980	4.07E+00	577	4.08E+00	3,380	4.22E+00	3,270	4.38E+00	2.46E-08
LEC28.70.12.B.8	---	3.86E-05	17.9	0.004	1.39E-04	820	4.30E+00	486	4.34E+00	2,890	4.55E+00	2,750	4.65E+00	2.56E-08
LEC28.70.12.B.10	---	3.79E-05	20.9	0.002	8.64E-05	1,240	1.03E+01	704	9.95E+00	4,120	1.03E+01	3,940	1.05E+01	4.90E-08
ORLEC28 90 °C pH(RT) 7 Reactor A														
LEC28.90.7.A.Blank1	---	2.06E-05	---	---	---	35	---	48	---	[54.8]	---	90	---	---
LEC28.90.7.A.Blank2	---	2.07E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC28.90.7.A.Blank3		2.06E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.90.7.A.2		3.42E-05	4.9	0.068	1.53E-03	24	9.95E-03	4,630	3.34E+00	1,690	2.15E-01	27,900	3.81E+00	3.89E-08
LEC28.90.7.A.4		3.24E-05	9.0	0.065	1.49E-03	[16.5]	6.80E-03	1,920	1.35E+00	1,550	1.92E-01	13,200	1.76E+00	3.36E-08
LEC28.90.7.A.6		3.29E-05	14.2	0.060	1.41E-03	[16.5]	7.26E-03	1,090	8.17E-01	1,140	1.51E-01	7,730	1.10E+00	2.31E-08
LEC28.90.7.A.7		3.46E-05	16.1	0.058	1.38E-03	[16.5]	7.84E-03	956	7.74E-01	1,050	1.50E-01	6,670	1.02E+00	2.05E-08
LEC28.90.7.A.8		3.44E-05	19.0	0.055	1.33E-03	[16.5]	8.06E-03	842	7.01E-01	998	1.47E-01	5,770	9.10E-01	1.72E-08
LEC28.90.7.A.9		3.53E-05	20.9	0.054	1.31E-03	[16.5]	8.41E-03	758	6.58E-01	979	1.50E-01	4,880	8.02E-01	1.19E-08
ORLEC28 90 °C pH(RT) 7 Reactor B														
LEC28.90.7.B.Blank1		2.08E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.90.7.B.Blank2		2.25E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	47	---	---
LEC28.90.7.B.Blank3		2.19E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.90.7.B.2		3.67E-05	4.9	0.070	1.57E-03	[16.5]	7.32E-03	4,020	3.04E+00	965	1.29E-01	24,900	3.56E+00	4.33E-08
LEC28.90.7.B.4		3.61E-05	9.0	0.066	1.51E-03	[16.5]	7.48E-03	1,870	1.44E+00	926	1.26E-01	13,200	1.93E+00	4.01E-08
LEC28.90.7.B.6		3.53E-05	14.2	0.061	1.43E-03	[16.5]	7.70E-03	1,060	8.43E-01	840	1.18E-01	7,690	1.16E+00	2.60E-08
LEC28.90.7.B.7		3.66E-05	16.1	0.059	1.39E-03	[16.5]	8.20E-03	930	7.87E-01	808	1.21E-01	6,600	1.06E+00	2.24E-08
LEC28.90.7.B.8		3.52E-05	19.0	0.056	1.35E-03	[16.5]	8.16E-03	842	7.10E-01	814	1.21E-01	5,700	9.10E-01	1.65E-08
LEC28.90.7.B.9		3.57E-05	20.9	0.055	1.33E-03	[16.5]	8.41E-03	757	6.57E-01	813	1.25E-01	5,090	8.37E-01	1.48E-08
ORLEC28 90 °C pH(RT) 8 Reactor A														
LEC28.90.8.A.Blank1		1.62E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.90.8.A.Blank3		6.46E-06	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.90.8.A.2		2.21E-05	4.9	0.084	1.78E-03	317	7.46E-02	3,790	1.52E+00	1,440	1.02E-01	22,000	1.67E+00	1.24E-08
LEC28.90.8.A.4		1.82E-05	9.0	0.081	1.73E-03	339	6.75E-02	2,420	8.21E-01	1,520	9.09E-02	15,900	1.02E+00	1.65E-08
LEC28.90.8.A.6		1.91E-05	14.2	0.078	1.68E-03	321	6.91E-02	1,400	5.14E-01	1,420	9.19E-02	10,600	7.36E-01	1.84E-08
LEC28.90.8.A.7		1.94E-05	16.1	0.076	1.66E-03	305	6.76E-02	1,190	4.50E-01	1,350	9.00E-02	9,390	6.72E-01	1.84E-08
LEC28.90.8.A.8		1.89E-05	18.9	0.074	1.63E-03	298	6.53E-02	993	3.71E-01	1,330	8.76E-02	8,110	5.73E-01	1.67E-08
LEC28.90.8.A.9		1.89E-05	20.9	0.073	1.62E-03	293	6.47E-02	859	3.23E-01	1,310	8.69E-02	7,170	5.11E-01	1.55E-08
ORLEC28 90 °C pH(RT) 8 Reactor B														
LEC28.90.8.B.Blank1		1.90E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.90.8.B.Blank3		7.81E-06	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.90.8.B.4		3.05E-05	9.0	0.089	1.85E-03	265	8.26E-02	1,350	7.17E-01	1,170	1.10E-01	9,530	9.58E-01	1.99E-08
LEC28.90.8.B.6		2.90E-05	14.2	0.086	1.80E-03	257	7.80E-02	876	4.53E-01	1,150	1.05E-01	6,880	6.74E-01	1.82E-08
LEC28.90.8.B.7		2.77E-05	16.1	0.085	1.78E-03	252	7.39E-02	775	3.87E-01	1,120	9.87E-02	6,120	5.79E-01	1.58E-08
LEC28.90.8.B.8		2.87E-05	19.0	0.083	1.76E-03	239	7.39E-02	654	3.44E-01	1,060	9.85E-02	5,240	5.22E-01	1.47E-08
LEC28.90.8.B.9		2.93E-05	20.9	0.082	1.74E-03	213	6.75E-02	575	3.10E-01	1,030	9.81E-02	4,720	4.82E-01	1.42E-08

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{LEX} (mol Na ⁻² s ⁻¹)
ORLEC28 90 °C pH(RT) 9 Reactor A														
LEC28.90.9.A.Blank1		3.60E-06	---	---	---	25	---	[25.2]	---	1,180	---	57	---	---
LEC28.90.9.A.Blank2		1.88E-05	---	---	---	25	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.90.9.A.Blank3		2.10E-05	0.0	---	---	23	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.90.9.A.2		3.65E-05	4.9	0.092	1.87E-03	511	1.88E-01	1,130	7.09E-01	1,800	1.99E-01	6,660	7.91E-01	6.78E-09
LEC28.90.9.A.4		3.67E-05	9.0	0.091	1.86E-03	463	1.73E-01	513	3.26E-01	1,620	1.82E-01	3,570	4.30E-01	8.56E-09
LEC28.90.9.A.6		3.74E-05	14.2	0.090	1.84E-03	457	1.75E-01	271	1.77E-01	1,600	1.85E-01	2,300	2.85E-01	8.88E-09
LEC28.90.9.A.7		3.77E-05	16.1	0.089	1.83E-03	454	1.76E-01	232	1.54E-01	1,600	1.87E-01	2,060	2.58E-01	8.64E-09
LEC28.90.9.A.8		3.67E-05	19.0	0.088	1.82E-03	468	1.78E-01	209	1.36E-01	1,650	1.89E-01	1,830	2.25E-01	7.37E-09
LEC28.90.9.A.9		3.74E-05	20.9	0.088	1.82E-03	471	1.83E-01	189	1.25E-01	1,680	1.97E-01	1,650	2.07E-01	6.76E-09
ORLEC28 90 °C pH(RT) 10 Reactor A														
LEC28.90.10.A.Blank1	---	3.24E-05	---	---	---	34	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.90.10.A.Blank2	---	3.48E-05	---	---	---	31	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.90.10.A.Blank3	---	3.44E-05	0.0	---	---	31	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.90.10.A.1	---	3.32E-05	0.9	0.053	1.06E-03	803	4.76E-01	476	4.81E-01	2,630	4.69E-01	2,490	4.76E-01	< 0
LEC28.90.10.A.2	---	3.29E-05	3.9	0.049	9.99E-04	1,570	9.77E-01	961	1.02E+00	5,310	9.93E-01	4,610	9.26E-01	< 0
LEC28.90.10.A.3	---	3.42E-05	6.0	0.047	9.72E-04	1,580	1.05E+00	966	1.10E+00	5,300	1.06E+00	4,680	1.00E+00	< 0
LEC28.90.10.A.4	---	3.39E-05	7.9	0.045	9.47E-04	1,580	1.07E+00	952	1.10E+00	5,310	1.08E+00	4,630	1.01E+00	< 0
LEC28.90.10.A.5	---	3.33E-05	10.9	0.042	8.99E-04	1,540	1.08E+00	924	1.10E+00	5,180	1.09E+00	4,500	1.02E+00	< 0
LEC28.90.10.A.6	---	3.41E-05	13.1	0.040	8.73E-04	1,480	1.09E+00	907	1.14E+00	5,120	1.14E+00	4,340	1.03E+00	< 0
LEC28.90.10.A.7	---	3.16E-05	13.8	0.040	8.74E-04	1,440	9.83E-01	874	1.02E+00	4,890	1.00E+00	4,160	9.17E-01	< 0
ORLEC28 90 °C pH(RT) 10 Reactor B														
LEC28.90.10.B.Blank1	---	3.46E-05	---	---	---	89	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.90.10.B.Blank2	---	3.71E-05	---	---	---	94	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.90.10.B.Blank3	---	3.52E-05	0.0	---	---	76	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC28.90.10.B.1	---	3.77E-05	0.9	0.057	1.13E-03	825	5.20E-01	476	5.11E-01	2,620	4.96E-01	2,470	5.02E-01	< 0
LEC28.90.10.B.2	---	3.81E-05	3.9	0.052	1.07E-03	1,480	9.97E-01	876	1.01E+00	4,880	9.88E-01	4,340	9.43E-01	< 0
LEC28.90.10.B.3	---	3.78E-05	6.0	0.051	1.04E-03	1,470	1.01E+00	872	1.02E+00	4,840	9.96E-01	4,280	9.45E-01	< 0
LEC28.90.10.B.4	---	3.82E-05	7.9	0.049	1.02E-03	1,470	1.04E+00	885	1.07E+00	4,900	1.05E+00	4,180	9.57E-01	< 0
LEC28.90.10.B.5	---	3.80E-05	10.9	0.045	9.66E-04	1,430	1.06E+00	859	1.09E+00	4,810	1.07E+00	4,160	9.98E-01	< 0
LEC28.90.10.B.6	---	3.87E-05	13.1	0.043	9.41E-04	1,350	1.05E+00	802	1.06E+00	4,550	1.06E+00	3,840	9.62E-01	< 0
LEC28.90.10.B.7	---	3.87E-05	13.8	0.043	9.41E-04	1,340	1.04E+00	791	1.05E+00	4,470	1.04E+00	3,580	8.98E-01	< 0
ORLEC28 90 °C pH(RT) 11 Reactor A														
LEC28.90.11.A.Blank3	---	3.27E-05	0.0	---	---	18	---	[25.2]	---	108	---	[44.7]	---	---

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC28.90.11.A.1	---	3.03E-05	0.9	0.013	2.54E-04	183	4.14E-01	186	7.17E-01	1,170	7.95E-01	939	6.85E-01	< 0
LEC28.90.11.A.2	---	2.97E-05	2.0	0.012	2.46E-04	416	9.51E-01	425	1.66E+00	2,380	1.64E+00	2,100	1.55E+00	< 0
LEC28.90.11.A.3	---	2.99E-05	2.9	0.012	2.40E-04	688	1.62E+00	528	2.12E+00	2,910	2.06E+00	2,600	1.98E+00	< 0
LEC28.90.11.A.4	---	3.28E-05	3.9	0.011	2.31E-04	767	2.06E+00	562	2.57E+00	3,050	2.46E+00	2,720	2.35E+00	< 0
LEC28.90.11.A.5	---	3.06E-05	4.9	0.010	2.22E-04	590	1.54E+00	580	2.58E+00	3,140	2.46E+00	2,720	2.29E+00	< 0
LEC28.90.11.A.6	---	3.27E-05	6.0	0.010	2.12E-04	604	1.76E+00	584	2.90E+00	3,120	2.73E+00	2,730	2.57E+00	< 0
LEC28.90.11.A.7	---	3.01E-05	7.0	0.009	2.04E-04	639	1.78E+00	588	2.79E+00	3,050	2.55E+00	2,780	2.50E+00	< 0
LEC28.90.11.A.8	---	3.28E-05	7.9	0.009	1.98E-04	577	1.81E+00	533	2.85E+00	2,860	2.70E+00	2,670	2.70E+00	< 0
ORLEC28 90 °C pH(RT) 11 Reactor B														
LEC28.90.11.B.Blank3	---	3.35E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	51	---	---
LEC28.90.11.B.1	---	3.79E-05	0.9	0.012	2.56E-04	2,050	5.73E+00	898	4.28E+00	1,940	1.63E+00	267	2.41E-01	< 0
LEC28.90.11.B.2	---	3.86E-05	2.0	0.012	2.45E-04	388	1.15E+00	629	3.18E+00	3,320	2.96E+00	3,110	2.98E+00	< 0
LEC28.90.11.B.3	---	3.88E-05	2.9	0.011	2.36E-04	759	2.36E+00	685	3.63E+00	3,810	3.56E+00	3,310	3.32E+00	< 0
LEC28.90.11.B.4	---	3.54E-05	3.9	0.010	2.24E-04	715	2.13E+00	700	3.56E+00	3,840	3.44E+00	3,400	3.27E+00	< 0
LEC28.90.11.B.5	---	3.93E-05	4.9	0.009	2.10E-04	836	2.95E+00	660	3.97E+00	3,710	3.94E+00	3,250	3.70E+00	< 0
LEC28.90.11.B.6	---	3.62E-05	6.0	0.008	1.98E-04	863	2.98E+00	650	3.82E+00	3,610	3.75E+00	3,090	3.44E+00	< 0
LEC28.90.11.B.7	---	3.77E-05	7.0	0.008	1.86E-04	654	2.50E+00	627	4.08E+00	3,390	3.89E+00	2,990	3.68E+00	< 0
LEC28.90.11.B.8	---	3.51E-05	7.9	0.007	1.78E-04	711	2.65E+00	600	3.81E+00	3,250	3.64E+00	2,680	3.22E+00	< 0
ORLEC28 90 °C pH(RT) 12 Reactor A														
LEC28.90.12.A.Blank1	---	3.47E-05	---	---	---	69	---	[25.2]	---	85	---	134	---	---
LEC28.90.12.A.Blank2	---	3.46E-05	---	---	---	40	---	[25.2]	---	90	---	142	---	---
LEC28.90.12.A.Blank3	---	3.40E-05	0.0	---	---	30	---	[25.2]	---	114	---	140	---	---
LEC28.90.12.A.1	---	3.16E-05	0.9	0.005	9.92E-05	769	4.63E+00	400	4.10E+00	2,430	4.40E+00	2,050	3.98E+00	< 0
LEC28.90.12.A.2	---	3.48E-05	2.0	0.004	8.09E-05	1,480	1.21E+01	788	1.09E+01	4,640	1.14E+01	3,960	1.04E+01	< 0
LEC28.90.12.A.3	---	3.29E-05	2.9	0.003	7.10E-05	1,530	1.34E+01	804	1.20E+01	4,760	1.25E+01	4,150	1.17E+01	< 0
LEC28.90.12.A.4	---	3.54E-05	3.9	0.002	5.72E-05	1,370	1.60E+01	718	1.43E+01	4,280	1.51E+01	3,650	1.38E+01	< 0
LEC28.90.12.A.5	---	3.35E-05	4.9	0.002	4.61E-05	1,080	1.48E+01	564	1.32E+01	3,380	1.39E+01	2,840	1.26E+01	< 0
LEC28.90.12.A.6	---	3.54E-05	6.0	0.001	3.68E-05	730	1.32E+01	410	1.27E+01	2,520	1.37E+01	2,030	1.19E+01	< 0
LEC28.90.12.A.7	---	3.30E-05	7.0	0.001	3.20E-05	522	1.02E+01	291	9.67E+00	1,850	1.08E+01	1,440	9.06E+00	< 0
LEC28.90.12.A.8	---	3.40E-05	7.9	0.001	2.88E-05	409	9.11E+00	195	7.40E+00	1,350	9.04E+00	1,020	7.33E+00	< 0
ORLEC28 90 °C pH(RT) 12 Reactor B														
LEC28.90.12.B.Blank1	---	3.77E-05	---	---	---	40	---	[25.2]	---	282	---	149	---	---
LEC28.90.12.B.Blank2	---	3.95E-05	---	---	---	31	---	[25.2]	---	286	---	146	---	---
LEC28.90.12.B.Blank3	---	3.83E-05	0.0	---	---	24	---	[25.2]	---	264	---	139	---	---

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC28.90.12.B.1	---	3.65E-05	0.9	0.005	1.00E-04	689	4.73E+00	379	4.43E+00	2,390	4.93E+00	1,920	4.25E+00	< 0
LEC28.90.12.B.2	---	3.96E-05	2.0	0.004	8.23E-05	1,250	1.14E+01	694	1.08E+01	4,140	1.13E+01	3,410	1.00E+01	< 0
LEC28.90.12.B.3	---	3.89E-05	2.9	0.003	7.19E-05	1,260	1.29E+01	700	1.22E+01	4,190	1.29E+01	3,460	1.14E+01	< 0
LEC28.90.12.B.4	---	4.02E-05	3.9	0.002	5.90E-05	1,110	1.43E+01	612	1.34E+01	3,690	1.43E+01	3,040	1.26E+01	< 0
LEC28.90.12.B.5	---	3.91E-05	4.9	0.002	4.79E-05	868	1.34E+01	479	1.26E+01	2,920	1.35E+01	2,380	1.18E+01	< 0
LEC28.90.12.B.6	---	3.93E-05	6.0	0.001	4.02E-05	593	1.09E+01	334	1.05E+01	2,110	1.17E+01	1,680	1.00E+01	< 0
LEC28.90.12.B.7	---	3.97E-05	7.0	0.001	3.61E-05	398	8.28E+00	218	7.73E+00	1,540	9.63E+00	1,130	7.59E+00	< 0
LEC28.90.12.B.8	---	3.79E-05	7.9	0.001	3.40E-05	266	5.61E+00	142	5.10E+00	1,020	6.47E+00	744	5.06E+00	< 0
ORLEC33 23 °C pH(RT) 7 Reactor A														
LEC33.23.7A.Blank1		2.70E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.7A.Blank2		3.99E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.7A.Blank3		4.02E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.7A.2		3.89E-05	6.9	1.195	2.42E-02	[16.5]	5.43E-04	450	2.12E-02	[54.8]	4.54E-04	2,440	2.30E-02	1.56E-10
LEC33.23.7A.4		3.87E-05	13.8	1.191	2.41E-02	[16.5]	5.41E-04	484	2.27E-02	[54.8]	4.53E-04	2,370	2.23E-02	< 0
LEC33.23.7A.6		3.99E-05	20.8	1.188	2.41E-02	[16.5]	5.59E-04	405	1.96E-02	[54.8]	4.68E-04	1,990	1.93E-02	< 0
LEC33.23.7A.7		4.03E-05	23.9	1.187	2.41E-02	[16.5]	5.65E-04	397	1.94E-02	[54.8]	4.73E-04	1,940	1.90E-02	< 0
LEC33.23.7A.8		4.03E-05	27.8	1.185	2.41E-02	[16.5]	5.66E-04	381	1.87E-02	[54.8]	4.74E-04	1,880	1.85E-02	< 0
LEC33.23.7A.9		3.88E-05	30.8	1.184	2.40E-02	[16.5]	5.45E-04	368	1.74E-02	[54.8]	4.56E-04	1,810	1.71E-02	< 0
LEC33.23.7A.10		3.83E-05	34.9	1.182	2.40E-02	[16.5]	5.38E-04	400	1.87E-02	[54.8]	4.51E-04	1,920	1.79E-02	< 0
LEC33.23.7A.11		4.02E-05	38.1	1.181	2.40E-02	[16.5]	5.66E-04	358	1.76E-02	[54.8]	4.74E-04	1,810	1.78E-02	1.85E-11
LEC33.23.7A.12		4.07E-05	41.8	1.179	2.40E-02	[16.5]	5.74E-04	363	1.81E-02	[54.8]	4.81E-04	1,770	1.76E-02	< 0
LEC33.23.7A.13		4.07E-05	44.9	1.178	2.40E-02	[16.5]	5.74E-04	340	1.69E-02	[54.8]	4.81E-04	1,650	1.64E-02	< 0
ORLEC33 23 °C pH(RT) 7 Reactor B														
LEC33.23.7B.Blank1		3.69E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.7B.Blank2		1.79E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.7B.Blank3		3.64E-07	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.7B.2		3.55E-05	6.9	1.195	2.42E-02	[16.5]	4.95E-04	516	2.22E-02	106	8.14E-04	3,430	2.95E-02	6.30E-10
LEC33.23.7B.4		3.04E-05	13.8	1.192	2.42E-02	[16.5]	4.25E-04	483	1.78E-02	[54.8]	3.56E-04	2,380	1.75E-02	< 0
LEC33.23.7B.6		2.79E-05	20.8	1.190	2.41E-02	[16.5]	3.91E-04	463	1.57E-02	[54.8]	3.27E-04	2,260	1.53E-02	< 0
LEC33.23.7B.9		3.14E-05	30.8	1.187	2.41E-02	[16.5]	4.40E-04	358	1.37E-02	[54.8]	3.69E-04	1,770	1.35E-02	< 0
LEC33.23.7B.10		3.29E-05	34.9	1.185	2.41E-02	[16.5]	4.61E-04	373	1.49E-02	[54.8]	3.86E-04	1,800	1.44E-02	< 0
LEC33.23.7B.11		2.88E-05	38.1	1.185	2.41E-02	[16.5]	4.04E-04	352	1.23E-02	[54.8]	3.38E-04	1,740	1.22E-02	< 0
LEC33.23.7B.12		3.01E-05	41.8	1.183	2.40E-02	[16.5]	4.23E-04	384	1.41E-02	[54.8]	3.54E-04	1,870	1.37E-02	< 0
LEC33.23.7B.13		2.86E-05	44.9	1.182	2.40E-02	[16.5]	4.03E-04	371	1.29E-02	[54.8]	3.37E-04	1,800	1.26E-02	< 0

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
ORLEC33 23 °C pH(RT) 8 Reactor A														
LEC33.23.8A.Blank1		2.33E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.8A.Blank2		3.73E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.8A.Blank3		3.76E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.8A.2		3.76E-05	6.9	1.199	2.43E-02	24	7.55E-04	109	4.95E-03	89	7.20E-04	1,060	9.63E-03	4.02E-10
LEC33.23.8A.4		3.70E-05	13.8	1.199	2.42E-02	23	7.25E-04	77	3.44E-03	63	5.01E-04	549	4.91E-03	1.26E-10
LEC33.23.8A.6		3.74E-05	20.8	1.198	2.42E-02	20	6.29E-04	75	3.40E-03	[54.8]	4.37E-04	455	4.12E-03	6.14E-11
LEC33.23.8A.7		3.80E-05	23.9	1.198	2.42E-02	24	7.64E-04	77	3.52E-03	[54.8]	4.43E-04	438	4.02E-03	4.33E-11
LEC33.23.8A.8		3.74E-05	27.8	1.198	2.42E-02	24	7.59E-04	78	3.53E-03	[54.8]	4.37E-04	426	3.86E-03	2.79E-11
LEC33.23.8A.9		3.77E-05	30.8	1.197	2.42E-02	23	7.19E-04	78	3.53E-03	[54.8]	4.40E-04	405	3.69E-03	1.32E-11
LEC33.23.8A.10		3.79E-05	34.9	1.197	2.42E-02	20	6.30E-04	82	3.74E-03	[54.8]	4.42E-04	396	3.63E-03	< 0
LEC33.23.8A.11		3.80E-05	38.1	1.197	2.42E-02	17	5.49E-04	80	3.67E-03	[54.8]	4.43E-04	383	3.52E-03	< 0
LEC33.23.8A.12		3.78E-05	41.8	1.196	2.42E-02	19	5.91E-04	87	3.96E-03	87	7.07E-04	413	3.77E-03	< 0
LEC33.23.8A.13		3.91E-05	44.9	1.196	2.42E-02	[16.5]	5.46E-04	83	3.92E-03	87	7.36E-04	381	3.61E-03	< 0
ORLEC33 23 °C pH(RT) 8 Reactor B														
LEC33.23.8B.Blank1		3.81E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.8B.Blank2		3.79E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.8B.Blank3		3.78E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.8B.2		3.70E-05	6.9	1.199	2.42E-02	27	8.32E-04	115	5.14E-03	93	7.47E-04	1,040	9.31E-03	3.58E-10
LEC33.23.8B.4		3.24E-05	13.8	1.198	2.42E-02	23	6.31E-04	85	3.33E-03	69	4.81E-04	576	4.51E-03	1.01E-10
LEC33.23.8B.6		3.33E-05	20.8	1.198	2.42E-02	22	6.05E-04	87	3.49E-03	58	4.17E-04	518	4.18E-03	5.88E-11
LEC33.23.8B.7		3.24E-05	23.9	1.197	2.42E-02	23	6.33E-04	93	3.63E-03	55	3.88E-04	496	3.89E-03	2.26E-11
LEC33.23.8B.8		3.55E-05	27.8	1.197	2.42E-02	22	6.66E-04	93	3.99E-03	[54.8]	4.14E-04	469	4.03E-03	3.33E-12
LEC33.23.8B.9		3.55E-05	30.8	1.197	2.42E-02	21	6.34E-04	88	3.76E-03	[54.8]	4.15E-04	418	3.59E-03	< 0
LEC33.23.8B.10		3.67E-05	34.9	1.196	2.42E-02	20	6.06E-04	94	4.17E-03	[54.8]	4.29E-04	416	3.70E-03	< 0
LEC33.23.8B.11		3.77E-05	38.1	1.196	2.42E-02	20	6.24E-04	83	3.79E-03	[54.8]	4.40E-04	399	3.64E-03	< 0
LEC33.23.8B.12		3.74E-05	41.8	1.196	2.42E-02	18	5.61E-04	88	4.00E-03	90	7.32E-04	411	3.73E-03	< 0
LEC33.23.8B.13		3.81E-05	44.9	1.195	2.42E-02	18	5.80E-04	85	3.93E-03	90	7.39E-04	400	3.69E-03	< 0
ORLEC33 23 °C pH(RT) 9 Reactor A														
LEC33.23.9A.Blank1		3.03E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.9A.Blank2		3.58E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.9A.Blank3		3.51E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.9A.2		3.34E-05	6.9	1.199	2.43E-02	53	1.49E-03	86	3.47E-03	210	1.52E-03	885	7.15E-03	3.17E-10
LEC33.23.9A.4		3.56E-05	13.8	1.199	2.42E-02	68	2.05E-03	88	3.79E-03	299	2.30E-03	645	5.54E-03	1.51E-10

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.23.9A.6		3.42E-05	20.8	1.198	2.42E-02	61	1.77E-03	62	2.57E-03	269	1.99E-03	363	3.00E-03	3.72E-11
LEC33.23.9A.7		3.25E-05	23.9	1.198	2.42E-02	68	1.88E-03	67	2.62E-03	307	2.16E-03	362	2.85E-03	1.92E-11
LEC33.23.9A.8		3.36E-05	27.8	1.198	2.42E-02	72	2.04E-03	69	2.78E-03	336	2.44E-03	360	2.92E-03	1.18E-11
LEC33.23.9A.9		3.22E-05	30.8	1.198	2.42E-02	74	2.01E-03	66	2.58E-03	336	2.34E-03	324	2.52E-03	< 0
LEC33.23.9A.10		3.36E-05	34.9	1.197	2.42E-02	80	2.28E-03	75	3.04E-03	381	2.77E-03	351	2.85E-03	< 0
LEC33.23.9A.11		3.49E-05	38.1	1.197	2.42E-02	77	2.26E-03	64	2.70E-03	335	2.53E-03	319	2.69E-03	< 0
LEC33.23.9A.12		3.56E-05	41.8	1.197	2.42E-02	77	2.33E-03	64	2.77E-03	327	2.52E-03	314	2.71E-03	< 0
LEC33.23.9A.13		3.14E-05	44.9	1.197	2.42E-02	78	2.06E-03	66	2.51E-03	320	2.17E-03	302	2.29E-03	< 0
ORLEC33 23 °C pH(RT) 9 Reactor B														
LEC33.23.9B.Blank1		2.52E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.9B.Blank2		3.68E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.9B.Blank3		3.75E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.9B.2		3.58E-05	6.9	1.199	2.43E-02	48	1.44E-03	80	3.43E-03	192	1.48E-03	829	7.16E-03	3.20E-10
LEC33.23.9B.4		3.70E-05	13.8	1.199	2.42E-02	50	1.56E-03	68	3.03E-03	189	1.51E-03	595	5.32E-03	1.97E-10
LEC33.23.9B.7		3.48E-05	23.9	1.198	2.42E-02	61	1.79E-03	59	2.49E-03	268	2.02E-03	311	2.62E-03	1.11E-11
LEC33.23.9B.8		3.59E-05	27.8	1.198	2.42E-02	63	1.92E-03	59	2.55E-03	282	2.19E-03	310	2.69E-03	1.26E-11
LEC33.23.9B.9		3.48E-05	30.8	1.198	2.42E-02	63	1.86E-03	57	2.40E-03	290	2.18E-03	286	2.41E-03	2.26E-13
LEC33.23.9B.10		3.54E-05	34.9	1.198	2.42E-02	65	1.94E-03	67	2.85E-03	314	2.40E-03	295	2.53E-03	< 0
LEC33.23.9B.11		3.64E-05	38.1	1.197	2.42E-02	66	2.02E-03	62	2.74E-03	303	2.39E-03	286	2.52E-03	< 0
LEC33.23.9B.12		3.67E-05	41.8	1.197	2.42E-02	66	2.05E-03	60	2.67E-03	290	2.30E-03	277	2.46E-03	< 0
LEC33.23.9B.13		3.33E-05	44.9	1.197	2.42E-02	68	1.92E-03	60	2.41E-03	290	2.09E-03	262	2.11E-03	< 0
ORLEC33 23 °C pH(RT) 10 Reactor A														
LEC33.23.10A.Blank1		3.34E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.10A.Blank2		3.90E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.10A.Blank3		3.92E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.10A.2		3.88E-05	6.9	1.200	2.43E-02	111	3.63E-03	85	3.97E-03	328	2.75E-03	663	6.21E-03	1.92E-10
LEC33.23.10A.4		3.82E-05	13.8	1.199	2.42E-02	166	5.35E-03	99	4.54E-03	474	3.91E-03	561	5.17E-03	5.43E-11
LEC33.23.10A.6		3.76E-05	20.8	1.198	2.42E-02	160	5.09E-03	97	4.41E-03	474	3.86E-03	518	4.72E-03	2.62E-11
LEC33.23.10A.7		3.95E-05	23.9	1.198	2.42E-02	162	5.40E-03	97	4.64E-03	475	4.05E-03	515	4.92E-03	2.38E-11
LEC33.23.10A.8		3.77E-05	27.8	1.197	2.42E-02	151	4.81E-03	90	4.11E-03	436	3.55E-03	490	4.47E-03	3.01E-11
LEC33.23.10A.9		3.70E-05	30.8	1.197	2.42E-02	156	4.87E-03	96	4.29E-03	469	3.75E-03	560	5.01E-03	6.15E-11
LEC33.23.10A.10		4.00E-05	34.8	1.197	2.42E-02	151	5.10E-03	95	4.58E-03	449	3.88E-03	525	5.08E-03	4.32E-11
LEC33.23.10A.11		3.99E-05	38.0	1.196	2.42E-02	147	4.96E-03	97	4.67E-03	432	3.73E-03	495	4.78E-03	9.57E-12
LEC33.23.10A.12		3.94E-05	41.8	1.196	2.42E-02	149	4.96E-03	94	4.46E-03	430	3.66E-03	541	5.16E-03	5.94E-11

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.23.10A.13		3.81E-05	44.9	1.196	2.42E-02	141	4.54E-03	91	4.17E-03	411	3.39E-03	535	4.93E-03	6.57E-11
ORLEC33 23 °C pH(RT) 10 Reactor B														
LEC33.23.10B.Blank1		3.62E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.10B.Blank2		3.48E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.10B.Blank3		3.54E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.23.10B.2		3.59E-05	6.9	1.199	2.43E-02	188	5.69E-03	138	5.97E-03	632	4.89E-03	1,010	8.75E-03	2.39E-10
LEC33.23.10B.4		3.56E-05	13.8	1.198	2.42E-02	268	8.06E-03	165	7.10E-03	864	6.65E-03	1,010	8.70E-03	1.38E-10
LEC33.23.10B.6		3.84E-05	20.8	1.197	2.42E-02	243	7.89E-03	152	7.05E-03	789	6.55E-03	908	8.44E-03	1.19E-10
LEC33.23.10B.7		3.76E-05	23.9	1.196	2.42E-02	256	8.13E-03	156	7.08E-03	816	6.63E-03	873	7.94E-03	7.33E-11
LEC33.23.10B.8		3.86E-05	27.8	1.196	2.42E-02	246	8.03E-03	148	6.91E-03	762	6.37E-03	825	7.71E-03	6.89E-11
LEC33.23.10B.9		3.93E-05	30.8	1.195	2.42E-02	227	7.54E-03	152	7.22E-03	750	6.38E-03	820	7.80E-03	4.97E-11
LEC33.23.10B.10		3.75E-05	34.8	1.194	2.42E-02	240	7.62E-03	149	6.76E-03	768	6.24E-03	875	7.95E-03	1.02E-10
LEC33.23.10B.11		3.79E-05	38.0	1.194	2.42E-02	239	7.66E-03	147	6.74E-03	770	6.32E-03	889	8.16E-03	1.22E-10
LEC33.23.10B.12		3.81E-05	41.8	1.193	2.42E-02	238	7.68E-03	148	6.83E-03	756	6.24E-03	876	8.09E-03	1.09E-10
LEC33.23.10B.13		3.90E-05	44.9	1.193	2.42E-02	223	7.37E-03	141	6.66E-03	706	5.97E-03	803	7.60E-03	8.03E-11
ORLEC33 23 °C pH(RT) 11 Reactor A														
LEC33.23.11A.Blank1		3.54E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	79	---	---
LEC33.23.11A.Blank2		3.95E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	80	---	---
LEC33.23.11A.Blank3		3.99E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	71	---	---
LEC33.23.11A.2		4.25E-05	6.9	0.199	4.02E-03	173	3.74E-02	125	3.87E-02	592	3.28E-02	612	3.79E-02	< 0
LEC33.23.11A.4		4.89E-05	13.8	0.197	4.01E-03	152	3.79E-02	109	3.89E-02	508	3.25E-02	521	3.72E-02	< 0
LEC33.23.11A.6		3.70E-05	20.8	0.196	4.00E-03	184	3.48E-02	130	3.52E-02	636	3.08E-02	604	3.27E-02	< 0
LEC33.23.11A.7		3.69E-05	23.9	0.196	3.99E-03	186	3.52E-02	131	3.55E-02	649	3.15E-02	577	3.13E-02	< 0
LEC33.23.11A.8		3.67E-05	27.8	0.196	3.98E-03	179	3.37E-02	126	3.40E-02	602	2.90E-02	576	3.11E-02	< 0
LEC33.23.11A.9		3.66E-05	30.8	0.195	3.98E-03	121	2.28E-02	121	3.26E-02	579	2.79E-02	536	2.89E-02	< 0
LEC33.23.11A.10		3.72E-05	34.8	0.195	3.97E-03	160	3.07E-02	120	3.29E-02	574	2.82E-02	528	2.90E-02	< 0
LEC33.23.11A.11		3.70E-05	38.0	0.194	3.97E-03	152	2.90E-02	111	3.03E-02	524	2.56E-02	488	2.67E-02	< 0
LEC33.23.11A.12		3.77E-05	41.8	0.194	3.96E-03	153	2.98E-02	119	3.32E-02	582	2.90E-02	539	3.01E-02	< 0
LEC33.23.11A.13		3.65E-05	44.9	0.193	3.95E-03	156	2.95E-02	127	3.43E-02	597	2.89E-02	525	2.84E-02	< 0
ORLEC33 23 °C pH(RT) 11 Reactor B														
LEC33.23.11B.Blank1		3.21E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	104	---	---
LEC33.23.11B.Blank2		3.41E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	84	---	---
LEC33.23.11B.Blank3		3.46E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	75	---	---
LEC33.23.11B.2		3.32E-05	6.9	0.199	4.02E-03	158	2.67E-02	144	3.48E-02	705	3.05E-02	698	3.38E-02	< 0

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.23.11B.4		3.49E-05	13.8	0.198	4.01E-03	101	1.80E-02	143	3.64E-02	707	3.22E-02	667	3.40E-02	< 0
LEC33.23.11B.6		3.43E-05	20.8	0.197	4.00E-03	189	3.32E-02	139	3.49E-02	699	3.14E-02	625	3.14E-02	< 0
LEC33.23.11B.7		3.51E-05	23.9	0.196	3.99E-03	180	3.24E-02	137	3.53E-02	694	3.20E-02	619	3.19E-02	< 0
LEC33.23.11B.8		3.47E-05	27.8	0.196	3.98E-03	120	2.14E-02	136	3.47E-02	667	3.04E-02	577	2.94E-02	< 0
LEC33.23.11B.9		3.38E-05	30.8	0.195	3.98E-03	168	2.92E-02	130	3.23E-02	644	2.87E-02	580	2.89E-02	< 0
LEC33.23.11B.10		3.45E-05	34.8	0.195	3.97E-03	165	2.94E-02	127	3.23E-02	618	2.81E-02	584	2.97E-02	< 0
LEC33.23.11B.11		3.42E-05	38.0	0.194	3.97E-03	160	2.82E-02	119	3.00E-02	587	2.65E-02	527	2.66E-02	< 0
LEC33.23.11B.12		3.54E-05	41.8	0.194	3.96E-03	166	3.04E-02	125	3.28E-02	653	3.06E-02	548	2.88E-02	< 0
LEC33.23.11B.13		3.52E-05	44.9	0.194	3.95E-03	172	3.13E-02	126	3.28E-02	657	3.06E-02	581	3.03E-02	< 0
ORLEC33 23 °C pH(RT) 12 Reactor A														
LEC33.23.12A.Blank1		3.44E-05	---	---	---	37	---	[25.2]	---	[54.8]	---	137	---	---
LEC33.23.12A.Blank2		3.99E-05	---	---	---	21	---	[25.2]	---	[54.8]	---	138	---	---
LEC33.23.12A.Blank3		3.84E-05	0.0	---	---	27	---	[25.2]	---	[54.8]	---	137	---	---
LEC33.23.12A.2		3.88E-05	6.9	0.098	1.99E-03	324	1.29E-01	222	1.27E-01	1,160	1.18E-01	1,020	1.16E-01	< 0
LEC33.23.12A.4		3.84E-05	13.8	0.096	1.97E-03	352	1.41E-01	254	1.45E-01	1,290	1.32E-01	1,130	1.29E-01	< 0
LEC33.23.12A.7		3.90E-05	23.9	0.093	1.93E-03	347	1.44E-01	249	1.47E-01	1,290	1.37E-01	1,140	1.35E-01	< 0
LEC33.23.12A.8		3.90E-05	27.8	0.092	1.91E-03	346	1.45E-01	246	1.47E-01	1,260	1.35E-01	1,140	1.36E-01	< 0
LEC33.23.12A.9		3.87E-05	30.8	0.091	1.90E-03	345	1.44E-01	246	1.46E-01	1,270	1.35E-01	1,090	1.30E-01	< 0
LEC33.23.12A.10		3.85E-05	34.8	0.090	1.88E-03	352	1.47E-01	256	1.53E-01	1,320	1.41E-01	1,120	1.34E-01	< 0
LEC33.23.12A.11		3.86E-05	38.0	0.089	1.87E-03	348	1.47E-01	251	1.52E-01	1,290	1.39E-01	1,110	1.34E-01	< 0
LEC33.23.12A.12		3.85E-05	41.8	0.088	1.86E-03	347	1.47E-01	253	1.54E-01	1,300	1.41E-01	1,140	1.39E-01	< 0
LEC33.23.12A.13		3.85E-05	44.9	0.087	1.84E-03	334	1.43E-01	251	1.53E-01	1,260	1.38E-01	1,220	1.49E-01	< 0
ORLEC33 23 °C pH(RT) 12 Reactor B														
LEC33.23.12B.Blank2		3.94E-05	---	---	---	125	---	[25.2]	---	13,200	---	149	---	---
LEC33.23.12B.Blank3		3.48E-05	0.0	---	---	171	---	[25.2]	---	11,200	---	141	---	---
LEC33.23.12B.2		3.52E-05	6.9	0.098	1.99E-03	355	1.28E-01	236	1.22E-01	2,830	2.61E-01	1,080	1.12E-01	< 0
LEC33.23.12B.4		3.28E-05	13.8	0.096	1.97E-03	394	1.34E-01	272	1.33E-01	2,470	2.16E-01	1,260	1.23E-01	< 0
LEC33.23.12B.6		3.34E-05	20.8	0.094	1.94E-03	383	1.35E-01	270	1.36E-01	2,030	1.83E-01	1,280	1.29E-01	< 0
LEC33.23.12B.7		3.27E-05	23.9	0.094	1.93E-03	386	1.34E-01	274	1.36E-01	1,950	1.73E-01	1,220	1.21E-01	< 0
LEC33.23.12B.8		3.31E-05	27.8	0.092	1.92E-03	383	1.35E-01	271	1.37E-01	1,840	1.66E-01	1,230	1.24E-01	< 0
LEC33.23.12B.9		3.52E-05	30.8	0.092	1.91E-03	386	1.46E-01	261	1.41E-01	1,710	1.65E-01	1,210	1.31E-01	< 0
LEC33.23.12B.10		3.25E-05	34.8	0.090	1.89E-03	392	1.38E-01	288	1.45E-01	1,850	1.66E-01	1,290	1.30E-01	< 0
LEC33.23.12B.11		3.32E-05	38.0	0.090	1.88E-03	375	1.36E-01	271	1.40E-01	1,680	1.55E-01	1,240	1.28E-01	< 0
LEC33.23.12B.12		3.46E-05	41.8	0.089	1.87E-03	375	1.42E-01	270	1.46E-01	1,650	1.60E-01	1,280	1.39E-01	< 0

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.23.12B.13		3.53E-05	44.9	0.088	1.86E-03	362	1.41E-01	257	1.43E-01	1,570	1.56E-01	1,420	1.58E-01	1.30E-09
ORLEC33 40 °C pH(RT) 7 Reactor A														
LEC33.40.7A.Blank1		2.47E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	60	---	---
LEC33.40.7A.Blank2		3.14E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	49	---	---
LEC33.40.7A.Blank3		3.19E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	81	---	---
LEC33.40.7A.1		3.34E-05	4.0	0.648	1.32E-02	57	2.93E-03	2,010	1.49E-01	164	2.17E-03	8,800	1.31E-01	< 0
LEC33.40.7A.2		3.46E-05	7.0	0.641	1.31E-02	[16.5]	8.94E-04	2,460	1.91E-01	150	2.08E-03	11,000	1.71E-01	< 0
LEC33.40.7A.5		3.55E-05	18.0	0.616	1.27E-02	[16.5]	9.40E-04	2,130	1.73E-01	135	1.97E-03	9,590	1.56E-01	< 0
LEC33.40.7A.6		3.53E-05	21.0	0.612	1.27E-02	[16.5]	9.41E-04	1,820	1.48E-01	113	1.65E-03	8,200	1.34E-01	< 0
LEC33.40.7A.7		3.54E-05	25.0	0.604	1.26E-02	[16.5]	9.51E-04	1,760	1.45E-01	113	1.67E-03	7,940	1.31E-01	< 0
LEC33.40.7A.8		3.53E-05	28.0	0.599	1.25E-02	[16.5]	9.52E-04	1,770	1.46E-01	117	1.73E-03	8,190	1.35E-01	< 0
LEC33.40.7A.9		3.52E-05	32.0	0.591	1.24E-02	[16.5]	9.60E-04	1,730	1.44E-01	117	1.74E-03	7,760	1.29E-01	< 0
LEC33.40.7A.10		3.57E-05	35.1	0.587	1.23E-02	[16.5]	9.78E-04	1,680	1.42E-01	120	1.82E-03	7,770	1.32E-01	< 0
ORLEC33 40 °C pH(RT) 7 Reactor B														
LEC33.40.7B.Blank1		3.50E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	77	---	---
LEC33.40.7B.Blank2		3.97E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	56	---	---
LEC33.40.7B.Blank3		3.94E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.40.7B.1		3.94E-05	4.0	0.648	1.32E-02	[16.5]	1.01E-03	1,770	1.55E-01	105	1.65E-03	8,650	1.52E-01	< 0
LEC33.40.7B.2		3.95E-05	7.0	0.641	1.31E-02	[16.5]	1.02E-03	2,200	1.94E-01	114	1.80E-03	9,740	1.72E-01	< 0
LEC33.40.7B.5		3.81E-05	18.0	0.617	1.28E-02	[16.5]	1.01E-03	1,930	1.69E-01	108	1.69E-03	8,120	1.42E-01	< 0
LEC33.40.7B.6		3.81E-05	21.0	0.613	1.27E-02	[16.5]	1.01E-03	1,660	1.46E-01	93	1.46E-03	7,020	1.23E-01	< 0
LEC33.40.7B.7		3.78E-05	25.0	0.605	1.26E-02	[16.5]	1.01E-03	1,590	1.40E-01	90	1.41E-03	6,670	1.17E-01	< 0
LEC33.40.7B.8		3.81E-05	28.0	0.600	1.25E-02	[16.5]	1.03E-03	1,610	1.43E-01	97	1.55E-03	6,880	1.23E-01	< 0
LEC33.40.7B.9		3.81E-05	32.0	0.593	1.24E-02	[16.5]	1.04E-03	1,530	1.37E-01	96	1.54E-03	6,490	1.17E-01	< 0
LEC33.40.7B.10		3.79E-05	35.1	0.588	1.24E-02	[16.5]	1.04E-03	1,500	1.35E-01	99	1.59E-03	6,420	1.15E-01	< 0
ORLEC33 40 °C pH(RT) 8 Reactor A														
LEC33.40.8A.Blank1		3.55E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	71	---	---
LEC33.40.8A.Blank2		3.62E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.40.8A.Blank3		3.54E-05	0.0	---	---	22	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.40.8A.1		3.38E-05	4.0	0.657	1.33E-02	45	2.36E-03	473	3.52E-02	167	2.22E-03	2,590	3.85E-02	2.91E-10
LEC33.40.8A.2		3.36E-05	7.0	0.655	1.33E-02	60	3.13E-03	712	5.27E-02	212	2.81E-03	3,080	4.57E-02	< 0
LEC33.40.8A.4		3.24E-05	14.0	0.649	1.32E-02	66	3.32E-03	897	6.46E-02	241	3.10E-03	3,850	5.55E-02	< 0
LEC33.40.8A.5		3.32E-05	18.0	0.646	1.32E-02	93	4.81E-03	686	5.06E-02	175	2.31E-03	2,860	4.23E-02	< 0
LEC33.40.8A.6		3.35E-05	21.0	0.644	1.31E-02	54	2.82E-03	650	4.86E-02	157	2.10E-03	2,820	4.22E-02	< 0

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.40.8A.7		3.33E-05	25.0	0.642	1.31E-02	53	2.78E-03	656	4.88E-02	158	2.10E-03	2,870	4.28E-02	< 0
LEC33.40.8A.8		3.29E-05	28.0	0.640	1.31E-02	53	2.71E-03	649	4.79E-02	151	1.99E-03	2,840	4.19E-02	< 0
LEC33.40.8A.9		3.38E-05	32.0	0.637	1.30E-02	53	2.80E-03	626	4.75E-02	149	2.02E-03	2,800	4.26E-02	< 0
LEC33.40.8A.10		3.35E-05	35.1	0.636	1.30E-02	51	2.67E-03	613	4.61E-02	142	1.91E-03	2,730	4.11E-02	< 0
ORLEC33 40 °C pH(RT) 8 Reactor B														
LEC33.40.8B.Blank1		3.58E-05	---	---	---	18	---	[25.2]	---	[54.8]	---	65	---	---
LEC33.40.8B.Blank2		3.93E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.40.8B.Blank3		3.94E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.40.8B.1		3.89E-05	4.0	0.656	1.33E-02	204	1.22E-02	466	4.00E-02	153	2.35E-03	2,130	3.66E-02	< 0
LEC33.40.8B.2		3.92E-05	7.0	0.654	1.33E-02	50	3.04E-03	598	5.17E-02	171	2.65E-03	2,700	4.68E-02	< 0
LEC33.40.8B.4		3.69E-05	14.0	0.649	1.32E-02	59	3.39E-03	757	6.19E-02	195	2.86E-03	3,280	5.37E-02	< 0
LEC33.40.8B.5		3.81E-05	18.0	0.646	1.32E-02	41	2.43E-03	532	4.51E-02	121	1.84E-03	2,300	3.91E-02	< 0
LEC33.40.8B.6		3.82E-05	21.0	0.645	1.31E-02	37	2.18E-03	464	3.95E-02	99	1.50E-03	2,030	3.46E-02	< 0
LEC33.40.8B.7		3.84E-05	25.0	0.643	1.31E-02	37	2.24E-03	466	3.99E-02	89	1.37E-03	2,090	3.59E-02	< 0
LEC33.40.8B.8		3.83E-05	28.0	0.641	1.31E-02	38	2.25E-03	452	3.87E-02	87	1.33E-03	1,960	3.36E-02	< 0
LEC33.40.8B.9		3.86E-05	32.0	0.639	1.31E-02	39	2.33E-03	437	3.78E-02	82	1.27E-03	1,900	3.29E-02	< 0
LEC33.40.8B.10		3.86E-05	35.1	0.638	1.30E-02	35	2.14E-03	419	3.63E-02	76	1.18E-03	1,890	3.28E-02	< 0
ORLEC33 40 °C pH(RT) 9 Reactor A														
LEC33.40.9A.Blank1		3.63E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	50	---	---
LEC33.40.9A.Blank2		3.85E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.40.9A.Blank3		3.88E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	58	---	---
LEC33.40.9A.1		2.77E-05	4.0	0.659	1.33E-02	97	4.13E-03	148	9.01E-03	365	3.98E-03	1,520	1.85E-02	8.18E-10
LEC33.40.9A.2		3.80E-05	7.0	0.659	1.33E-02	160	9.34E-03	137	1.14E-02	673	1.00E-02	1,100	1.84E-02	5.97E-10
LEC33.40.9A.5		3.81E-05	18.0	0.657	1.33E-02	210	1.23E-02	131	1.10E-02	839	1.26E-02	740	1.24E-02	1.24E-10
LEC33.40.9A.6		3.88E-05	21.0	0.657	1.33E-02	198	1.18E-02	125	1.07E-02	773	1.18E-02	673	1.15E-02	7.15E-11
LEC33.40.9A.7		3.87E-05	25.0	0.656	1.33E-02	190	1.13E-02	118	1.01E-02	740	1.13E-02	647	1.11E-02	8.46E-11
LEC33.40.9A.8		3.88E-05	28.0	0.656	1.33E-02	193	1.15E-02	124	1.06E-02	768	1.17E-02	656	1.12E-02	5.39E-11
LEC33.40.9A.9		3.87E-05	32.0	0.655	1.33E-02	206	1.23E-02	128	1.09E-02	765	1.17E-02	630	1.08E-02	< 0
LEC33.40.9A.10		3.88E-05	35.1	0.655	1.33E-02	199	1.19E-02	132	1.13E-02	793	1.22E-02	688	1.18E-02	4.23E-11
ORLEC33 40 °C pH(RT) 9 Reactor B														
LEC33.40.9B.Blank1		3.57E-05	---	---	---	138	---	35	---	[54.8]	---	63	---	---
LEC33.40.9B.Blank2		3.87E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.40.9B.Blank3		3.83E-05	0.0	---	---	18	---	[25.2]	---	[54.8]	---	58	---	---
LEC33.40.9B.1		2.67E-05	4.0	0.660	1.33E-02	105	4.30E-03	157	9.19E-03	374	3.92E-03	1,670	1.96E-02	8.92E-10

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{LEX} (mol Na ⁻² s ⁻¹)
LEC33.40.9B.2		3.76E-05	7.0	0.659	1.33E-02	174	1.00E-02	144	1.19E-02	686	1.01E-02	1,250	2.07E-02	7.54E-10
LEC33.40.9B.5		3.68E-05	18.0	0.657	1.33E-02	229	1.30E-02	141	1.14E-02	888	1.29E-02	803	1.30E-02	1.37E-10
LEC33.40.9B.6		3.61E-05	21.0	0.657	1.33E-02	214	1.19E-02	136	1.08E-02	840	1.19E-02	752	1.19E-02	9.93E-11
LEC33.40.9B.7		3.66E-05	25.0	0.656	1.33E-02	190	1.07E-02	140	1.13E-02	824	1.19E-02	735	1.19E-02	4.96E-11
LEC33.40.9B.8		3.64E-05	28.0	0.656	1.33E-02	195	1.09E-02	141	1.13E-02	830	1.19E-02	695	1.12E-02	< 0
LEC33.40.9B.9		3.64E-05	32.0	0.655	1.33E-02	245	1.38E-02	161	1.29E-02	798	1.15E-02	665	1.07E-02	< 0
LEC33.40.9B.10		3.66E-05	35.1	0.655	1.33E-02	198	1.12E-02	143	1.15E-02	851	1.23E-02	696	1.12E-02	< 0
ORLEC33 40 °C pH(RT) 10 Reactor A														
LEC33.40.10A.Blank1		3.64E-05	---	---	---	18	---	[25.2]	---	[54.8]	---	51	---	---
LEC33.40.10A.Blank2		3.60E-05	---	---	---	17	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.40.10A.Blank3		3.58E-05	0.0	---	---	17	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.40.10A.1		3.68E-05	4.0	0.658	1.33E-02	297	1.68E-02	283	2.29E-02	1,340	1.94E-02	1,810	2.93E-02	5.51E-10
LEC33.40.10A.2		3.70E-05	7.0	0.657	1.33E-02	473	2.69E-02	393	3.20E-02	2,020	2.94E-02	1,890	3.08E-02	< 0
LEC33.40.10A.5		3.69E-05	18.0	0.651	1.32E-02	588	3.36E-02	502	4.10E-02	2,540	3.71E-02	2,360	3.86E-02	< 0
LEC33.40.10A.6		3.72E-05	20.9	0.650	1.32E-02	468	2.70E-02	411	3.39E-02	2,010	2.97E-02	1,810	2.99E-02	< 0
LEC33.40.10A.7		3.76E-05	25.0	0.648	1.32E-02	456	2.66E-02	398	3.32E-02	1,960	2.93E-02	1,800	3.01E-02	< 0
LEC33.40.10A.8		3.74E-05	28.0	0.647	1.32E-02	447	2.60E-02	415	3.45E-02	1,980	2.95E-02	1,690	2.81E-02	< 0
LEC33.40.10A.9		3.99E-05	32.0	0.645	1.31E-02	428	2.66E-02	391	3.48E-02	1,920	3.06E-02	1,600	2.85E-02	< 0
LEC33.40.10A.10		4.00E-05	35.1	0.643	1.31E-02	429	2.68E-02	387	3.46E-02	1,890	3.02E-02	1,630	2.92E-02	< 0
ORLEC33 40 °C pH(RT) 10 Reactor B														
LEC33.40.10B.Blank1		3.58E-05	---	---	---	19	---	[25.2]	---	[54.8]	---	52	---	---
LEC33.40.10B.Blank2		3.88E-05	---	---	---	17	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.40.10B.Blank3		3.74E-05	0.0	---	---	17	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.40.10B.1		3.78E-05	4.0	0.598	1.21E-02	232	1.48E-02	233	2.13E-02	1,060	1.74E-02	1,430	2.62E-02	4.19E-10
LEC33.40.10B.2		3.86E-05	7.0	0.597	1.21E-02	352	2.30E-02	301	2.81E-02	1,610	2.69E-02	1,370	2.56E-02	< 0
LEC33.40.10B.5		3.75E-05	18.0	0.592	1.20E-02	461	2.95E-02	412	3.77E-02	2,010	3.29E-02	1,730	3.17E-02	< 0
LEC33.40.10B.6		3.84E-05	20.9	0.591	1.20E-02	350	2.29E-02	310	2.90E-02	1,570	2.63E-02	1,310	2.46E-02	< 0
LEC33.40.10B.7		3.76E-05	25.0	0.590	1.20E-02	337	2.16E-02	299	2.74E-02	1,530	2.51E-02	1,280	2.35E-02	< 0
LEC33.40.10B.8		3.65E-05	28.0	0.589	1.20E-02	349	2.18E-02	308	2.74E-02	1,570	2.50E-02	1,290	2.30E-02	< 0
LEC33.40.10B.9		3.56E-05	32.0	0.588	1.20E-02	351	2.14E-02	310	2.70E-02	1,580	2.46E-02	1,380	2.41E-02	< 0
LEC33.40.10B.10		3.45E-05	35.1	0.587	1.20E-02	347	2.05E-02	308	2.61E-02	1,580	2.39E-02	1,320	2.24E-02	< 0
ORLEC33 40 °C pH(RT) 11 Reactor A														
LEC33.40.11A.Blank2		3.88E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.40.11A.Blank3		3.99E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.40.11A.1		3.69E-05	4.0	0.099	2.01E-03	270	1.02E-01	223	1.20E-01	1,190	1.15E-01	1,010	1.09E-01	< 0
LEC33.40.11A.2		3.68E-05	7.0	0.098	2.00E-03	203	7.65E-02	275	1.48E-01	1,390	1.34E-01	1,260	1.36E-01	< 0
LEC33.40.11A.3		3.62E-05	10.9	0.097	1.98E-03	330	1.23E-01	279	1.49E-01	1,470	1.41E-01	1,190	1.27E-01	< 0
LEC33.40.11A.4		3.62E-05	13.9	0.096	1.97E-03	349	1.31E-01	289	1.55E-01	1,530	1.47E-01	1,250	1.35E-01	< 0
LEC33.40.11A.5		3.56E-05	18.0	0.095	1.95E-03	207	7.71E-02	265	1.41E-01	1,340	1.28E-01	1,170	1.25E-01	< 0
LEC33.40.11A.6		3.64E-05	20.9	0.094	1.95E-03	311	1.19E-01	246	1.35E-01	1,300	1.27E-01	1,110	1.22E-01	< 0
LEC33.40.11A.7		3.59E-05	25.0	0.093	1.93E-03	327	1.25E-01	262	1.43E-01	1,380	1.35E-01	1,210	1.32E-01	< 0
LEC33.40.11A.8		3.50E-05	28.0	0.092	1.92E-03	214	8.00E-02	264	1.41E-01	1,350	1.29E-01	1,170	1.25E-01	< 0
LEC33.40.11A.9		3.44E-05	32.0	0.091	1.90E-03	303	1.12E-01	254	1.35E-01	1,340	1.27E-01	1,170	1.24E-01	< 0
LEC33.40.11A.10		3.31E-05	35.1	0.090	1.89E-03	329	1.18E-01	274	1.40E-01	1,430	1.31E-01	1,210	1.24E-01	< 0
ORLEC33 40 °C pH(RT) 11 Reactor B														
LEC33.40.11B.Blank1		3.58E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.40.11B.Blank2		3.75E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.40.11B.Blank3		3.72E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.40.11B.1		3.65E-05	4.0	0.099	2.00E-03	287	1.07E-01	225	1.20E-01	1,200	1.14E-01	1,070	1.14E-01	< 0
LEC33.40.11B.2		3.64E-05	7.0	0.098	1.99E-03	231	8.64E-02	279	1.49E-01	1,420	1.36E-01	1,280	1.37E-01	< 0
LEC33.40.11B.3		3.60E-05	10.9	0.096	1.97E-03	352	1.31E-01	280	1.49E-01	1,490	1.42E-01	1,270	1.36E-01	< 0
LEC33.40.11B.4		3.61E-05	13.9	0.096	1.96E-03	265	9.98E-02	287	1.55E-01	1,420	1.37E-01	1,310	1.41E-01	< 0
LEC33.40.11B.5		3.56E-05	18.0	0.094	1.95E-03	313	1.17E-01	268	1.43E-01	1,390	1.33E-01	1,240	1.33E-01	< 0
LEC33.40.11B.6		3.61E-05	20.9	0.094	1.94E-03	299	1.14E-01	249	1.36E-01	1,310	1.28E-01	1,140	1.24E-01	< 0
LEC33.40.11B.7		3.58E-05	25.0	0.093	1.92E-03	319	1.22E-01	259	1.41E-01	1,370	1.34E-01	1,200	1.31E-01	< 0
LEC33.40.11B.8		3.53E-05	28.0	0.092	1.91E-03	200	7.56E-02	269	1.45E-01	1,380	1.34E-01	1,210	1.31E-01	< 0
LEC33.40.11B.9		3.48E-05	32.0	0.091	1.90E-03	318	1.20E-01	265	1.42E-01	1,390	1.34E-01	1,240	1.33E-01	< 0
LEC33.40.11B.10		3.35E-05	35.1	0.090	1.89E-03	325	1.18E-01	270	1.41E-01	142	1.32E-02	1,260	1.31E-01	< 0
ORLEC33 40 °C pH(RT) 12 Reactor A														
LEC33.40.12A.Blank2		3.68E-05	---	---	---	[16.5]	---	[25.2]	---	125	---	153	---	---
LEC33.40.12A.Blank3		3.80E-05	0.0	---	---	[16.5]	---	[25.2]	---	176	---	149	---	---
LEC33.40.12A.1		3.61E-05	4.0	0.047	9.78E-04	646	4.88E-01	475	5.13E-01	2,510	4.85E-01	2,090	4.52E-01	< 0
LEC33.40.12A.2		3.75E-05	7.0	0.045	9.46E-04	864	7.00E-01	674	7.81E-01	3,530	7.32E-01	3,080	7.15E-01	< 0
LEC33.40.12A.3		3.47E-05	10.9	0.042	9.01E-04	990	7.81E-01	714	8.06E-01	3,770	7.61E-01	3,170	7.16E-01	< 0
LEC33.40.12A.4		3.72E-05	13.9	0.040	8.71E-04	977	8.53E-01	707	8.83E-01	3,730	8.33E-01	3,130	7.82E-01	< 0
LEC33.40.12A.5		3.91E-05	18.0	0.037	8.22E-04	901	8.77E-01	654	9.10E-01	3,450	8.59E-01	2,860	7.97E-01	< 0
LEC33.40.12A.6		3.78E-05	20.9	0.035	7.99E-04	846	8.19E-01	605	8.38E-01	3,230	8.00E-01	2,630	7.29E-01	< 0
LEC33.40.12A.7		3.85E-05	25.0	0.032	7.51E-04	830	8.71E-01	606	9.09E-01	3,290	8.83E-01	2,730	8.20E-01	< 0

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{LEX} (mol Na ⁻² s ⁻¹)
LEC33.40.12A.8		3.81E-05	28.0	0.030	7.26E-04	737	7.92E-01	579	8.90E-01	3,050	8.39E-01	2,620	8.06E-01	< 0
ORLEC33 40 °C pH(RT) 12 Reactor B														
LEC33.40.12B.Blank2		3.84E-05	---	---	---	[16.5]	---	[25.2]	---	185	---	148	---	---
LEC33.40.12B.Blank3		3.75E-05	0.0	---	---	[16.5]	---	[25.2]	---	210	---	155	---	---
LEC33.40.12B.1		3.61E-05	4.0	0.048	9.80E-04	577	4.35E-01	422	4.55E-01	2,240	4.32E-01	1,920	4.15E-01	< 0
LEC33.40.12B.2		3.69E-05	7.0	0.046	9.53E-04	799	6.34E-01	599	6.79E-01	3,120	6.33E-01	2,840	6.45E-01	< 0
LEC33.40.12B.3		3.46E-05	10.9	0.043	9.11E-04	920	7.16E-01	656	7.30E-01	3,450	6.87E-01	3,040	6.77E-01	< 0
LEC33.40.12B.4		3.53E-05	13.9	0.041	8.85E-04	927	7.57E-01	664	7.76E-01	3,510	7.34E-01	3,050	7.13E-01	< 0
LEC33.40.12B.5		3.77E-05	18.0	0.038	8.39E-04	879	8.08E-01	631	8.29E-01	3,360	7.90E-01	2,940	7.73E-01	< 0
LEC33.40.12B.6		3.73E-05	20.9	0.036	8.14E-04	862	8.08E-01	624	8.36E-01	3,310	7.94E-01	2,850	7.65E-01	< 0
LEC33.40.12B.7		3.72E-05	25.0	0.033	7.68E-04	831	8.24E-01	607	8.61E-01	3,230	8.20E-01	2,790	7.92E-01	< 0
LEC33.40.12B.8		3.73E-05	28.0	0.032	7.45E-04	797	8.17E-01	583	8.55E-01	3,080	8.08E-01	2,650	7.78E-01	< 0
LEC33.40.12B.9		3.75E-05	32.0	0.029	7.01E-04	763	8.35E-01	559	8.75E-01	2,980	8.34E-01	2,530	7.93E-01	< 0
ORLEC33 70 °C pH(RT) 7 Reactor A														
LEC33.70.7A.Blank1	---	3.30E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.70.7A.Blank2	---	3.90E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.70.7A.Blank3	---	3.52E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.70.7A.1	---	3.80E-05	2.9	0.330	7.12E-03	26	2.79E-03	14,400	2.25E+00	4,280	1.20E-01	60,000	1.88E+00	< 0
LEC33.70.7A.2	---	3.69E-05	5.0	0.305	6.75E-03	29	3.21E-03	14,100	2.25E+00	5,580	1.60E-01	59,900	1.92E+00	< 0
LEC33.70.7A.3	---	3.73E-05	6.9	0.286	6.46E-03	25	2.94E-03	11,500	1.94E+00	4,790	1.45E-01	50,200	1.70E+00	< 0
LEC33.70.7A.4	---	3.69E-05	9.9	0.250	5.91E-03	24	3.01E-03	9,790	1.79E+00	4,040	1.32E-01	44,100	1.61E+00	< 0
LEC33.70.7A.5	---	3.75E-05	12.1	0.235	5.67E-03	22	3.03E-03	8,360	1.62E+00	3,290	1.14E-01	37,500	1.45E+00	< 0
LEC33.70.7A.6	---	3.67E-05	13.9	0.224	5.50E-03	18	2.43E-03	7,330	1.43E+00	2,830	9.90E-02	30,300	1.19E+00	< 0
LEC33.70.7A.7	---	3.70E-05	17.0	0.199	5.07E-03	19	2.82E-03	6,510	1.39E+00	2,450	9.36E-02	27,800	1.19E+00	< 0
ORLEC33 70 °C pH(RT) 7 Reactor B														
LEC33.70.7B.Blank1	---	3.53E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.70.7B.Blank2	---	3.88E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.70.7B.Blank3	---	3.78E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.70.7B.1	---	3.86E-05	2.9	0.350	7.41E-03	22	2.32E-03	10,200	1.56E+00	2,730	7.45E-02	44,100	1.35E+00	< 0
LEC33.70.7B.2	---	3.87E-05	5.0	0.329	7.10E-03	20	2.19E-03	10,700	1.71E+00	3,510	1.00E-01	44,100	1.41E+00	< 0
LEC33.70.7B.3	---	3.78E-05	6.9	0.313	6.86E-03	19	2.16E-03	9,260	1.49E+00	3,140	9.05E-02	39,900	1.29E+00	< 0
LEC33.70.7B.4	---	3.83E-05	9.9	0.282	6.40E-03	18	2.18E-03	8,070	1.41E+00	2,690	8.44E-02	35,400	1.24E+00	< 0
LEC33.70.7B.5	---	3.79E-05	12.1	0.269	6.21E-03	[16.5]	2.06E-03	6,980	1.25E+00	2,290	7.33E-02	29,300	1.05E+00	< 0
LEC33.70.7B.6	---	3.76E-05	13.9	0.259	6.06E-03	[16.5]	2.09E-03	6,310	1.15E+00	1,990	6.47E-02	28,400	1.03E+00	< 0

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{LEX} (mol Na ⁻² s ⁻¹)
LEC33.70.7B.7	---	3.82E-05	17.0	0.236	5.69E-03	[16.5]	2.27E-03	5,610	1.10E+00	1,730	6.08E-02	24,700	9.71E-01	< 0
LEC33.70.7B.8	---	3.76E-05	19.1	0.229	5.57E-03	[16.5]	2.28E-03	5,020	9.91E-01	1,540	5.44E-02	22,900	9.06E-01	< 0
LEC33.70.7B.9	---	3.75E-05	21.0	0.220	5.42E-03	[16.5]	2.33E-03	4,550	9.20E-01	1,400	5.07E-02	19,600	7.94E-01	< 0
ORLEC33 70 °C pH(RT) 8 Reactor A														
LEC33.70.8A.Blank1	---	3.00E-05	---	---	---	[16.5]	---	26	---	59	---	[44.7]	---	---
LEC33.70.8A.Blank2	---	3.48E-05	---	---	---	[16.5]	---	[25.2]	---	72	---	[44.7]	---	---
LEC33.70.8A.Blank3	---	3.28E-05	0.0	---	---	[16.5]	---	[25.2]	---	77	---	[44.7]	---	---
LEC33.70.8A.1	---	3.45E-05	2.9	0.370	7.67E-03	98	9.00E-03	6,880	9.06E-01	2,230	5.25E-02	29,800	7.85E-01	< 0
LEC33.70.8A.2	---	3.40E-05	5.0	0.355	7.47E-03	171	1.59E-02	7,750	1.03E+00	2,920	6.96E-02	31,300	8.34E-01	< 0
LEC33.70.8A.3	---	3.36E-05	6.9	0.345	7.32E-03	198	1.86E-02	6,740	9.06E-01	2,460	5.92E-02	27,200	7.32E-01	< 0
LEC33.70.8A.4	---	3.42E-05	9.9	0.325	7.04E-03	192	1.91E-02	5,800	8.26E-01	2,060	5.25E-02	25,200	7.19E-01	< 0
LEC33.70.8A.5	---	3.47E-05	12.1	0.317	6.92E-03	165	1.69E-02	4,850	7.12E-01	1,680	4.41E-02	20,200	5.94E-01	< 0
LEC33.70.8A.6	---	3.44E-05	13.9	0.310	6.83E-03	165	1.70E-02	4,460	6.58E-01	1,540	4.07E-02	19,100	5.64E-01	< 0
LEC33.70.8A.7	---	3.36E-05	17.0	0.296	6.61E-03	168	1.75E-02	4,130	6.14E-01	1,400	3.73E-02	18,400	5.48E-01	< 0
LEC33.70.8A.8	---	3.38E-05	19.1	0.290	6.53E-03	148	1.57E-02	3,690	5.60E-01	1,280	3.47E-02	17,100	5.19E-01	< 0
LEC33.70.8A.9	---	3.36E-05	21.0	0.284	6.43E-03	142	1.52E-02	3,560	5.44E-01	1,310	3.58E-02	14,900	4.56E-01	< 0
ORLEC33 70 °C pH(RT) 8 Reactor B														
LEC33.70.8B.Blank1	---	3.38E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.70.8B.Blank2	---	3.93E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.70.8B.Blank3	---	3.53E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.70.8B.1	---	3.75E-05	2.9	0.368	7.65E-03	140	1.41E-02	6,730	9.66E-01	1,920	4.93E-02	27,500	7.90E-01	< 0
LEC33.70.8B.2	---	3.78E-05	5.0	0.353	7.44E-03	248	2.58E-02	7,360	1.09E+00	2,350	6.25E-02	30,100	8.96E-01	< 0
LEC33.70.8B.3	---	3.73E-05	6.9	0.343	7.29E-03	219	2.29E-02	6,070	9.08E-01	2,030	5.43E-02	24,000	7.19E-01	< 0
LEC33.70.8B.4	---	3.80E-05	9.9	0.323	7.01E-03	223	2.47E-02	5,250	8.32E-01	1,780	5.05E-02	21,900	6.95E-01	< 0
LEC33.70.8B.5	---	3.74E-05	12.1	0.315	6.89E-03	218	2.42E-02	4,560	7.25E-01	1,540	4.38E-02	19,600	6.24E-01	< 0
LEC33.70.8B.6	---	3.88E-05	13.9	0.308	6.79E-03	192	2.24E-02	4,100	6.85E-01	1,400	4.19E-02	16,700	5.59E-01	< 0
LEC33.70.8B.7	---	3.77E-05	17.0	0.293	6.57E-03	179	2.10E-02	3,740	6.29E-01	1,300	3.91E-02	15,700	5.28E-01	< 0
LEC33.70.8B.8	---	3.79E-05	19.1	0.287	6.49E-03	161	1.92E-02	3,430	5.86E-01	1,320	4.04E-02	15,000	5.13E-01	< 0
LEC33.70.8B.9	---	3.75E-05	21.0	0.281	6.39E-03	155	1.86E-02	3,210	5.52E-01	1,230	3.78E-02	14,400	4.96E-01	< 0
ORLEC33 70 °C pH(RT) 9 Reactor A														
LEC33.70.9A.Blank1	---	3.17E-05	---	---	---	[16.5]	---	[25.2]	---	370	---	[44.7]	---	---
LEC33.70.9A.Blank2	---	3.69E-05	---	---	---	[16.5]	---	[25.2]	---	335	---	[44.7]	---	---
LEC33.70.9A.Blank3	---	3.45E-05	0.0	---	---	[16.5]	---	[25.2]	---	331	---	[44.7]	---	---
LEC33.70.9A.1	---	3.68E-05	2.9	0.396	8.04E-03	531	4.98E-02	853	1.14E-01	3,260	7.83E-02	4,890	1.31E-01	1.45E-09

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.70.9A.2	---	3.71E-05	5.0	0.395	8.02E-03	718	6.80E-02	667	9.03E-02	4,040	9.79E-02	3,850	1.04E-01	1.21E-09
LEC33.70.9A.3	---	3.63E-05	6.9	0.394	8.01E-03	647	6.00E-02	554	7.35E-02	3,600	8.55E-02	2,690	7.14E-02	< 0
LEC33.70.9A.4	---	3.71E-05	9.9	0.392	7.98E-03	647	6.15E-02	563	7.66E-02	3,550	8.64E-02	2,510	6.83E-02	< 0
LEC33.70.9A.5	---	3.66E-05	12.1	0.391	7.97E-03	636	5.98E-02	589	7.92E-02	3,400	8.18E-02	2,480	6.68E-02	< 0
LEC33.70.9A.6	---	3.76E-05	13.9	0.390	7.95E-03	642	6.21E-02	605	8.37E-02	3,410	8.44E-02	2,520	6.98E-02	< 0
LEC33.70.9A.7	---	3.66E-05	17.0	0.387	7.92E-03	614	5.81E-02	604	8.17E-02	3,350	8.11E-02	2,340	6.33E-02	< 0
LEC33.70.9A.8	---	3.71E-05	19.1	0.386	7.90E-03	632	6.07E-02	623	8.55E-02	3,380	8.30E-02	2,490	6.84E-02	< 0
LEC33.70.9A.9	---	3.69E-05	21.0	0.385	7.89E-03	631	6.04E-02	617	8.45E-02	3,330	8.16E-02	2,550	6.99E-02	< 0
ORLEC33 70 °C pH(RT) 9 Reactor B														
LEC33.70.9B.Blank1	---	3.43E-05	---	---	---	[16.5]	---	[25.2]	---	86	---	[44.7]	---	---
LEC33.70.9B.Blank2	---	3.84E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.70.9B.Blank3	---	3.64E-05	0.0	---	---	[16.5]	---	[25.2]	---	57	---	[44.7]	---	---
LEC33.70.9B.1	---	3.78E-05	2.9	0.397	8.04E-03	553	5.33E-02	794	1.09E-01	2,950	7.27E-02	4,640	1.28E-01	1.60E-09
LEC33.70.9B.2	---	3.87E-05	5.0	0.396	8.03E-03	698	6.88E-02	619	8.72E-02	3,650	9.20E-02	3,490	9.85E-02	9.65E-10
LEC33.70.9B.3	---	3.64E-05	6.9	0.395	8.02E-03	668	6.20E-02	557	7.40E-02	3,450	8.20E-02	2,890	7.68E-02	2.47E-10
LEC33.70.9B.4	---	3.77E-05	9.9	0.393	7.99E-03	620	5.99E-02	555	7.67E-02	3,270	8.09E-02	2,510	6.94E-02	< 0
LEC33.70.9B.5	---	3.68E-05	12.1	0.391	7.97E-03	615	5.81E-02	574	7.76E-02	3,220	7.79E-02	2,450	6.63E-02	< 0
LEC33.70.9B.6	---	3.66E-05	13.9	0.390	7.96E-03	617	5.81E-02	586	7.89E-02	3,230	7.78E-02	2,560	6.90E-02	< 0
LEC33.70.9B.7	---	3.65E-05	17.0	0.388	7.93E-03	622	5.86E-02	588	7.92E-02	3,200	7.71E-02	2,550	6.88E-02	< 0
LEC33.70.9B.8	---	3.65E-05	19.1	0.387	7.91E-03	598	5.64E-02	582	7.86E-02	3,130	7.56E-02	2,340	6.32E-02	< 0
LEC33.70.9B.9	---	3.67E-05	21.0	0.386	7.90E-03	619	5.89E-02	602	8.19E-02	3,210	7.81E-02	2,380	6.48E-02	< 0
ORLEC33 70 °C pH(RT) 10 Reactor A														
LEC33.70.10.A.Blank1	---	4.57E-05	---	---	---	[16.5]	---	[25.2]	---	228	---	[44.7]	---	---
LEC33.70.10.A.Blank2	---	4.97E-05	---	---	---	[16.5]	---	[25.2]	---	266	---	[44.7]	---	---
LEC33.70.10.A.Blank3	---	4.81E-05	0.0	---	---	[16.5]	---	[25.2]	---	144	---	[44.7]	---	---
LEC33.70.10.A.1	---	4.87E-05	1.0	0.224	4.54E-03	546	1.20E-01	396	1.24E-01	2,220	1.25E-01	2,170	1.36E-01	1.04E-09
LEC33.70.10.A.6	---	3.74E-05	13.0	0.212	4.37E-03	1,250	2.19E-01	905	2.27E-01	5,100	2.29E-01	4,010	2.01E-01	< 0
LEC33.70.10.A.7	---	3.74E-05	15.0	0.210	4.35E-03	960	1.69E-01	693	1.75E-01	3,950	1.78E-01	2,970	1.50E-01	< 0
LEC33.70.10.A.8	---	3.78E-05	17.9	0.208	4.32E-03	942	1.69E-01	677	1.74E-01	3,820	1.75E-01	2,860	1.47E-01	< 0
LEC33.70.10.A.9	---	3.76E-05	20.1	0.206	4.30E-03	909	1.63E-01	673	1.72E-01	3,790	1.74E-01	2,850	1.46E-01	< 0
LEC33.70.10.A.10	---	3.93E-05	20.9	0.206	4.30E-03	912	1.71E-01	652	1.75E-01	3,680	1.76E-01	2,820	1.51E-01	< 0
ORLEC33 70 °C pH(RT) 10 Reactor B														
LEC33.70.10.B.Blank1	---	4.72E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.70.10.B.Blank2	---	5.08E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.70.10.B.Blank3	---	5.02E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.70.10.B.1	---	4.93E-05	1.0	0.227	4.60E-03	554	1.22E-01	410	1.29E-01	2,260	1.27E-01	2,130	1.34E-01	4.44E-10
LEC33.70.10.B.6	---	3.72E-05	13.0	0.215	4.43E-03	1,210	2.08E-01	886	2.18E-01	4,990	2.20E-01	3,970	1.95E-01	< 0
LEC33.70.10.B.7	---	3.79E-05	15.0	0.214	4.41E-03	931	1.64E-01	663	1.67E-01	3,770	1.70E-01	2,960	1.49E-01	< 0
LEC33.70.10.B.8	---	3.86E-05	17.9	0.211	4.38E-03	881	1.59E-01	636	1.64E-01	3,630	1.67E-01	2,840	1.47E-01	< 0
LEC33.70.10.B.9	---	3.82E-05	20.1	0.210	4.36E-03	852	1.53E-01	622	1.59E-01	3,530	1.62E-01	2,770	1.42E-01	< 0
LEC33.70.10.B.10	---	3.92E-05	20.9	0.210	4.36E-03	883	1.63E-01	630	1.66E-01	3,590	1.69E-01	2,900	1.53E-01	< 0
ORLEC33 70 °C pH(RT) 11 Reactor A														
LEC33.70.11.A.Blank1	---	3.71E-05	---	---	---	[16.5]	---	[25.2]	---	95	---	[44.7]	---	---
LEC33.70.11.A.Blank2	---	3.77E-05	---	---	---	[16.5]	---	[25.2]	---	99	---	[44.7]	---	---
LEC33.70.11.A.Blank3	---	3.73E-05	0.0	---	---	[16.5]	---	[25.2]	---	83	---	[44.7]	---	---
LEC33.70.11.A.1	---	3.86E-05	1.0	0.039	7.96E-04	239	2.37E-01	196	2.78E-01	1,200	3.04E-01	1,050	2.98E-01	1.73E-09
LEC33.70.11.A.2	---	3.79E-05	3.8	0.037	7.69E-04	541	5.46E-01	445	6.42E-01	2,490	6.43E-01	2,220	6.41E-01	< 0
LEC33.70.11.A.3	---	3.84E-05	6.1	0.036	7.54E-04	566	5.90E-01	476	7.09E-01	2,610	6.96E-01	2,350	7.01E-01	< 0
LEC33.70.11.A.4	---	3.88E-05	8.0	0.035	7.40E-04	557	5.97E-01	479	7.34E-01	2,620	7.19E-01	2,400	7.37E-01	2.01E-10
LEC33.70.11.A.5	---	3.82E-05	10.9	0.033	7.15E-04	384	4.20E-01	482	7.54E-01	2,570	7.19E-01	2,440	7.64E-01	8.78E-10
LEC33.70.11.A.6	---	3.78E-05	13.0	0.032	7.01E-04	562	6.21E-01	483	7.63E-01	2,630	7.43E-01	2,520	7.97E-01	2.92E-09
LEC33.70.11.A.7	---	3.84E-05	15.0	0.031	6.87E-04	405	4.63E-01	474	7.75E-01	2,500	7.32E-01	2,440	7.99E-01	2.04E-09
LEC33.70.11.A.8	---	3.83E-05	17.9	0.030	6.61E-04	559	6.64E-01	476	8.09E-01	2,550	7.75E-01	2,380	8.09E-01	7.60E-11
LEC33.70.11.A.9	---	3.81E-05	20.1	0.029	6.47E-04	539	6.50E-01	451	7.78E-01	2,460	7.59E-01	2,340	8.08E-01	2.59E-09
LEC33.70.11.A.10	---	3.85E-05	20.9	0.029	6.46E-04	518	6.32E-01	458	7.99E-01	2,460	7.68E-01	2,340	8.18E-01	1.58E-09
ORLEC33 70 °C pH(RT) 11 Reactor B														
LEC33.70.11.B.Blank1	---	4.01E-05	---	---	---	[16.5]	---	[25.2]	---	194	---	[44.7]	---	---
LEC33.70.11.B.Blank2	---	3.68E-05	---	---	---	[16.5]	---	[25.2]	---	217	---	[44.7]	---	---
LEC33.70.11.B.Blank3	---	3.45E-05	0.0	---	---	[16.5]	---	[25.2]	---	189	---	[44.7]	---	---
LEC33.70.11.B.1	---	3.46E-05	1.0	0.040	8.01E-04	311	2.75E-01	269	3.40E-01	1,660	3.75E-01	1,460	3.69E-01	2.53E-09
LEC33.70.11.B.2	---	3.69E-05	3.8	0.037	7.68E-04	588	5.79E-01	548	7.72E-01	3,120	7.86E-01	2,880	8.12E-01	3.46E-09
LEC33.70.11.B.3	---	3.58E-05	6.1	0.036	7.52E-04	688	6.70E-01	576	8.02E-01	3,230	8.05E-01	3,040	8.48E-01	3.91E-09
LEC33.70.11.B.4	---	3.75E-05	8.0	0.035	7.36E-04	623	6.51E-01	573	8.56E-01	3,150	8.42E-01	2,890	8.64E-01	7.22E-10
LEC33.70.11.B.5	---	3.77E-05	10.9	0.033	7.07E-04	545	5.94E-01	555	8.65E-01	2,990	8.34E-01	2,850	8.90E-01	2.09E-09
LEC33.70.11.B.6	---	3.65E-05	13.0	0.032	6.92E-04	702	7.59E-01	556	8.59E-01	3,120	8.63E-01	2,860	8.85E-01	2.21E-09
LEC33.70.11.B.7	---	3.68E-05	15.0	0.031	6.76E-04	658	7.34E-01	545	8.70E-01	3,050	8.71E-01	2,830	9.04E-01	2.96E-09
LEC33.70.11.B.8	---	3.69E-05	17.9	0.029	6.47E-04	664	7.75E-01	544	9.08E-01	2,990	8.93E-01	2,790	9.32E-01	2.09E-09
LEC33.70.11.B.9	---	3.56E-05	20.1	0.028	6.31E-04	624	7.21E-01	535	8.84E-01	2,950	8.72E-01	2,740	9.07E-01	1.93E-09

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.70.11.B.10	---	3.81E-05	20.9	0.028	6.30E-04	638	7.89E-01	511	9.04E-01	2,840	8.99E-01	2,660	9.42E-01	3.28E-09
ORLEC33 70 °C pH(RT) 12 Reactor A														
LEC33.70.12.A.Blank1	---	3.72E-05	---	---	---	[16.5]	---	[25.2]	---	457	---	134	---	---
LEC33.70.12.A.Blank2	---	3.89E-05	---	---	---	[16.5]	---	[25.2]	---	309	---	134	---	---
LEC33.70.12.A.Blank3	---	3.78E-05	0.0	---	---	[16.5]	---	[25.2]	---	284	---	137	---	---
LEC33.70.12.A.1	---	3.74E-05	1.0	0.020	4.12E-04	689	1.28E+00	495	1.31E+00	3,050	1.45E+00	2,530	1.35E+00	2.64E-09
LEC33.70.12.A.2	---	3.95E-05	3.8	0.015	3.41E-04	1,500	3.55E+00	1,040	3.52E+00	6,090	3.69E+00	5,150	3.49E+00	< 0
LEC33.70.12.A.3	---	3.90E-05	6.1	0.013	3.08E-04	1,480	3.83E+00	1,030	3.81E+00	5,970	3.96E+00	5,180	3.84E+00	2.27E-09
LEC33.70.12.A.4	---	3.95E-05	8.0	0.011	2.75E-04	1,420	4.17E+00	994	4.17E+00	5,750	4.32E+00	5,010	4.21E+00	3.28E-09
LEC33.70.12.A.5	---	3.95E-05	10.9	0.008	2.18E-04	1,240	4.59E+00	875	4.64E+00	5,080	4.82E+00	4,380	4.65E+00	8.91E-10
LEC33.70.12.A.6	---	3.86E-05	13.0	0.006	1.92E-04	1,060	4.36E+00	755	4.44E+00	4,430	4.67E+00	3,750	4.42E+00	< 0
LEC33.70.12.A.7	---	3.93E-05	15.0	0.005	1.66E-04	941	4.57E+00	651	4.52E+00	3,800	4.72E+00	3,200	4.44E+00	< 0
ORLEC33 70 °C pH(RT) 12 Reactor B														
LEC33.70.12.B.Blank1	---	3.67E-05	---	---	---	[16.5]	---	[25.2]	---	207	---	133	---	---
LEC33.70.12.B.Blank2	---	3.56E-05	---	---	---	[16.5]	---	[25.2]	---	165	---	139	---	---
LEC33.70.12.B.Blank3	---	3.66E-05	0.0	---	---	[16.5]	---	[25.2]	---	162	---	139	---	---
LEC33.70.12.B.1	---	3.27E-05	1.0	0.019	3.89E-04	703	1.21E+00	485	1.19E+00	2,870	1.26E+00	2,500	1.23E+00	3.29E-09
LEC33.70.12.B.2	---	3.62E-05	3.8	0.014	3.24E-04	1,500	3.43E+00	1,050	3.43E+00	6,070	3.55E+00	5,270	3.45E+00	1.45E-09
LEC33.70.12.B.3	---	3.63E-05	6.1	0.012	2.92E-04	1,500	3.82E+00	1,050	3.83E+00	6,060	3.95E+00	5,220	3.81E+00	< 0
LEC33.70.12.B.4	---	3.66E-05	8.0	0.011	2.62E-04	1,130	3.22E+00	981	4.00E+00	5,570	4.06E+00	4,930	4.03E+00	2.13E-09
LEC33.70.12.B.5	---	3.60E-05	10.9	0.007	2.08E-04	1,340	4.74E+00	903	4.57E+00	5,220	4.73E+00	4,480	4.54E+00	< 0
LEC33.70.12.B.6	---	3.55E-05	13.0	0.006	1.85E-04	1,080	4.25E+00	762	4.29E+00	4,430	4.46E+00	3,820	4.31E+00	1.37E-09
LEC33.70.12.B.7	---	3.46E-05	15.0	0.005	1.61E-04	964	4.23E+00	674	4.22E+00	3,950	4.43E+00	3,320	4.17E+00	< 0
LEC33.70.12.B.8	---	3.42E-05	17.9	0.003	1.21E-04	819	4.72E+00	569	4.69E+00	3,380	4.99E+00	2,820	4.66E+00	< 0
LEC33.70.12.B.10	---	3.32E-05	20.9	0.002	7.57E-05	1,080	9.70E+00	745	9.56E+00	4,440	1.02E+01	3,700	9.51E+00	< 0
ORLEC33 90 °C pH(RT) 7 Reactor A														
LEC33.90.7.A.Blank1		1.90E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	50	---	---
LEC33.90.7.A.Blank2		2.41E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.90.7.A.Blank3		2.24E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.90.7.A.2		3.97E-05	4.9	0.051	1.30E-03	24	1.51E-02	6,540	5.84E+00	4,730	7.56E-01	38,100	6.82E+00	8.36E-08
LEC33.90.7.A.4		3.87E-05	9.0	0.048	1.23E-03	[16.5]	1.06E-02	2,630	2.42E+00	3,620	5.95E-01	15,900	2.93E+00	4.37E-08
LEC33.90.7.A.6		3.70E-05	14.2	0.040	1.10E-03	[16.5]	1.13E-02	1,620	1.59E+00	2,180	3.82E-01	9,040	1.77E+00	1.60E-08
LEC33.90.7.A.7		3.85E-05	16.1	0.037	1.04E-03	[16.5]	1.25E-02	1,460	1.59E+00	2,060	4.00E-01	7,910	1.72E+00	1.15E-08
LEC33.90.7.A.8		3.77E-05	19.0	0.033	9.60E-04	[16.5]	1.33E-02	1,200	1.38E+00	1,940	4.00E-01	6,360	1.47E+00	7.26E-09

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.90.7.A.9		3.83E-05	20.9	0.031	9.30E-04	[16.5]	1.39E-02	1,020	1.23E+00	2,180	4.71E-01	5,140	1.24E+00	9.46E-10
LEC33.90.7.A.10		3.71E-05	22.1	0.031	9.19E-04	[16.5]	1.36E-02	897	1.06E+00	1,880	3.98E-01	4,390	1.04E+00	< 0
ORLEC33 90 °C pH(RT) 7 Reactor B														
LEC33.90.7.B.Blank1		1.27E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.90.7.B.Blank2		2.08E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.90.7.B.Blank3		2.04E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.90.7.B.2		3.39E-05	4.9	0.056	1.38E-03	28	1.38E-02	7,080	5.07E+00	5,280	6.77E-01	39,900	5.72E+00	5.59E-08
LEC33.90.7.B.4		3.44E-05	9.0	0.051	1.30E-03	[16.5]	8.93E-03	3,030	2.34E+00	3,840	5.32E-01	18,300	2.84E+00	4.21E-08
LEC33.90.7.B.6		3.42E-05	14.2	0.044	1.17E-03	[16.5]	9.86E-03	1,780	1.52E+00	2,530	3.87E-01	10,200	1.74E+00	1.92E-08
LEC33.90.7.B.7		3.57E-05	16.1	0.040	1.11E-03	[16.5]	1.09E-02	1,590	1.50E+00	2,300	3.89E-01	8,800	1.66E+00	1.39E-08
LEC33.90.7.B.8		3.44E-05	19.0	0.036	1.03E-03	[16.5]	1.13E-02	1,340	1.31E+00	2,170	3.80E-01	6,960	1.36E+00	4.50E-09
LEC33.90.7.B.9		3.48E-05	20.9	0.035	1.00E-03	[16.5]	1.17E-02	1,080	1.10E+00	2,080	3.79E-01	5,490	1.12E+00	1.68E-09
LEC33.90.7.B.10		3.49E-05	22.1	0.034	9.90E-04	[16.5]	1.19E-02	1,000	1.03E+00	2,070	3.82E-01	4,600	9.50E-01	< 0
ORLEC33 90 °C pH(RT) 8 Reactor A														
LEC33.90.8.A.Blank1		1.24E-05	---	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.90.8.A.Blank3		7.77E-06	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.90.8.A.2		3.55E-05	4.9	0.060	1.44E-03	445	2.24E-01	6,240	4.50E+00	2,660	3.43E-01	32,700	4.72E+00	1.90E-08
LEC33.90.8.A.4		3.43E-05	9.0	0.059	1.42E-03	245	1.21E-01	2,110	1.49E+00	1,260	1.59E-01	13,300	1.88E+00	3.35E-08
LEC33.90.8.A.6		3.49E-05	14.2	0.054	1.34E-03	203	1.08E-01	1,210	9.23E-01	1,010	1.38E-01	8,270	1.26E+00	2.92E-08
LEC33.90.8.A.7		3.41E-05	16.1	0.051	1.30E-03	197	1.06E-01	1,090	8.38E-01	989	1.36E-01	7,560	1.16E+00	2.80E-08
LEC33.90.8.A.8		3.38E-05	19.0	0.048	1.25E-03	193	1.07E-01	982	7.80E-01	993	1.41E-01	6,710	1.07E+00	2.47E-08
LEC33.90.8.A.9		3.40E-05	20.9	0.047	1.22E-03	193	1.10E-01	901	7.33E-01	1,010	1.47E-01	5,960	9.71E-01	2.04E-08
LEC33.90.8.A.10		3.39E-05	22.1	0.046	1.21E-03	189	1.08E-01	818	6.69E-01	982	1.44E-01	5,540	9.07E-01	2.04E-08
ORLEC33 90 °C pH(RT) 8 Reactor B														
LEC33.90.8.B.Blank1		1.15E-05	---	---	---	19	---	[25.2]	---	[54.8]	---	61	---	---
LEC33.90.8.B.Blank3		7.05E-06	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.90.8.B.2		3.57E-05	4.9	0.073	1.66E-03	312	1.38E-01	4,520	2.85E+00	1,750	1.98E-01	24,500	3.09E+00	2.09E-08
LEC33.90.8.B.4		3.45E-05	9.0	0.069	1.60E-03	214	9.44E-02	2,080	1.31E+00	1,120	1.26E-01	13,300	1.68E+00	3.16E-08
LEC33.90.8.B.6		3.53E-05	14.2	0.064	1.52E-03	185	8.77E-02	1,170	7.93E-01	931	1.13E-01	8,210	1.11E+00	2.76E-08
LEC33.90.8.B.7		3.41E-05	16.1	0.062	1.49E-03	185	8.67E-02	1,060	7.11E-01	918	1.10E-01	7,260	9.74E-01	2.27E-08
LEC33.90.8.B.8		3.45E-05	19.0	0.059	1.44E-03	179	8.79E-02	934	6.56E-01	900	1.13E-01	6,440	9.05E-01	2.14E-08
LEC33.90.8.B.9		3.48E-05	20.9	0.058	1.42E-03	179	9.00E-02	846	6.08E-01	907	1.17E-01	5,860	8.43E-01	2.02E-08
LEC33.90.8.B.10		3.42E-05	22.1	0.057	1.41E-03	177	8.78E-02	801	5.68E-01	910	1.15E-01	5,390	7.65E-01	1.69E-08
ORLEC33 90 °C pH(RT) 9 Reactor A														

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.90.9.A.Blank1		1.07E-05	---	---	---	38	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.90.9.A.Blank2		2.05E-05	---	---	---	35	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.90.9.A.Blank3		2.34E-05	0.0	---	---	26	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.90.9.A.2		3.85E-05	4.9	0.087	1.84E-03	564	2.42E-01	1,780	1.09E+00	2,390	2.63E-01	9,820	1.21E+00	9.82E-09
LEC33.90.9.A.4		3.88E-05	9.0	0.085	1.81E-03	386	1.70E-01	894	5.62E-01	1,610	1.81E-01	5,030	6.34E-01	6.11E-09
LEC33.90.9.A.6		3.87E-05	14.2	0.082	1.77E-03	332	1.49E-01	535	3.42E-01	1,440	1.65E-01	3,280	4.20E-01	6.69E-09
LEC33.90.9.A.7		3.81E-05	16.1	0.081	1.75E-03	306	1.36E-01	474	3.01E-01	1,390	1.58E-01	2,930	3.73E-01	6.15E-09
LEC33.90.9.A.8		3.82E-05	19.0	0.080	1.73E-03	306	1.38E-01	394	2.54E-01	1,340	1.54E-01	2,540	3.28E-01	6.34E-09
LEC33.90.9.A.9		3.88E-05	20.9	0.079	1.73E-03	302	1.39E-01	331	2.17E-01	1,320	1.55E-01	2,210	2.91E-01	6.29E-09
LEC33.90.9.A.10		3.76E-05	22.1	0.079	1.72E-03	299	1.33E-01	308	1.96E-01	1,310	1.49E-01	2,050	2.62E-01	5.61E-09
ORLEC33 90 °C pH(RT) 10 Reactor A														
LEC33.90.10.A.Blank1	---	3.90E-05	---	---	---	39	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.90.10.A.Blank2	---	3.94E-05	---	---	---	29	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.90.10.A.Blank3	---	3.89E-05	0.0	---	---	30	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.90.10.A.1	---	4.01E-05	0.9	0.051	1.04E-03	637	5.04E-01	443	5.01E-01	2,490	5.04E-01	2,290	5.19E-01	1.51E-09
LEC33.90.10.A.2	---	3.92E-05	3.9	0.047	9.85E-04	1,120	9.12E-01	807	9.40E-01	4,530	9.44E-01	3,940	9.19E-01	< 0
LEC33.90.10.A.3	---	3.83E-05	6.0	0.046	9.62E-04	1,150	9.37E-01	816	9.50E-01	4,610	9.61E-01	3,880	9.05E-01	< 0
LEC33.90.10.A.4	---	3.98E-05	7.9	0.044	9.40E-04	1,090	9.44E-01	780	9.66E-01	4,390	9.73E-01	3,680	9.12E-01	< 0
LEC33.90.10.A.5	---	3.88E-05	10.9	0.041	8.98E-04	1,060	9.36E-01	745	9.41E-01	4,240	9.58E-01	3,540	8.95E-01	< 0
LEC33.90.10.A.6	---	3.84E-05	13.1	0.040	8.77E-04	997	8.93E-01	733	9.39E-01	4,100	9.39E-01	3,390	8.69E-01	< 0
LEC33.90.10.A.7	---	4.08E-05	13.8	0.040	8.77E-04	990	9.43E-01	704	9.59E-01	4,000	9.75E-01	3,310	9.03E-01	< 0
ORLEC33 90 °C pH(RT) 10 Reactor B														
LEC33.90.10.B.Blank1	---	3.27E-05	---	---	---	30	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.90.10.B.Blank2	---	3.27E-05	---	---	---	30	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.90.10.B.Blank3	---	3.30E-05	0.0	---	---	29	---	[25.2]	---	[54.8]	---	[44.7]	---	---
LEC33.90.10.B.1	---	3.32E-05	0.9	0.052	1.05E-03	670	4.34E-01	470	4.35E-01	2,630	4.36E-01	2,370	4.40E-01	3.60E-10
LEC33.90.10.B.2	---	3.25E-05	3.9	0.048	1.00E-03	1,210	8.04E-01	885	8.41E-01	4,960	8.43E-01	4,270	8.12E-01	< 0
LEC33.90.10.B.3	---	3.40E-05	6.0	0.046	9.77E-04	1,240	8.83E-01	904	9.20E-01	5,060	9.22E-01	4,310	8.78E-01	< 0
LEC33.90.10.B.4	---	3.31E-05	7.9	0.045	9.57E-04	1,200	8.48E-01	878	8.88E-01	4,920	8.90E-01	4,110	8.32E-01	< 0
LEC33.90.10.B.5	---	3.33E-05	10.9	0.042	9.15E-04	1,180	8.79E-01	864	9.21E-01	4,810	9.17E-01	4,030	8.60E-01	< 0
LEC33.90.10.B.6	---	3.36E-05	13.1	0.041	8.95E-04	1,160	8.91E-01	821	9.02E-01	4,660	9.16E-01	3,970	8.73E-01	< 0
LEC33.90.10.B.7	---	3.23E-05	13.8	0.041	8.95E-04	1,150	8.49E-01	818	8.63E-01	4,660	8.80E-01	3,870	8.18E-01	< 0
ORLEC33 90 °C pH(RT) 11 Reactor A														
LEC33.90.11.A.Blank3	---	3.65E-05	0.0	---	---	[16.5]	---	[25.2]	---	[54.8]	---	[44.7]	---	---

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.90.11.A.1	---	3.69E-05	0.9	0.012	2.50E-04	208	6.29E-01	339	1.47E+00	1,920	1.49E+00	1,590	1.38E+00	< 0
LEC33.90.11.A.2	---	3.58E-05	2.0	0.011	2.37E-04	580	1.79E+00	628	2.77E+00	3,560	2.81E+00	2,930	2.59E+00	< 0
LEC33.90.11.A.3	---	3.71E-05	2.9	0.011	2.28E-04	678	2.26E+00	713	3.39E+00	3,980	3.39E+00	3,330	3.17E+00	< 0
LEC33.90.11.A.4	---	3.74E-05	3.9	0.010	2.16E-04	666	2.36E+00	735	3.73E+00	4,000	3.63E+00	3,350	3.40E+00	< 0
LEC33.90.11.A.5	---	3.76E-05	4.9	0.009	2.02E-04	648	2.47E+00	743	4.05E+00	4,000	3.90E+00	3,400	3.71E+00	< 0
LEC33.90.11.A.6	---	3.61E-05	6.0	0.008	1.90E-04	612	2.38E+00	725	4.04E+00	3,940	3.93E+00	3,390	3.78E+00	< 0
LEC33.90.11.A.7	---	3.73E-05	7.0	0.007	1.77E-04	648	2.79E+00	716	4.40E+00	3,840	4.22E+00	3,030	3.73E+00	< 0
ORLEC33 90 °C pH(RT) 11 Reactor B														
LEC33.90.11.B.Blank1	---	1.80E-05	---	---	---	[16.5]	---	[25.2]	---	71	---	[44.7]	---	---
LEC33.90.11.B.Blank2	---	3.00E-05	---	---	---	[16.5]	---	[25.2]	---	173	---	[44.7]	---	---
LEC33.90.11.B.Blank3	---	3.89E-05	0.0	---	---	[16.5]	---	[25.2]	---	137	---	[44.7]	---	---
LEC33.90.11.B.1	---	3.60E-05	0.9	0.013	2.66E-04	226	6.27E-01	370	1.47E+00	2,090	1.48E+00	1,730	1.37E+00	< 0
LEC33.90.11.B.2	---	3.61E-05	2.0	0.012	2.52E-04	532	1.56E+00	669	2.80E+00	3,680	2.76E+00	3,100	2.60E+00	< 0
LEC33.90.11.B.3	---	3.60E-05	2.9	0.011	2.43E-04	644	1.95E+00	730	3.16E+00	4,010	3.11E+00	3,160	2.74E+00	< 0
LEC33.90.11.B.4	---	3.58E-05	3.9	0.011	2.32E-04	375	1.18E+00	714	3.22E+00	3,750	3.03E+00	3,070	2.77E+00	< 0
LEC33.90.11.B.5	---	3.61E-05	4.9	0.010	2.19E-04	574	1.94E+00	750	3.63E+00	4,040	3.49E+00	3,410	3.30E+00	< 0
LEC33.90.11.B.6	---	3.67E-05	6.0	0.009	2.06E-04	501	1.83E+00	736	3.85E+00	3,920	3.67E+00	3,230	3.38E+00	< 0
LEC33.90.11.B.7	---	3.49E-05	7.0	0.008	1.94E-04	589	2.17E+00	763	4.03E+00	3,980	3.76E+00	3,380	3.57E+00	< 0
ORLEC33 90 °C pH(RT) 12 Reactor A														
LEC33.90.12.A.Blank2	---	2.63E-05	---	---	---	42	---	[25.2]	---	[54.8]	---	144	---	---
LEC33.90.12.A.Blank3	---	3.62E-05	0.0	---	---	19	---	[25.2]	---	77	---	126	---	---
LEC33.90.12.A.1	---	3.67E-05	0.9	0.005	9.71E-05	585	4.53E+00	394	4.36E+00	2,240	4.43E+00	1,780	3.94E+00	< 0
LEC33.90.12.A.2	---	3.83E-05	2.0	0.003	8.03E-05	1,140	1.11E+01	727	1.02E+01	4,190	1.05E+01	3,460	9.68E+00	< 0
LEC33.90.12.A.3	---	3.58E-05	2.9	0.003	7.11E-05	1,090	1.12E+01	748	1.10E+01	4,180	1.10E+01	3,390	1.00E+01	< 0
LEC33.90.12.A.4	---	3.80E-05	3.9	0.002	6.03E-05	945	1.22E+01	603	1.11E+01	3,530	1.17E+01	2,920	1.08E+01	< 0
LEC33.90.12.A.5	---	3.80E-05	4.9	0.002	5.10E-05	704	1.07E+01	462	1.01E+01	2,700	1.05E+01	2,100	9.17E+00	< 0
LEC33.90.12.A.6	---	3.79E-05	6.0	0.001	4.49E-05	474	8.17E+00	319	7.87E+00	2,040	9.00E+00	1,460	7.21E+00	< 0
LEC33.90.12.A.7	---	3.69E-05	7.0	0.001	4.20E-05	325	5.84E+00	204	5.24E+00	1,390	6.39E+00	1,060	5.45E+00	1.82E-08
LEC33.90.12.A.8	---	3.65E-05	7.9	0.001	4.05E-05	278	5.13E+00	131	3.46E+00	921	4.35E+00	719	3.80E+00	2.94E-08
ORLEC33 90 °C pH(RT) 12 Reactor B														
LEC33.90.12.B.Blank1	---	3.46E-05	---	---	---	279	---	[25.2]	---	64	---	142	---	---
LEC33.90.12.B.Blank2	---	3.80E-05	---	---	---	744	---	[25.2]	---	103	---	143	---	---
LEC33.90.12.B.Blank3	---	3.64E-05	0.0	---	---	652	---	[25.2]	---	132	---	153	---	---
LEC33.90.12.B.1	---	3.80E-05	0.9	0.005	9.85E-05	963	7.60E+00	410	4.63E+00	2,500	5.05E+00	2,170	4.90E+00	2.37E-08

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.90.12.B.2	---	3.77E-05	2.0	0.003	8.08E-05	1,360	1.30E+01	781	1.07E+01	4,470	1.09E+01	3,580	9.78E+00	< 0
LEC33.90.12.B.3	---	3.66E-05	2.9	0.003	7.00E-05	1,340	1.43E+01	812	1.24E+01	4,610	1.26E+01	4,010	1.23E+01	< 0
LEC33.90.12.B.4	---	3.86E-05	3.9	0.002	5.58E-05	1,170	1.66E+01	726	1.47E+01	4,120	1.49E+01	3,320	1.35E+01	< 0
LEC33.90.12.B.5	---	3.77E-05	4.9	0.001	4.22E-05	940	1.72E+01	606	1.59E+01	3,430	1.61E+01	2,750	1.44E+01	< 0
LEC33.90.12.B.6	---	3.62E-05	6.0	0.001	3.20E-05	708	1.64E+01	462	1.53E+01	2,670	1.58E+01	2,090	1.38E+01	< 0
LEC33.90.12.B.7	---	3.82E-05	7.0	0.001	2.40E-05	516	1.68E+01	340	1.58E+01	2,030	1.69E+01	1,710	1.59E+01	9.50E-09
LEC33.90.12.B.8	---	4.14E-05	7.9	0.000	1.78E-05	398	1.90E+01	247	1.69E+01	1,650	2.02E+01	1,230	1.68E+01	< 0

Appendix D

Single-Pass Flow-Through (SPFT) Results for Tests at Various Si Inlet Concentrations

When the average measured value is below the EQL, the EQL value is provided in brackets. For the samples provided in this appendix, the EQL value is equal to the instrument detection limit.

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
ORLEC28 23 °C 1 ppm Si														
LEC28.23.9.1Si.Blank1	1	3.92E-06	---	---	---	19	---	[25.2]	---	937	---	[44.7]	---	---
LEC28.23.9.1Si.Blank2	1	1.15E-05	---	---	---	53	---	[25.2]	---	929	---	[44.7]	---	---
LEC28.23.9.1Si.Blank3	1	1.35E-05	0.0	---	---	[16.5]	---	[25.2]	---	920	---	[44.7]	---	---
LEC28.23.9.1Si.2	1	3.56E-05	4.9	1.326	2.62E-02	74	1.91E-03	68	2.98E-03	1,130	8.72E-03	994	8.24E-03	4.34E-10
LEC28.23.9.1Si.3	1	3.74E-05	8.9	1.326	2.62E-02	66	1.77E-03	39	1.78E-03	1,080	8.76E-03	496	4.32E-03	2.10E-10
LEC28.23.9.1Si.4	1	3.61E-05	12.9	1.326	2.62E-02	65	1.69E-03	30	1.34E-03	1,070	8.38E-03	328	2.76E-03	1.17E-10
LEC28.23.9.1Si.5	1	3.54E-05	16.0	1.326	2.62E-02	63	1.61E-03	29	1.28E-03	1,070	8.22E-03	304	2.51E-03	1.02E-10
LEC28.23.9.1Si.6	1	3.67E-05	19.9	1.325	2.62E-02	69	1.81E-03	35	1.59E-03	1,070	8.51E-03	252	2.15E-03	4.66E-11
LEC28.23.9.1Si.8	1	3.60E-05	27.0	1.325	2.62E-02	69	1.80E-03	29	1.28E-03	1,110	8.66E-03	252	2.11E-03	6.83E-11
LEC28.23.9.1Si.14	1	3.90E-05	47.0	1.324	2.62E-02	75	2.11E-03	31	1.50E-03	1,160	9.80E-03	230	2.09E-03	4.84E-11
LEC28.23.9.1Si.17	1	3.89E-05	57.9	1.324	2.62E-02	76	2.14E-03	33	1.59E-03	1,140	9.62E-03	231	2.09E-03	4.16E-11
ORLEC28 23 °C 5 ppm Si														
LEC28.23.9.5Si.Blank1	5	1.03E-05	---	---	---	22	---	[25.2]	---	3,400	---	[44.7]	---	---
LEC28.23.9.5Si.Blank2	5	1.61E-05	---	---	---	17	---	[25.2]	---	3,580	---	[44.7]	---	---
LEC28.23.9.5Si.Blank3	5	1.74E-05	0.0	---	---	17	---	[25.2]	---	3,770	---	[44.7]	---	---
LEC28.23.9.5Si.2	5	4.00E-05	4.9	1.326	2.62E-02	67	1.92E-03	63	3.11E-03	4,460	3.87E-02	909	8.46E-03	4.41E-10
LEC28.23.9.5Si.3	5	3.90E-05	8.9	1.326	2.62E-02	66	1.86E-03	35	1.68E-03	4,460	3.77E-02	460	4.18E-03	2.06E-10
LEC28.23.9.5Si.4	5	3.89E-05	12.9	1.326	2.62E-02	57	1.60E-03	[25.2]	1.21E-03	4,570	3.86E-02	298	2.70E-03	1.23E-10
LEC28.23.9.5Si.5	5	3.92E-05	16.0	1.325	2.62E-02	52	1.47E-03	[25.2]	1.21E-03	4,630	3.93E-02	271	2.47E-03	1.04E-10
LEC28.23.9.5Si.6	5	3.87E-05	19.9	1.325	2.62E-02	59	1.65E-03	[25.2]	1.20E-03	4,630	3.89E-02	232	2.09E-03	7.36E-11
LEC28.23.9.5Si.8	5	3.88E-05	27.0	1.325	2.62E-02	54	1.50E-03	[25.2]	1.20E-03	4,700	3.95E-02	227	2.05E-03	6.99E-11
LEC28.23.9.5Si.14	5	3.71E-05	47.0	1.324	2.62E-02	58	1.56E-03	28	1.25E-03	4,770	3.84E-02	206	1.78E-03	4.33E-11
LEC28.23.9.5Si.17	5	3.85E-05	57.9	1.324	2.62E-02	58	1.60E-03	[25.2]	1.19E-03	4,740	3.96E-02	208	1.86E-03	5.54E-11
LEC28.23.9.5Si.18	5	3.84E-05	61.9	1.324	2.62E-02	56	1.56E-03	[25.2]	1.19E-03	4,740	3.95E-02	182	1.63E-03	3.61E-11
ORLEC28 23 °C 15 ppm Si														
LEC28.23.9.15Si.Blank1	15	5.58E-06	---	---	---	19	---	[25.2]	---	11,100	---	[44.7]	---	---
LEC28.23.9.15Si.Blank2	15	1.56E-05	---	---	---	19	---	[25.2]	---	11,100	---	[44.7]	---	---
LEC28.23.9.15Si.Blank3	15	1.58E-05	0.0	---	---	17	---	[25.2]	---	10,800	---	[44.7]	---	---
LEC28.23.9.15Si.2	15	3.79E-05	4.9	1.322	2.61E-02	57	1.57E-03	59	2.75E-03	10,400	8.58E-02	1,030	9.12E-03	5.26E-10
LEC28.23.9.15Si.3	15	3.89E-05	8.9	1.322	2.61E-02	54	1.52E-03	25	1.20E-03	11,400	9.63E-02	481	4.36E-03	2.61E-10
LEC28.23.9.15Si.4	15	3.83E-05	12.9	1.321	2.61E-02	50	1.39E-03	[25.2]	1.19E-03	12,100	1.01E-01	309	2.76E-03	1.30E-10

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC28.23.9.15Si.5	15	3.81E-05	16.0	1.321	2.61E-02	45	1.25E-03	[25.2]	1.18E-03	13,200	1.09E-01	283	2.52E-03	1.10E-10
LEC28.23.9.15Si.6	15	3.82E-05	19.9	1.320	2.61E-02	49	1.35E-03	[25.2]	1.19E-03	13,600	1.13E-01	228	2.03E-03	6.99E-11
LEC28.23.9.15Si.8	15	3.82E-05	27.0	1.319	2.61E-02	47	1.29E-03	[25.2]	1.19E-03	14,800	1.23E-01	231	2.06E-03	7.21E-11
LEC28.23.9.15Si.14	15	3.46E-05	47.0	1.318	2.61E-02	46	1.14E-03	[25.2]	1.08E-03	14,400	1.09E-01	186	1.50E-03	3.53E-11
LEC28.23.9.15Si.17	15	3.12E-05	57.9	1.317	2.61E-02	51	1.16E-03	[25.2]	9.71E-04	14,700	1.00E-01	209	1.53E-03	4.57E-11
LEC28.23.9.15Si.18	15	3.31E-05	61.9	1.315	2.60E-02	47	1.13E-03	[25.2]	1.03E-03	14,400	1.04E-01	172	1.33E-03	2.49E-11
ORLEC28 23 °C 15 ppm Si duplicate														
LEC28.23.9.Si15B.Blank1	15	3.10E-05	---	---	---	32	---	[25.2]	---	12,900	---	[44.7]	---	---
LEC28.23.9.Si15B.Blank2	15	4.48E-07	---	---	---	20	---	[25.2]	---	8,730	---	[44.7]	---	---
LEC28.23.9.Si15B.Blank3	15	1.70E-05	0.0	---	---	27	---	[25.2]	---	13,000	---	[44.7]	---	---
LEC28.23.9.Si15B.1	15	3.88E-05	2.0	2.500	4.94E-02	64	9.46E-04	92	2.31E-03	13,100	5.84E-02	2,420	1.16E-02	7.65E-10
LEC28.23.9.Si15B.2	15	3.86E-05	4.9	2.499	4.94E-02	68	1.01E-03	98	2.46E-03	13,200	5.85E-02	1,710	8.14E-03	4.69E-10
LEC28.23.9.Si15B.3	15	3.72E-05	7.1	2.499	4.94E-02	58	8.29E-04	67	1.64E-03	13,200	5.65E-02	1,080	4.96E-03	2.75E-10
LEC28.23.9.Si15B.4	15	3.86E-05	9.0	2.499	4.94E-02	51	7.48E-04	59	1.47E-03	13,200	5.86E-02	831	3.96E-03	2.05E-10
LEC28.23.9.Si15B.5	15	3.89E-05	11.8	2.499	4.94E-02	46	6.84E-04	47	1.18E-03	13,100	5.86E-02	679	3.26E-03	1.72E-10
LEC28.23.9.Si15B.6	15	3.74E-05	13.9	2.499	4.94E-02	46	6.51E-04	43	1.04E-03	13,200	5.67E-02	580	2.67E-03	1.35E-10
LEC28.23.9.Si15B.7	15	3.81E-05	15.9	2.499	4.94E-02	45	6.57E-04	45	1.12E-03	13,300	5.82E-02	552	2.59E-03	1.22E-10
LEC28.23.9.Si15B.8	15	3.78E-05	18.9	2.499	4.94E-02	79	1.14E-03	46	1.14E-03	12,800	5.56E-02	469	2.19E-03	8.64E-11
LEC28.23.9.Si15B.9	15	3.81E-05	19.9	2.499	4.94E-02	50	7.22E-04	40	9.89E-04	13,300	5.83E-02	477	2.24E-03	1.04E-10
LEC28.23.9.Si15B.10	15	3.68E-05	20.9	2.499	4.94E-02	48	6.69E-04	32	7.75E-04	13,400	5.67E-02	438	1.99E-03	1.00E-10
ORLEC28 23 °C 25 ppm Si														
LEC28.23.9.Si25B.Blank2	25	2.37E-05	---	---	---	23	---	[25.2]	---	18,900	---	[44.7]	---	---
LEC28.23.9.Si25B.Blank3	25	1.81E-05	0.0	---	---	19	---	[25.2]	---	19,000	---	[44.7]	---	---
LEC28.23.9.Si25B.1	25	1.09E-05	2.0	2.500	4.94E-02	96	4.01E-04	180	1.28E-03	19,500	2.45E-02	3,890	5.25E-03	3.27E-10
LEC28.23.9.Si25B.2	25	3.92E-05	4.9	2.499	4.94E-02	88	1.32E-03	140	3.58E-03	18,800	8.48E-02	2,630	1.27E-02	7.56E-10
LEC28.23.9.Si25B.3	25	3.81E-05	7.1	2.499	4.94E-02	61	8.88E-04	77	1.91E-03	18,700	8.20E-02	1,210	5.69E-03	3.12E-10
LEC28.23.9.Si25B.4	25	3.76E-05	9.0	2.499	4.94E-02	56	8.03E-04	61	1.51E-03	20,400	8.83E-02	933	4.33E-03	2.33E-10
LEC28.23.9.Si25B.5	25	3.90E-05	11.8	2.499	4.94E-02	53	7.95E-04	52	1.31E-03	20,500	9.20E-02	754	3.63E-03	1.92E-10
LEC28.23.9.Si25B.6	25	3.87E-05	13.9	2.499	4.94E-02	53	7.79E-04	43	1.09E-03	21,700	9.65E-02	587	2.80E-03	1.41E-10
LEC28.23.9.Si25B.7	25	3.97E-05	15.9	2.499	4.94E-02	52	7.87E-04	39	9.99E-04	24,600	1.12E-01	568	2.78E-03	1.47E-10
LEC28.23.9.Si25B.8	25	3.89E-05	18.9	2.499	4.94E-02	50	7.44E-04	35	8.81E-04	24,700	1.10E-01	512	2.45E-03	1.30E-10
LEC28.23.9.Si25B.9	25	3.95E-05	19.9	2.499	4.94E-02	48	7.23E-04	37	9.51E-04	24,300	1.10E-01	488	2.38E-03	1.18E-10
LEC28.23.9.Si25B.10	25	3.81E-05	20.9	2.498	4.94E-02	44	6.35E-04	37	9.06E-04	24,400	1.07E-01	483	2.27E-03	1.13E-10
ORLEC28 23 °C 35 ppm Si														

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC28.23.9.Si35B.Blank1	35	3.49E-05	---	---	---	[16.5]	---	[25.2]	---	27,800	---	[44.7]	---	---
LEC28.23.9.Si35B.Blank2	35	3.94E-05	---	---	---	19	---	[25.2]	---	26,800	---	[44.7]	---	---
LEC28.23.9.Si35B.Blank3	35	3.86E-05	0.0	---	---	17	---	[25.2]	---	27,500	---	[44.7]	---	---
LEC28.23.9.Si35B.1	35	3.87E-05	2.0	2.500	4.94E-02	77	1.13E-03	116	2.92E-03	28,200	1.25E-01	2,760	1.32E-02	8.46E-10
LEC28.23.9.Si35B.2	35	3.85E-05	4.9	2.500	4.94E-02	67	9.90E-04	96	2.41E-03	29,300	1.30E-01	1,820	8.65E-03	5.15E-10
LEC28.23.9.Si35B.3	35	3.77E-05	7.1	2.499	4.94E-02	57	8.21E-04	71	1.75E-03	29,700	1.29E-01	1,170	5.45E-03	3.05E-10
LEC28.23.9.Si35B.4	35	3.79E-05	9.0	2.499	4.94E-02	48	6.98E-04	57	1.41E-03	25,700	1.12E-01	936	4.37E-03	2.45E-10
LEC28.23.9.Si35B.5	35	3.89E-05	11.8	2.499	4.94E-02	38	5.65E-04	49	1.25E-03	20,600	9.22E-02	725	3.48E-03	1.84E-10
LEC28.23.9.Si35B.6	35	3.71E-05	13.9	2.499	4.94E-02	38	5.36E-04	45	1.08E-03	20,200	8.61E-02	620	2.83E-03	1.45E-10
LEC28.23.9.Si35B.7	35	3.70E-05	15.9	2.499	4.94E-02	38	5.40E-04	43	1.04E-03	20,900	8.88E-02	610	2.78E-03	1.44E-10
LEC28.23.9.Si35B.8	35	3.73E-05	18.9	2.499	4.94E-02	37	5.33E-04	39	9.38E-04	23,000	9.86E-02	531	2.44E-03	1.24E-10
LEC28.23.9.Si35B.9	35	3.79E-05	19.9	2.499	4.94E-02	38	5.50E-04	31	7.71E-04	23,500	1.02E-01	479	2.24E-03	1.21E-10
LEC28.23.9.Si35B.10	35	3.89E-05	20.9	2.499	4.94E-02	39	5.72E-04	35	8.81E-04	24,100	1.08E-01	484	2.32E-03	1.19E-10
ORLEC28 40 °C 1 ppm Si														
LEC28.40.9.1Si.Blank1	1	1.66E-05	---	---	---	[16.5]	---	[25.2]	---	934	---	[44.7]	---	---
LEC28.40.9.1Si.Blank2	1	2.44E-05	---	---	---	[16.5]	---	[25.2]	---	906	---	[44.7]	---	---
LEC28.40.9.1Si.Blank3	1	2.53E-05	0.0	---	---	[16.5]	---	[25.2]	---	918	---	[44.7]	---	---
LEC28.40.9.1Si.2	1	3.66E-05	6.9	0.667	1.32E-02	133	6.98E-03	94	8.39E-03	1,410	2.22E-02	845	1.43E-02	4.89E-10
LEC28.40.9.1Si.3	1	3.85E-05	8.9	0.667	1.32E-02	161	8.89E-03	101	9.50E-03	1,480	2.46E-02	756	1.35E-02	3.27E-10
LEC28.40.9.1Si.4	1	3.89E-05	12.9	0.666	1.32E-02	143	7.98E-03	94	8.98E-03	1,460	2.45E-02	638	1.15E-02	2.07E-10
LEC28.40.9.1Si.5	1	3.84E-05	15.9	0.666	1.32E-02	162	8.93E-03	99	9.26E-03	1,450	2.40E-02	575	1.02E-02	7.97E-11
LEC28.40.9.1Si.6	1	3.78E-05	19.9	0.665	1.32E-02	152	8.25E-03	99	9.13E-03	1,490	2.43E-02	591	1.04E-02	1.01E-10
LEC28.40.9.1Si.7	1	3.85E-05	22.9	0.665	1.32E-02	164	9.05E-03	97	9.13E-03	1,470	2.44E-02	539	9.60E-03	3.85E-11
LEC28.40.9.1Si.8	1	3.73E-05	27.0	0.665	1.32E-02	149	7.97E-03	104	9.48E-03	1,540	2.48E-02	578	9.98E-03	4.10E-11
LEC28.40.9.1Si.9	1	3.69E-05	29.9	0.664	1.32E-02	149	7.90E-03	101	9.12E-03	1,530	2.44E-02	561	9.60E-03	3.90E-11
LEC28.40.9.1Si.10	1	3.73E-05	34.0	0.664	1.31E-02	151	8.09E-03	100	9.13E-03	1,530	2.47E-02	568	9.82E-03	5.69E-11
LEC28.40.9.1Si.11	1	3.74E-05	37.0	0.663	1.31E-02	149	8.02E-03	98	9.00E-03	1,510	2.44E-02	556	9.65E-03	5.36E-11
ORLEC28 40 °C 5 ppm Si														
LEC28.40.9.5Si.Blank2	5	1.90E-05	---	---	---	[16.5]	---	[25.2]	---	3,050	---	[44.7]	---	---
LEC28.40.9.5Si.Blank3	5	2.28E-05	0.0	---	---	21	---	[25.2]	---	3,450	---	[44.7]	---	---
LEC28.40.9.5Si.2	5	3.80E-05	6.9	0.659	1.30E-02	137	7.55E-03	91	8.54E-03	4,920	8.15E-02	853	1.52E-02	5.47E-10
LEC28.40.9.5Si.3	5	3.98E-05	8.9	0.659	1.30E-02	148	8.54E-03	92	9.00E-03		0.00E+00	690	1.29E-02	---
LEC28.40.9.5Si.4	5	3.92E-05	12.9	0.658	1.30E-02	147	8.36E-03	92	8.90E-03	4,960	8.48E-02	641	1.18E-02	2.37E-10
LEC28.40.9.5Si.5	5	3.86E-05	15.9	0.658	1.30E-02	159	8.92E-03	95	9.03E-03		0.00E+00	568	1.03E-02	---

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC28.40.9.5Si.7	5	3.86E-05	22.9	0.657	1.30E-02	161	9.02E-03	93	8.90E-03		0.00E+00	518	9.37E-03	---
LEC28.40.9.5Si.8	5	3.77E-05	27.0	0.657	1.30E-02	163	8.92E-03	95	8.90E-03	5,070	8.35E-02	560	9.89E-03	8.19E-11
LEC28.40.9.5Si.9	5	3.81E-05	29.9	0.656	1.30E-02	159	8.80E-03	95	8.93E-03	5,080	8.46E-02	552	9.86E-03	7.73E-11
LEC28.40.9.5Si.10	5	3.86E-05	34.0	0.656	1.30E-02	150	8.42E-03	96	9.16E-03	5,010	8.46E-02	547	9.91E-03	6.22E-11
LEC28.40.9.5Si.11	5	3.83E-05	37.0	0.656	1.30E-02	146	8.13E-03	88	8.37E-03	5,030	8.42E-02	522	9.37E-03	8.25E-11
ORLEC28 40 °C 15 ppm Si														
LEC28.40.9.Si15.Blank1	15	3.63E-05	---	---	---	18	---	[25.2]	---	12,600	---	[44.7]	---	---
LEC28.40.9.Si15.Blank2	15	3.99E-05	---	---	---	20	---	[25.2]	---	13,100	---	[44.7]	---	---
LEC28.40.9.Si15.Blank3	15	3.87E-05	0.0	---	---	17	---	[25.2]	---	12,900	---	[44.7]	---	---
LEC28.40.9.Si15.1	15	3.94E-05	2.1	0.999	1.98E-02	101	3.80E-03	218	1.40E-02	13,100	1.48E-01	2,830	3.44E-02	1.68E-09
LEC28.40.9.Si15.2	15	3.95E-05	5.1	0.998	1.97E-02	125	4.73E-03	209	1.35E-02	13,200	1.50E-01	2,190	2.67E-02	1.09E-09
LEC28.40.9.Si15.3	15	3.93E-05	7.2	0.998	1.97E-02	114	4.29E-03	155	9.94E-03	13,100	1.48E-01	1,410	1.71E-02	5.93E-10
LEC28.40.9.Si15.4	15	3.99E-05	9.1	0.998	1.97E-02	114	4.36E-03	131	8.54E-03	13,100	1.51E-01	1,120	1.38E-02	4.36E-10
LEC28.40.9.Si15.5	15	3.80E-05	12.0	0.997	1.97E-02	114	4.15E-03	116	7.20E-03	13,000	1.42E-01	936	1.10E-02	3.14E-10
LEC28.40.9.Si15.6	15	3.86E-05	14.1	0.997	1.97E-02	116	4.29E-03	104	6.56E-03	13,200	1.47E-01	834	9.96E-03	2.81E-10
LEC28.40.9.Si15.7	15	3.86E-05	16.1	0.997	1.97E-02	109	4.03E-03	96	6.07E-03	12,700	1.41E-01	760	9.07E-03	2.48E-10
LEC28.40.9.Si15.8	15	3.82E-05	19.1	0.996	1.97E-02	115	4.21E-03	102	6.36E-03	13,300	1.46E-01	764	9.01E-03	2.20E-10
LEC28.40.9.Si15.9	15	3.88E-05	20.1	0.996	1.97E-02	118	4.39E-03	99	6.29E-03	13,400	1.50E-01	727	8.72E-03	2.01E-10
LEC28.40.9.Si15.10	15	3.86E-05	21.1	0.996	1.97E-02	120	4.44E-03	97	6.14E-03	13,400	1.49E-01	717	8.56E-03	2.00E-10
ORLEC28 40 °C 25 ppm Si														
LEC28.40.9.Si25B.Blank1	25	3.62E-05	---	---	---	28	---	[25.2]	---	23,300	---	[44.7]	---	---
LEC28.40.9.Si25B.Blank2	25	4.19E-05	---	---	---	35	---	[25.2]	---	25,200	---	[44.7]	---	---
LEC28.40.9.Si25B.Blank3	25	4.30E-05	0.0	---	---	30	---	[25.2]	---	24,800	---	[44.7]	---	---
LEC28.40.9.Si25B.1	25	3.83E-05	2.1	0.999	1.98E-02	113	4.14E-03	236	1.47E-02	23,300	2.57E-01	3,070	3.63E-02	1.78E-09
LEC28.40.9.Si25B.2	25	4.36E-05	5.1	0.998	1.97E-02	114	4.75E-03	203	1.44E-02	21,800	2.73E-01	2,180	2.93E-02	1.23E-09
LEC28.40.9.Si25B.4	25	4.16E-05	9.1	0.998	1.97E-02	99	3.95E-03	111	7.53E-03	22,300	2.67E-01	1,090	1.40E-02	5.34E-10
LEC28.40.9.Si25B.5	25	3.83E-05	12.0	0.998	1.97E-02	106	3.89E-03	121	7.56E-03	23,000	2.53E-01	1,030	1.22E-02	3.82E-10
LEC28.40.9.Si25B.6	25	3.66E-05	14.1	0.997	1.97E-02	100	3.51E-03	116	6.93E-03	22,000	2.32E-01	928	1.05E-02	2.95E-10
LEC28.40.9.Si25B.7	25	3.80E-05	16.1	0.997	1.97E-02	99	3.61E-03	110	6.82E-03	21,900	2.40E-01	850	9.98E-03	2.61E-10
LEC28.40.9.Si25B.8	25	3.45E-05	19.1	0.997	1.97E-02	102	3.37E-03	107	6.02E-03	22,300	2.21E-01	827	8.81E-03	2.30E-10
LEC28.40.9.Si25B.9	25	3.98E-05	20.1	0.997	1.97E-02	98	3.73E-03	109	7.08E-03	22,700	2.60E-01	760	9.34E-03	1.87E-10
LEC28.40.9.Si25B.10	25	3.65E-05	21.1	0.996	1.97E-02	99	3.44E-03	96	5.68E-03	22,300	2.34E-01	759	8.55E-03	2.37E-10
ORLEC28 40 °C 35 ppm Si														
LEC28.40.9.Si35B.Blank1	35	3.65E-05	---	---	---	25	---	[25.2]	---	28,900	---	[44.7]	---	---

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC28.40.9.Si35B.Blank2	35	3.88E-05	---	---	---	26	---	[25.2]	---	29,700	---	[44.7]	---	---
LEC28.40.9.Si35B.Blank3	35	3.88E-05	0.0	---	---	24	---	[25.2]	---	30,600	---	[44.7]	---	---
LEC28.40.9.Si35B.1	35	3.81E-05	2.1	0.999	1.98E-02	106	3.86E-03	232	1.44E-02	31,400	3.44E-01	2,920	3.43E-02	1.64E-09
LEC28.40.9.Si35B.2	35	3.79E-05	5.1	0.998	1.97E-02	104	3.77E-03	228	1.41E-02	32,600	3.55E-01	2,240	2.62E-02	1.00E-09
LEC28.40.9.Si35B.3	35	3.88E-05	7.2	0.998	1.97E-02	96	3.58E-03	180	1.14E-02	32,600	3.64E-01	1,580	1.89E-02	6.23E-10
LEC28.40.9.Si35B.4	35	3.85E-05	9.1	0.997	1.97E-02	89	3.27E-03	164	1.03E-02	28,800	3.20E-01	1,260	1.50E-02	3.87E-10
LEC28.40.9.Si35B.5	35	3.83E-05	12.0	0.997	1.97E-02	88	3.23E-03	143	8.95E-03	22,300	2.46E-01	1,080	1.28E-02	3.18E-10
LEC28.40.9.Si35B.6	35	3.78E-05	14.1	0.997	1.97E-02	96	3.49E-03	131	8.09E-03	23,100	2.52E-01	959	1.12E-02	2.58E-10
LEC28.40.9.Si35B.7	35	3.87E-05	16.1	0.996	1.97E-02	98	3.63E-03	118	7.45E-03	27,300	3.04E-01	888	1.06E-02	2.62E-10
LEC28.40.9.Si35B.8	35	3.85E-05	19.1	0.996	1.97E-02	97	3.58E-03	108	6.78E-03	31,900	3.54E-01	799	9.50E-03	2.25E-10
LEC28.40.9.Si35B.9	35	3.76E-05	20.1	0.996	1.97E-02	95	3.41E-03	105	6.45E-03	34,400	3.73E-01	765	8.90E-03	2.02E-10
LEC28.40.9.Si35B.10	35	3.88E-05	21.1	0.996	1.97E-02	93	3.46E-03	109	6.92E-03	36,500	4.09E-01	746	8.96E-03	1.69E-10
ORLEC28 40 °C 50 ppm Si														
LEC28.40.9.50Si.Blank1	50	1.01E-05	---	---	---	43	---	[25.2]	---	44,300	---	[44.7]	---	---
LEC28.40.9.50Si.Blank2	50	1.85E-05	---	---	---	44	---	[25.2]	---	45,600	---	[44.7]	---	---
LEC28.40.9.50Si.Blank3	50	2.02E-05	0.0	---	---	43	---	[25.2]	---	45,700	---	[44.7]	---	---
LEC28.40.9.50Si.2	50	3.06E-05	6.9	0.664	1.31E-02	54	2.39E-03	83	6.23E-03	45,900	6.08E-01	1,090	1.55E-02	7.65E-10
LEC28.40.9.50Si.3	50	3.26E-05	8.9	0.664	1.31E-02	67	3.15E-03	76	6.08E-03	45,500	6.42E-01	874	1.32E-02	5.91E-10
LEC28.40.9.50Si.4	50	3.31E-05	12.9	0.664	1.31E-02	81	3.86E-03	63	5.12E-03	21,300	3.05E-01	638	9.80E-03	3.87E-10
LEC28.40.9.50Si.5	50	3.07E-05	15.9	0.663	1.31E-02	64	2.83E-03	72	5.42E-03	46,400	6.16E-01	621	8.85E-03	2.83E-10
LEC28.40.9.50Si.6	50	3.51E-05	19.9	0.663	1.31E-02	49	2.49E-03	72	6.16E-03	46,300	7.04E-01	599	9.77E-03	2.98E-10
LEC28.40.9.50Si.7	50	3.77E-05	22.9	0.663	1.31E-02	61	3.32E-03	77	7.14E-03	46,600	7.62E-01	515	9.04E-03	1.57E-10
LEC28.40.9.50Si.8	50	3.83E-05	27.0	0.662	1.31E-02	42	2.32E-03	76	7.14E-03	46,800	7.77E-01	525	9.36E-03	1.84E-10
LEC28.40.9.50Si.9	50	3.79E-05	29.9	0.662	1.31E-02	49	2.68E-03	82	7.65E-03	46,900	7.70E-01	542	9.55E-03	1.57E-10
LEC28.40.9.50Si.10	50	3.75E-05	34.0	0.662	1.31E-02	47	2.54E-03	86	7.88E-03	47,800	7.77E-01	556	9.70E-03	1.51E-10
LEC28.40.9.50Si.11	50	3.76E-05	37.0	0.661	1.31E-02	45	2.45E-03	85	7.88E-03	48,100	7.85E-01	613	1.07E-02	2.36E-10
ORLEC28 70 °C 1 ppm Si														
LEC28.70.9.1Si.Blank1	1	1.14E-05	---	---	---	[16.5]	---	[25.2]	---	1,020	---	[44.7]	---	---
LEC28.70.9.1Si.Blank2	1	1.77E-05	---	---	---	[16.5]	---	[25.2]	---	986	---	[44.7]	---	---
LEC28.70.9.1Si.Blank3	1	1.69E-05	0.0	---	---	[16.5]	---	[25.2]	---	972	---	[44.7]	---	---
LEC28.70.9.1Si.2	1	3.23E-05	4.9	0.448	8.88E-03	706	4.86E-02	519	6.08E-02	3,640	7.53E-02	4,200	9.32E-02	2.67E-09
LEC28.70.9.1Si.3	1	3.38E-05	7.1	0.447	8.87E-03	792	5.71E-02	524	6.44E-02	3,730	8.08E-02	3,380	7.86E-02	1.18E-09
LEC28.70.9.1Si.4	1	3.41E-05	8.9	0.446	8.85E-03	764	5.56E-02	490	6.08E-02	3,820	8.36E-02	2,710	6.37E-02	2.37E-10
LEC28.70.9.1Si.5	1	3.41E-05	12.9	0.443	8.82E-03	749	5.47E-02	507	6.31E-02	3,550	7.79E-02	2,670	6.29E-02	< 0

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC28.70.9.1Si.6	1	3.37E-05	14.2	0.443	8.82E-03	715	5.16E-02	481	5.91E-02	3,660	7.94E-02	2,430	5.66E-02	< 0
LEC28.70.9.1Si.7	1	3.51E-05	16.1	0.442	8.80E-03	741	5.58E-02	516	6.62E-02	3,560	8.06E-02	2,560	6.22E-02	< 0
LEC28.70.9.1Si.8	1	3.47E-05	18.9	0.440	8.78E-03	709	5.30E-02	469	5.97E-02	3,600	8.09E-02	2,300	5.54E-02	< 0
LEC28.70.9.1Si.10	1	3.45E-05	22.9	0.439	8.75E-03	700	5.21E-02	469	5.95E-02	3,580	8.01E-02	2,250	5.40E-02	< 0
LEC28.70.9.1Si.11	1	3.49E-05	26.0	0.437	8.73E-03	709	5.36E-02	478	6.16E-02	3,620	8.23E-02	2,310	5.63E-02	< 0
LEC28.70.9.1Si.12	1	3.57E-05	28.0	0.436	8.72E-03	702	5.43E-02	470	6.20E-02	3,600	8.38E-02	2,290	5.72E-02	< 0
LEC28.70.9.1Si.13	1	3.59E-05	29.1	0.435	8.71E-03	700	5.45E-02	466	6.18E-02	3,570	8.35E-02	2,230	5.60E-02	< 0
ORLEC28 70 °C 5 ppm Si														
LEC28.70.9.5Si.Blank2	5	1.71E-05	---	---	---	[16.5]	---	[25.2]	---	3,700	---	[44.7]	---	---
LEC28.70.9.5Si.Blank3	5	2.05E-05	0.0	---	---	[16.5]	---	[25.2]	---	4,090	---	[44.7]	---	---
LEC28.70.9.5Si.2	5	3.43E-05	4.9	0.496	9.83E-03	600	3.96E-02	504	5.67E-02	6,910	1.37E-01	3,930	8.37E-02	2.23E-09
LEC28.70.9.5Si.3	5	3.39E-05	7.1	0.495	9.81E-03	698	4.56E-02	482	5.36E-02	5,960	1.17E-01	3,190	6.72E-02	1.12E-09
LEC28.70.9.5Si.4	5	3.54E-05	8.9	0.494	9.80E-03	669	4.57E-02	422	4.91E-02	7,180	1.47E-01	2,600	5.73E-02	6.76E-10
LEC28.70.9.5Si.5	5	3.57E-05	12.9	0.492	9.77E-03	654	4.52E-02	433	5.10E-02	6,860	1.43E-01	2,410	5.38E-02	2.27E-10
LEC28.70.9.5Si.6	5	3.50E-05	14.2	0.492	9.77E-03	625	4.22E-02	399	4.60E-02	6,970	1.42E-01	2,110	4.60E-02	4.90E-12
LEC28.70.9.5Si.7	5	3.61E-05	16.1	0.491	9.76E-03	647	4.53E-02	435	5.19E-02	6,820	1.44E-01	2,260	5.10E-02	< 0
LEC28.70.9.5Si.8	5	3.52E-05	18.9	0.489	9.74E-03	629	4.30E-02	407	4.74E-02	7,030	1.45E-01	2,060	4.54E-02	< 0
LEC28.70.9.5Si.10	5	3.70E-05	22.9	0.487	9.71E-03	621	4.47E-02	409	5.02E-02	7,060	1.53E-01	2,000	4.65E-02	< 0
LEC28.70.9.5Si.11	5	3.62E-05	26.0	0.486	9.69E-03	624	4.40E-02	408	4.90E-02	7,070	1.50E-01	1,910	4.35E-02	< 0
LEC28.70.9.5Si.12	5	3.52E-05	28.0	0.485	9.68E-03	617	4.24E-02	416	4.87E-02	7,040	1.45E-01	1,990	4.41E-02	< 0
LEC28.70.9.5Si.13	5	3.66E-05	29.1	0.485	9.68E-03	618	4.41E-02	408	4.97E-02	7,000	1.50E-01	1,970	4.54E-02	< 0
ORLEC28 70 °C 15 ppm Si														
LEC28.70.9.Si15.Blank1	15	3.64E-05	---	---	---	[16.5]	---	[25.2]	---	13,500	---	[44.7]	---	---
LEC28.70.9.Si15.Blank2	15	3.50E-05	---	---	---	[16.5]	---	[25.2]	---	13,500	---	[44.7]	---	---
LEC28.70.9.Si15.Blank3	15	3.58E-05	0.0	---	---	[16.5]	---	[25.2]	---	13,500	---	[44.7]	---	---
LEC28.70.9.Si15.1	15	3.66E-05	2.2	0.444	8.82E-03	331	2.60E-02	1,670	2.23E-01	14,600	3.44E-01	9,720	2.46E-01	1.88E-09
LEC28.70.9.Si15.2	15	3.68E-05	5.1	0.435	8.70E-03	457	3.65E-02	2,120	2.89E-01	15,200	3.65E-01	11,200	2.89E-01	7.32E-12
LEC28.70.9.Si15.3	15	3.61E-05	7.2	0.432	8.66E-03	415	3.27E-02	1,720	2.31E-01	14,700	3.48E-01	9,090	2.31E-01	1.26E-11
LEC28.70.9.Si15.4	15	3.73E-05	8.2	0.432	8.66E-03	387	3.15E-02	1,480	2.05E-01	14,600	3.57E-01	7,780	2.04E-01	< 0
LEC28.70.9.Si15.5	15	3.74E-05	9.1	0.430	8.64E-03	374	3.06E-02	1,390	1.94E-01	14,400	3.54E-01	7,460	1.97E-01	2.59E-10
ORLEC28 70 °C 25 ppm Si														
LEC28.70.9.Si25.Blank1	25	3.19E-05	---	---	---	23	---	[25.2]	---	23,300	---	[44.7]	---	---
LEC28.70.9.Si25.Blank2	25	2.96E-05	---	---	---	25	---	[25.2]	---	25,200	---	[44.7]	---	---
LEC28.70.9.Si25.Blank3	25	3.27E-05	0.0	---	---	20	---	[25.2]	---	25,200	---	[44.7]	---	---

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (μg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (μg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (μg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (μg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC28.70.9.Si25.1	25	3.17E-05	2.2	0.443	8.81E-03	349	2.37E-02	2,030	2.35E-01	24,800	5.07E-01	11,600	2.55E-01	1.59E-09
LEC28.70.9.Si25.2	25	3.28E-05	5.1	0.434	8.68E-03	440	3.14E-02	2,530	3.08E-01	23,400	5.03E-01	13,400	3.09E-01	7.25E-11
LEC28.70.9.Si25.3	25	3.26E-05	7.2	0.431	8.64E-03	413	2.95E-02	2,120	2.58E-01	23,100	4.96E-01	11,100	2.56E-01	< 0
LEC28.70.9.Si25.4	25	3.29E-05	8.2	0.430	8.63E-03	386	2.78E-02	1,860	2.28E-01	23,700	5.14E-01	9,930	2.31E-01	2.05E-10
LEC28.70.9.Si25.5	25	3.35E-05	9.1	0.429	8.61E-03	382	2.81E-02	1,770	2.22E-01	24,200	5.34E-01	9,490	2.25E-01	2.78E-10
ORLEC28 70 °C 50 ppm Si														
LEC28.70.9.50Si.Blank1	50	9.48E-06	---	---	---	23	---	[25.2]	---	46,900	---	94	---	---
LEC28.70.9.50Si.Blank2	50	2.16E-05	---	---	---	19	---	[25.2]	---	47,600	---	87	---	---
LEC28.70.9.50Si.Blank3	50	2.17E-05	0.0	---	---	24	---	[25.2]	---	46,200	---	88	---	---
LEC28.70.9.50Si.2	50	3.77E-05	4.9	0.442	8.81E-03	146	1.18E-02	1,530	2.11E-01	48,200	1.17E+00	7,770	2.03E-01	< 0
LEC28.70.9.50Si.3	50	3.82E-05	7.1	0.439	8.77E-03	137	1.13E-02	1,370	1.92E-01	46,900	1.16E+00	6,880	1.83E-01	< 0
LEC28.70.9.50Si.4	50	3.52E-05	8.9	0.437	8.75E-03	111	8.45E-03	1,160	1.50E-01	47,600	1.09E+00	5,920	1.45E-01	< 0
LEC28.70.9.50Si.5	50	3.62E-05	12.9	0.431	8.66E-03	125	9.86E-03	1,060	1.43E-01	46,200	1.10E+00	5,570	1.42E-01	< 0
LEC28.70.9.50Si.6	50	3.70E-05	14.2	0.431	8.67E-03	100	8.04E-03	924	1.27E-01	47,500	1.15E+00	4,810	1.25E-01	< 0
LEC28.70.9.50Si.7	50	3.65E-05	16.1	0.429	8.64E-03	119	9.49E-03	916	1.24E-01	46,500	1.11E+00	4,970	1.28E-01	2.81E-10
LEC28.70.9.50Si.8	50	3.66E-05	18.9	0.426	8.60E-03	97	7.78E-03	826	1.13E-01	47,600	1.15E+00	4,390	1.14E-01	5.91E-11
LEC28.70.9.50Si.11	50	3.81E-05	26.0	0.417	8.48E-03	98	8.32E-03	959	1.39E-01	47,800	1.22E+00	4,980	1.36E-01	< 0
LEC28.70.9.50Si.12	50	3.85E-05	28.0	0.416	8.47E-03	87	7.51E-03	703	1.03E-01	48,200	1.25E+00	3,880	1.08E-01	3.83E-10
ORLEC28 70 °C 75 ppm Si														
LEC28.70.9.75Si.Blank1	75	1.52E-05	---	---	---	35	---	[25.2]	---	70,100	---	135	---	---
LEC28.70.9.75Si.Blank2	75	2.32E-05	---	---	---	34	---	[25.2]	---	70,200	---	115	---	---
LEC28.70.9.75Si.Blank3	75	2.32E-05	0.0	---	---	35	---	[25.2]	---	69,800	---	113	---	---
LEC28.70.9.75Si.2	75	4.12E-05	4.9	0.437	8.72E-03	107	9.55E-03	1,580	2.40E-01	71,200	1.91E+00	8,110	2.34E-01	< 0
LEC28.70.9.75Si.3	75	4.16E-05	7.1	0.434	8.68E-03	106	9.61E-03	1,410	2.18E-01	70,100	1.91E+00	7,210	2.11E-01	< 0
LEC28.70.9.75Si.4	75	4.21E-05	8.9	0.431	8.65E-03	81	7.45E-03	1,160	1.82E-01	71,100	1.97E+00	6,350	1.88E-01	5.48E-10
LEC28.70.9.75Si.5	75	4.56E-05	12.9	0.424	8.55E-03	96	9.70E-03	964	1.65E-01	69,100	2.09E+00	5,180	1.68E-01	2.38E-10
LEC28.70.9.75Si.6	75	4.79E-05	14.2	0.425	8.56E-03	70	7.35E-03	782	1.41E-01	70,800	2.25E+00	4,170	1.42E-01	1.12E-10
LEC28.70.9.75Si.7	75	4.73E-05	16.1	0.422	8.52E-03	100	1.05E-02	838	1.50E-01	75,900	2.39E+00	4,500	1.52E-01	2.07E-10
LEC28.70.9.75Si.8	75	4.90E-05	18.9	0.419	8.48E-03	69	7.50E-03	685	1.28E-01	72,500	2.38E+00	3,640	1.28E-01	6.48E-11
ORLEC28 90 °C 1 ppm Si														
LEC28.90.9.1Si.Blank1	1	1.47E-05	---	---	---	[16.5]	---	[25.2]	---	927	---	[44.7]	---	---
LEC28.90.9.1Si.Blank2	1	1.91E-05	---	---	---	18	---	[25.2]	---	932	---	[44.7]	---	---
LEC28.90.9.1Si.Blank3	1	1.89E-05	0.0	---	---	21	---	[25.2]	---	917	---	[44.7]	---	---
LEC28.90.9.1Si.2	1	3.55E-05	4.9	0.112	2.28E-03	650	1.92E-01	1,440	7.24E-01	3,130	2.77E-01	7,830	7.45E-01	1.77E-09

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (μg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (μg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (μg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (μg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC28.90.9.1Si.3	1	3.57E-05	7.1	0.111	2.26E-03	555	1.65E-01	975	4.95E-01	2,810	2.52E-01	5,490	5.28E-01	2.70E-09
LEC28.90.9.1Si.4	1	3.54E-05	9.1	0.110	2.25E-03	554	1.65E-01	656	3.33E-01	2,710	2.43E-01	4,190	4.03E-01	5.76E-09
LEC28.90.9.1Si.5	1	3.62E-05	12.9	0.107	2.21E-03	458	1.41E-01	478	2.52E-01	2,540	2.36E-01	3,100	3.09E-01	4.74E-09
LEC28.90.9.1Si.6	1	3.58E-05	14.2	0.108	2.22E-03	473	1.44E-01	337	1.75E-01	2,480	2.27E-01	2,710	2.66E-01	7.55E-09
LEC28.90.9.1Si.7	1	3.74E-05	16.1	0.107	2.21E-03	487	1.56E-01	309	1.69E-01	2,530	2.44E-01	2,310	2.39E-01	5.79E-09
LEC28.90.9.1Si.8	1	3.58E-05	18.9	0.106	2.19E-03	474	1.46E-01	261	1.37E-01	2,460	2.28E-01	1,950	1.94E-01	4.69E-09
LEC28.90.9.1Si.9	1	3.64E-05	20.9	0.105	2.19E-03	527	1.66E-01	249	1.33E-01	2,600	2.46E-01	1,900	1.93E-01	4.90E-09
LEC28.90.9.1Si.10	1	3.55E-05	22.1	0.105	2.19E-03	522	1.60E-01	239	1.25E-01	2,660	2.45E-01	1,820	1.80E-01	4.56E-09
ORLEC28 90 °C 5 ppm Si														
LEC28.90.9.5Si.Blank2	5	2.16E-05	---	---	---	[16.5]	---	[25.2]	---	3,440	---	[44.7]	---	---
LEC28.90.9.5Si.Blank3	5	2.15E-05	0.0	---	---	[16.5]	---	[25.2]	---	3,770	---	[44.7]	---	---
LEC28.90.9.5Si.2	5	3.68E-05	4.9	0.110	2.24E-03	488	1.51E-01	1,480	7.82E-01	6,070	5.66E-01	7,710	7.71E-01	< 0
LEC28.90.9.5Si.3	5	3.57E-05	7.1	0.109	2.23E-03	398	1.21E-01	1,050	5.42E-01	5,700	5.19E-01	5,640	5.51E-01	7.63E-10
LEC28.90.9.5Si.4	5	3.66E-05	9.1	0.107	2.21E-03	395	1.24E-01	764	4.08E-01	5,890	5.54E-01	4,570	4.62E-01	4.46E-09
LEC28.90.9.5Si.5	5	3.67E-05	12.9	0.104	2.17E-03	314	1.00E-01	549	2.99E-01	5,510	5.30E-01	3,390	3.50E-01	4.18E-09
LEC28.90.9.5Si.6	5	3.80E-05	14.2	0.105	2.17E-03	311	1.03E-01	418	2.36E-01	5,520	5.49E-01	3,130	3.34E-01	8.13E-09
LEC28.90.9.5Si.7	5	3.66E-05	16.1	0.104	2.16E-03	326	1.04E-01	375	2.04E-01	5,620	5.41E-01	2,700	2.79E-01	6.13E-09
LEC28.90.9.5Si.8	5	3.61E-05	18.9	0.102	2.14E-03	321	1.02E-01	339	1.84E-01	5,780	5.54E-01	2,430	2.50E-01	5.43E-09
LEC28.90.9.5Si.9	5	3.59E-05	20.9	0.102	2.13E-03	318	1.01E-01	286	1.55E-01	5,680	5.42E-01	2,180	2.23E-01	5.66E-09
LEC28.90.9.5Si.10	5	3.58E-05	22.1	0.102	2.13E-03	322	1.02E-01	267	1.45E-01	5,560	5.31E-01	2,020	2.07E-01	5.16E-09
ORLEC28 90 °C 25 ppm Si														
LEC28.90.9.Si25.Blank1	25	3.60E-05	---	---	---	[16.5]	---	[25.2]	---	19,400	---	[44.7]	---	---
LEC28.90.9.Si25.Blank2	25	3.82E-05	---	---	---	[16.5]	---	[25.2]	---	19,500	---	[44.7]	---	---
LEC28.90.9.Si25.Blank3	25	3.87E-05	0.0	---	---	[16.5]	---	[25.2]	---	19,300	---	[44.7]	---	---
LEC28.90.9.Si25.1	25	3.78E-05	2.2	0.103	2.07E-03	370	1.27E-01	1,780	1.04E+00	20,400	2.11E+00	9,580	1.06E+00	1.64E-09
LEC28.90.9.Si25.2	25	3.81E-05	5.2	0.096	1.99E-03	452	1.64E-01	1,550	9.56E-01	20,800	2.26E+00	8,860	1.03E+00	6.49E-09
LEC28.90.9.Si25.3	25	3.79E-05	7.3	0.096	1.98E-03	400	1.45E-01	981	6.05E-01	20,800	2.26E+00	6,110	7.14E-01	8.96E-09
LEC28.90.9.Si25.4	25	3.84E-05	8.2	0.095	1.98E-03	374	1.37E-01	773	4.84E-01	21,400	2.36E+00	5,190	6.15E-01	1.08E-08
LEC28.90.9.Si25.5	25	3.89E-05	9.1	0.095	1.97E-03	367	1.37E-01	678	4.32E-01	21,800	2.45E+00	4,700	5.67E-01	1.12E-08
ORLEC28 90 °C 50 ppm Si														
LEC28.90.9.50Si.Blank1	50	1.07E-05	---	---	---	23	---	[25.2]	---	45,200	---	92	---	---
LEC28.90.9.50Si.Blank2	50	2.04E-05	---	---	---	28	---	[25.2]	---	45,900	---	93	---	---
LEC28.90.9.50Si.Blank3	50	1.94E-05	0.0	---	---	30	---	[25.2]	---	46,600	---	93	---	---
LEC28.90.9.50Si.2	50	3.35E-05	4.9	0.107	2.19E-03	234	6.76E-02	1,860	9.15E-01	48,000	4.17E+00	10,100	9.41E-01	2.13E-09

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC28.90.9.50Si.3	50	3.31E-05	7.1	0.105	2.17E-03	201	5.80E-02	1,340	6.59E-01	45,400	3.94E+00	7,460	6.94E-01	2.94E-09
LEC28.90.9.50Si.4	50	3.30E-05	9.1	0.103	2.15E-03	193	5.61E-02	974	4.83E-01	48,200	4.21E+00	5,870	5.51E-01	5.63E-09
LEC28.90.9.50Si.5	50	3.30E-05	12.9	0.100	2.10E-03	173	5.14E-02	689	3.49E-01	45,700	4.08E+00	4,450	4.26E-01	6.42E-09
LEC28.90.9.50Si.6	50	3.25E-05	14.2	0.101	2.11E-03	170	4.96E-02	537	2.67E-01	48,400	4.25E+00	3,990	3.76E-01	8.97E-09
LEC28.90.9.50Si.7	50	3.41E-05	16.1	0.100	2.09E-03	175	5.40E-02	469	2.47E-01	47,800	4.43E+00	3,380	3.37E-01	7.42E-09
LEC28.90.9.50Si.8	50	3.24E-05	18.9	0.098	2.07E-03	159	4.70E-02	395	1.99E-01	47,700	4.24E+00	2,960	2.82E-01	6.88E-09
ORLEC28 90 °C 75 ppm Si														
LEC28.90.9.75Si.Blank1	75	1.33E-05	---	---	---	43	---	[25.2]	---	69,100	---	181	---	---
LEC28.90.9.75Si.Blank2	75	1.93E-05	---	---	---	46	---	[25.2]	---	69,800	---	118	---	---
LEC28.90.9.75Si.Blank3	75	2.08E-05	0.0	---	---	42	---	[25.2]	---	71,100	---	122	---	---
LEC28.90.9.75Si.2	75	3.58E-05	4.9	0.106	2.17E-03	159	4.95E-02	1,800	9.55E-01	71,600	6.70E+00	9,450	9.49E-01	< 0
LEC28.90.9.75Si.5	75	7.50E+01	12.9	0.098	2.07E-03	126	3.90E-02	654	3.45E-01	71,602	6.67E+00	4,090	4.09E-01	5.25E-09
LEC28.90.9.75Si.6	75	3.42E-05	14.2	0.092	1.98E-03	107	3.50E-02	487	2.71E-01	71,603	7.04E+00	3,800	4.01E-01	1.07E-08
LEC28.90.9.75Si.7	75	3.45E-05	16.1	0.084	1.86E-03	110	3.85E-02	429	2.56E-01	71,604	7.53E+00	3,210	3.62E-01	8.80E-09
LEC28.90.9.75Si.8	75	3.41E-05	18.9	0.076	1.75E-03	108	3.99E-02	362	2.28E-01	72,700	8.07E+00	2,670	3.18E-01	7.46E-09
LEC28.90.9.75Si.9	75	3.41E-05	20.9	0.069	1.63E-03	103	4.06E-02	328	2.20E-01	72,800	8.63E+00	2,480	3.16E-01	7.86E-09
LEC28.90.9.75Si.10	75	3.43E-05	22.1	0.062	1.52E-03	107	4.58E-02	306	2.23E-01	73,800	9.50E+00	2,410	3.33E-01	9.06E-09
ORLEC28 90 °C 100 ppm Si														
LEC28.90.9.100Si.Blank1	100	8.65E-06	---	---	---	70	---	[25.2]	---	94,400	---	236	---	---
LEC28.90.9.100Si.Blank2	100	1.40E-05	---	---	---	64	---	[25.2]	---	93,600	---	195	---	---
LEC28.90.9.100Si.Blank3	100	1.46E-05	0.0	---	---	63	---	[25.2]	---	94,000	---	186	---	---
LEC28.90.9.100Si.2	100	3.09E-05	4.9	0.105	2.16E-03	123	3.32E-02	1,980	9.10E-01	95,800	7.77E+00	10,300	8.96E-01	< 0
LEC28.90.9.100Si.3	100	3.42E-05	7.1	0.103	2.13E-03	123	3.73E-02	1,470	7.59E-01	84,500	7.70E+00	8,410	8.23E-01	5.22E-09
LEC28.90.9.100Si.4	100	3.17E-05	9.1	0.102	2.11E-03	106	3.00E-02	1,030	4.97E-01	97,000	8.26E+00	6,350	5.80E-01	6.87E-09
LEC28.90.9.100Si.5	100	3.72E-05	12.9	0.098	2.06E-03	118	4.03E-02	702	4.08E-01	92,600	9.50E+00	4,880	5.37E-01	1.07E-08
LEC28.90.9.100Si.6	100	3.04E-05	14.2	0.099	2.07E-03	107	2.97E-02	561	2.65E-01	97,900	8.16E+00	4,430	3.97E-01	1.08E-08
LEC28.90.9.100Si.7	100	3.06E-05	16.1	0.098	2.05E-03	101	2.84E-02	498	2.39E-01	97,500	8.24E+00	3,810	3.46E-01	8.84E-09
LEC28.90.9.100Si.8	100	3.04E-05	18.9	0.096	2.04E-03	104	2.94E-02	414	1.99E-01	97,300	8.26E+00	3,150	2.87E-01	7.25E-09
LEC28.90.9.100Si.9	100	2.96E-05	20.9	0.096	2.03E-03	99	2.72E-02	351	1.65E-01	97,700	8.09E+00	2,820	2.51E-01	7.09E-09
LEC28.90.9.100Si.10	100	3.00E-05	22.1	0.096	2.03E-03	103	2.88E-02	328	1.56E-01	99,700	8.39E+00	2,740	2.47E-01	7.51E-09
ORLEC33 23 °C 1 ppm Si														
LEC33.23.9.1Si.Blank1	1	2.16E-05	---	---	---	35	---	[25.2]	---	944	---	[44.7]	---	---
LEC33.23.9.1Si.Blank2	1	2.13E-05	---	---	---	[16.5]	---	[25.2]	---	943	---	[44.7]	---	---
LEC33.23.9.1Si.Blank3	1	1.92E-05	0.0	---	---	50	---	[25.2]	---	959	---	[44.7]	---	---

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.23.9.1Si.2	1	3.71E-05	4.9	1.322	2.67E-02	64	1.82E-03	85	3.46E-03	1,120	8.14E-03	908	7.38E-03	3.36E-10
LEC33.23.9.1Si.3	1	4.12E-05	8.9	1.322	2.67E-02	43	1.36E-03	34	1.53E-03	967	7.81E-03	437	3.95E-03	---
LEC33.23.9.1Si.4	1	4.23E-05	12.9	1.322	2.67E-02	38	1.23E-03	28	1.30E-03	964	7.99E-03	315	2.92E-03	---
LEC33.23.9.1Si.5	1	4.26E-05	16.0	1.322	2.67E-02	51	1.67E-03	[25.2]	1.18E-03	1,070	8.93E-03	272	2.54E-03	1.17E-10
LEC33.23.9.1Si.6	1	4.18E-05	19.9	1.322	2.67E-02	40	1.28E-03	26	1.19E-03	979	8.02E-03	253	2.32E-03	---
LEC33.23.9.1Si.8	1	4.20E-05	27.0	1.322	2.67E-02	48	1.53E-03	27	1.24E-03	1,100	9.05E-03	234	2.15E-03	7.88E-11
LEC33.23.9.1Si.14	1	3.95E-05	47.0	1.321	2.67E-02	57	1.72E-03	29	1.27E-03	1,160	8.98E-03	215	1.86E-03	5.07E-11
LEC33.23.9.1Si.17	1	4.00E-05	57.9	1.320	2.67E-02	61	1.88E-03	31	1.34E-03	1,180	9.25E-03	222	1.95E-03	5.21E-11
ORLEC33 23 °C 5 ppm Si														
LEC33.23.9.5Si.Blank1	5	0.00E+00	---	---	---	17	---	[25.2]	---	3,570	---	[44.7]	---	---
LEC33.23.9.5Si.Blank2	5	1.64E-05	---	---	---	17	---	[25.2]	---	3,670	---	[44.7]	---	---
LEC33.23.9.5Si.Blank3	5	1.45E-05	0.0	---	---	18	---	[25.2]	---	3,740	---	[44.7]	---	---
LEC33.23.9.5Si.2	5	3.00E-05	4.9	1.326	2.68E-02	61	1.40E-03	102	3.34E-03	4,570	2.68E-02	1,100	7.22E-03	3.33E-10
LEC33.23.9.5Si.3	5	3.94E-05	8.9	1.325	2.68E-02	49	1.47E-03	48	2.07E-03	4,380	3.37E-02	575	4.96E-03	2.48E-10
LEC33.23.9.5Si.4	5	3.83E-05	12.9	1.325	2.68E-02	46	1.35E-03	27	1.13E-03	4,420	3.31E-02	332	2.78E-03	1.42E-10
LEC33.23.9.5Si.5	5	3.85E-05	16.0	1.325	2.68E-02	41	1.19E-03	[25.2]	1.06E-03	4,700	3.54E-02	274	2.31E-03	1.07E-10
LEC33.23.9.5Si.6	5	3.81E-05	19.9	1.325	2.68E-02	40	1.16E-03	[25.2]	1.05E-03	4,410	3.29E-02	258	2.15E-03	9.46E-11
LEC33.23.9.5Si.8	5	3.79E-05	27.0	1.325	2.68E-02	41	1.19E-03	[25.2]	1.04E-03	4,750	3.52E-02	239	1.98E-03	8.05E-11
LEC33.23.9.5Si.14	5	3.76E-05	47.0	1.324	2.68E-02	49	1.40E-03	[25.2]	1.04E-03	4,770	3.51E-02	200	1.65E-03	5.24E-11
LEC33.23.9.5Si.17	5	3.74E-05	57.9	1.324	2.68E-02	44	1.25E-03	[25.2]	1.03E-03	4,770	3.49E-02	183	1.50E-03	4.02E-11
LEC33.23.9.5Si.18	5	3.86E-05	61.9	1.324	2.68E-02	42	1.24E-03	[25.2]	1.06E-03	4,760	3.59E-02	189	1.60E-03	4.58E-11
ORLEC33 23 °C 15 ppm Si														
LEC33.23.9.15Si.Blank1	15	1.09E-05	---	---	---	21	---	[25.2]	---	11,500	---	[44.7]	---	---
LEC33.23.9.15Si.Blank2	15	1.62E-05	---	---	---	19	---	[25.2]	---	10,800	---	[44.7]	---	---
LEC33.23.9.15Si.Blank3	15	1.66E-05	0.0	---	---	20	---	[25.2]	---	11,000	---	[44.7]	---	---
LEC33.23.9.15Si.3	15	3.93E-05	8.9	1.325	2.68E-02	40	1.20E-03	35	1.50E-03	11,100	8.53E-02	489	4.21E-03	2.32E-10
LEC33.23.9.15Si.4	15	3.86E-05	12.9	1.325	2.68E-02	36	1.06E-03	[25.2]	1.06E-03	11,600	8.75E-02	329	2.78E-03	1.47E-10
LEC33.23.9.15Si.5	15	3.81E-05	16.0	1.325	2.68E-02	36	1.05E-03	[25.2]	1.05E-03	13,400	9.99E-02	299	2.49E-03	1.24E-10
LEC33.23.9.15Si.6	15	3.85E-05	19.9	1.324	2.68E-02	46	1.35E-03	[25.2]	1.06E-03	21,900	1.65E-01	271	2.28E-03	1.05E-10
LEC33.23.9.15Si.8	15	3.78E-05	27.0	1.324	2.68E-02	37	1.07E-03	[25.2]	1.04E-03	14,400	1.07E-01	263	2.18E-03	9.76E-11
LEC33.23.9.15Si.14	15	3.43E-05	47.0	1.324	2.68E-02	36	9.49E-04	[25.2]	9.45E-04	15,000	1.01E-01	212	1.59E-03	5.55E-11
LEC33.23.9.15Si.17	15	3.18E-05	57.9	1.324	2.68E-02	35	8.50E-04	[25.2]	8.76E-04	14,600	9.08E-02	198	1.38E-03	4.31E-11
LEC33.23.9.15Si.18	15	3.33E-05	61.9	1.323	2.68E-02	33	8.39E-04	[25.2]	9.19E-04	14,300	9.33E-02	192	1.40E-03	4.15E-11
ORLEC33 23 °C 15 ppm Si duplicate														

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.23.9.Si15B.Blank1	15	6.20E-06	---	---	---	20	---	[25.2]	---	12,900	---	63	---	---
LEC33.23.9.Si15B.Blank2	15	0.00E+00	---	---	---	[16.5]	---	[25.2]	---	2,100	---	[44.7]	---	---
LEC33.23.9.Si15B.Blank3	15	6.93E-06	0.0	---	---	37	---	[25.2]	---	12,900	---	[44.7]	---	---
LEC33.23.9.Si15B.1	15	3.89E-05	2.0	2.499	5.05E-02	60	9.51E-04	164	3.69E-03	13,000	5.24E-02	2,670	1.20E-02	7.17E-10
LEC33.23.9.Si15B.2	15	3.92E-05	4.9	2.498	5.05E-02	58	9.21E-04	160	3.63E-03	13,000	5.28E-02	1,910	8.68E-03	4.34E-10
LEC33.23.9.Si15B.3	15	3.87E-05	7.0	2.498	5.05E-02	51	8.01E-04	125	2.80E-03	13,000	5.21E-02	1,270	5.70E-03	2.49E-10
LEC33.23.9.Si15B.4	15	3.87E-05	9.0	2.498	5.05E-02	47	7.30E-04	101	2.27E-03	12,800	5.14E-02	996	4.48E-03	1.90E-10
LEC33.23.9.Si15B.5	15	3.93E-05	11.8	2.498	5.05E-02	42	6.66E-04	86	1.95E-03	13,100	5.34E-02	806	3.68E-03	1.48E-10
LEC33.23.9.Si15B.6	15	4.08E-05	13.9	2.498	5.05E-02	38	6.35E-04	67	1.58E-03	13,000	5.50E-02	674	3.19E-03	1.38E-10
LEC33.23.9.Si15B.7	15	3.97E-05	15.9	2.497	5.05E-02	38	6.15E-04	67	1.54E-03	13,100	5.39E-02	621	2.86E-03	1.14E-10
LEC33.23.9.Si15B.8	15	4.04E-05	18.9	2.497	5.05E-02	38	6.24E-04	60	1.41E-03	13,200	5.53E-02	557	2.61E-03	1.03E-10
LEC33.23.9.Si15B.9	15	3.90E-05	19.9	2.497	5.05E-02	38	6.03E-04	56	1.26E-03	13,000	5.25E-02	519	2.35E-03	9.33E-11
LEC33.23.9.Si15B.10	15	4.06E-05	20.9	2.497	5.05E-02	37	6.10E-04	57	1.33E-03	13,100	5.51E-02	509	2.40E-03	9.15E-11
ORLEC33 23 °C 25 ppm Si														
LEC33.23.9.Si25B.Blank1	25	3.22E-05	---	---	---	35	---	[25.2]	---	18,600	---	66	---	---
LEC33.23.9.Si25B.Blank2	25	2.55E-05	---	---	---	26	---	[25.2]	---	18,800	---	61	---	---
LEC33.23.9.Si25B.Blank3	25	1.83E-05	0.0	---	---	24	---	[25.2]	---	18,800	---	60	---	---
LEC33.23.9.Si25B.1	25	1.37E-05	2.0	2.500	5.05E-02	78	4.31E-04	237	1.88E-03	18,900	2.68E-02	3,770	5.97E-03	3.52E-10
LEC33.23.9.Si25B.2	25	3.90E-05	4.9	2.499	5.05E-02	75	1.18E-03	209	4.73E-03	18,600	7.53E-02	2,650	1.20E-02	6.25E-10
LEC33.23.9.Si25B.3	25	4.01E-05	7.0	2.499	5.05E-02	64	1.04E-03	124	2.88E-03	19,300	8.02E-02	1,480	6.89E-03	3.44E-10
LEC33.23.9.Si25B.4	25	4.01E-05	9.0	2.499	5.05E-02	57	9.27E-04	94	2.19E-03	20,400	8.49E-02	1,090	5.07E-03	2.48E-10
LEC33.23.9.Si25B.5	25	3.89E-05	11.8	2.498	5.05E-02	55	8.73E-04	77	1.74E-03	21,300	8.59E-02	877	3.96E-03	1.91E-10
LEC33.23.9.Si25B.6	25	3.94E-05	13.9	2.498	5.05E-02	53	8.48E-04	66	1.50E-03	23,100	9.45E-02	752	3.44E-03	1.67E-10
LEC33.23.9.Si25B.7	25	3.83E-05	15.9	2.498	5.05E-02	54	8.35E-04	66	1.46E-03	25,100	9.97E-02	714	3.17E-03	1.47E-10
LEC33.23.9.Si25B.8	25	3.92E-05	18.9	2.498	5.05E-02	50	7.90E-04	60	1.36E-03	25,200	1.02E-01	630	2.87E-03	1.30E-10
LEC33.23.9.Si25B.9	25	3.92E-05	19.9	2.498	5.05E-02	49	7.80E-04	54	1.23E-03	24,900	1.01E-01	618	2.81E-03	1.36E-10
LEC33.23.9.Si25B.10	25	3.81E-05	20.9	2.498	5.05E-02	45	7.01E-04	61	1.34E-03	24,900	9.84E-02	594	2.63E-03	1.10E-10
ORLEC33 23 °C 35 ppm Si														
LEC33.23.9.Si35B.Blank1	35	3.31E-05	---	---	---	24	---	[25.2]	---	27,700	---	60	---	---
LEC33.23.9.Si35B.Blank2	35	3.90E-05	---	---	---	25	---	[25.2]	---	27,700	---	62	---	---
LEC33.23.9.Si35B.Blank3	35	3.93E-05	0.0	---	---	24	---	[25.2]	---	27,500	---	57	---	---
LEC33.23.9.Si35B.1	35	4.00E-05	2.0	2.499	5.05E-02	59	9.60E-04	148	3.43E-03	28,800	1.19E-01	2,730	1.27E-02	7.94E-10
LEC33.23.9.Si35B.2	35	3.92E-05	4.9	2.499	5.05E-02	56	8.92E-04	126	2.86E-03	29,600	1.20E-01	1,710	7.77E-03	4.22E-10
LEC33.23.9.Si35B.3	35	4.01E-05	7.0	2.499	5.05E-02	50	8.15E-04	87	2.01E-03	30,200	1.25E-01	1,120	5.21E-03	2.74E-10

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.23.9.Si35B.4	35	3.99E-05	9.0	2.499	5.05E-02	42	6.77E-04	74	1.70E-03	26,100	1.08E-01	889	4.11E-03	2.07E-10
LEC33.23.9.Si35B.5	35	3.96E-05	11.8	2.499	5.05E-02	34	5.45E-04	62	1.42E-03	20,900	8.58E-02	733	3.37E-03	1.67E-10
LEC33.23.9.Si35B.6	35	4.11E-05	13.9	2.498	5.05E-02	34	5.69E-04	55	1.30E-03	20,900	8.92E-02	648	3.09E-03	1.54E-10
LEC33.23.9.Si35B.7	35	4.07E-05	15.9	2.498	5.05E-02	34	5.63E-04	50	1.18E-03	21,300	8.99E-02	582	2.75E-03	1.35E-10
LEC33.23.9.Si35B.8	35	4.11E-05	18.9	2.498	5.05E-02	37	6.09E-04	42	9.90E-04	23,100	9.84E-02	528	2.52E-03	1.31E-10
LEC33.23.9.Si35B.9	35	3.81E-05	19.9	2.498	5.05E-02	35	5.39E-04	41	9.15E-04	24,300	9.61E-02	504	2.23E-03	1.13E-10
LEC33.23.9.Si35B.10	35	4.06E-05	20.9	2.498	5.05E-02	37	6.09E-04	42	9.86E-04	24,600	1.04E-01	507	2.39E-03	1.21E-10
ORLEC33 40 °C 1 ppm Si														
LEC33.40.9.1Si.Blank1	1	1.17E-05	---	---	---	[16.5]	---	[25.2]	---	921	---	[44.7]	---	---
LEC33.40.9.1Si.Blank2	1	2.26E-05	---	---	---	[16.5]	---	[25.2]	---	906	---	[44.7]	---	---
LEC33.40.9.1Si.Blank3	1	2.24E-05	0.0	---	---	[16.5]	---	[25.2]	---	914	---	[44.7]	---	---
LEC33.40.9.1Si.2	1	3.87E-05	6.9	0.659	1.33E-02	110	6.53E-03	117	9.93E-03	1,440	2.19E-02	884	1.50E-02	4.37E-10
LEC33.40.9.1Si.3	1	4.19E-05	8.9	0.659	1.33E-02	109	7.01E-03	101	9.29E-03	1,370	2.25E-02	699	1.29E-02	3.08E-10
LEC33.40.9.1Si.4	1	3.46E-05	12.9	0.659	1.33E-02	108	5.74E-03	87	6.60E-03	1,410	1.92E-02	632	9.61E-03	2.59E-10
LEC33.40.9.1Si.5	1	3.51E-05	16.0	0.659	1.33E-02	121	6.52E-03	82	6.31E-03	1,400	1.93E-02	537	8.29E-03	1.70E-10
LEC33.40.9.1Si.6	1	3.56E-05	19.9	0.658	1.33E-02	118	6.46E-03	83	6.49E-03	1,440	2.02E-02	520	8.14E-03	1.42E-10
LEC33.40.9.1Si.7	1	3.43E-05	22.9	0.658	1.33E-02	129	6.80E-03	82	6.19E-03	1,410	1.90E-02	485	7.32E-03	9.72E-11
LEC33.40.9.1Si.8	1	3.57E-05	27.0	0.657	1.33E-02	117	6.43E-03	85	6.70E-03	1,440	2.03E-02	494	7.77E-03	9.25E-11
LEC33.40.9.1Si.9	1	3.59E-05	29.9	0.657	1.33E-02	120	6.62E-03	81	6.40E-03	1,460	2.06E-02	491	7.75E-03	1.16E-10
LEC33.40.9.1Si.10	1	3.64E-05	34.0	0.657	1.33E-02	117	6.56E-03	84	6.77E-03	1,420	2.04E-02	465	7.46E-03	5.99E-11
LEC33.40.9.1Si.11	1	3.57E-05	37.0	0.657	1.33E-02	116	6.37E-03	83	6.48E-03	1,420	1.99E-02	465	7.31E-03	7.08E-11
ORLEC33 40 °C 5 ppm Si														
LEC33.40.9.5Si.Blank1	5	6.34E-07	---	---	---	[49.4]	---	[75.6]	---	3,460	---	[134]	---	---
LEC33.40.9.5Si.Blank2	5	1.85E-05	---	---	---	[16.5]	---	[25.2]	---	3,380	---	[44.7]	---	---
LEC33.40.9.5Si.Blank3	5	2.27E-05	0.0	---	---	[16.5]	---	[25.2]	---	3,520	---	[44.7]	---	---
LEC33.40.9.5Si.2	5	3.83E-05	6.9	0.660	1.34E-02	109	6.40E-03	115	9.66E-03	4,960	7.45E-02	994	1.67E-02	6.06E-10
LEC33.40.9.5Si.3	5	3.56E-05	8.9	0.660	1.34E-02	130	7.09E-03	107	8.34E-03	4,850	6.77E-02	810	1.26E-02	3.69E-10
LEC33.40.9.5Si.4	5	3.58E-05	12.9	0.660	1.33E-02	122	6.70E-03	100	7.84E-03	4,970	6.98E-02	713	1.12E-02	2.89E-10
LEC33.40.9.5Si.5	5	3.56E-05	16.0	0.659	1.33E-02	131	7.16E-03	95	7.39E-03	4,900	6.85E-02	616	9.64E-03	1.93E-10
LEC33.40.9.5Si.6	5	3.64E-05	19.9	0.659	1.33E-02	124	6.94E-03	99	7.95E-03	5,040	7.21E-02	604	9.67E-03	1.48E-10
LEC33.40.9.5Si.7	5	3.65E-05	22.9	0.659	1.33E-02	137	7.69E-03	97	7.81E-03	5,020	7.21E-02	554	8.90E-03	9.39E-11
LEC33.40.9.5Si.8	5	3.74E-05	27.0	0.658	1.33E-02	131	7.52E-03	96	7.91E-03	5,110	7.51E-02	576	9.47E-03	1.33E-10
LEC33.40.9.5Si.9	5	3.76E-05	29.9	0.658	1.33E-02	132	7.62E-03	95	7.85E-03	5,070	7.49E-02	553	9.14E-03	1.11E-10
LEC33.40.9.5Si.10	5	3.75E-05	34.0	0.657	1.33E-02	123	7.08E-03	98	8.06E-03	5,010	7.38E-02	540	8.90E-03	7.23E-11

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.40.9.SSi.11	5	3.79E-05	37.0	0.657	1.33E-02	116	6.76E-03	97	8.04E-03	5,040	7.51E-02	528	8.80E-03	6.59E-11
ORLEC33 40 °C 15 ppm Si														
LEC33.40.9.Si15.Blank1	15	2.53E-05	---	---	---	22	---	[25.2]	---	13,200	---	[44.7]	---	---
LEC33.40.9.Si15.Blank2	15	3.76E-05	---	---	---	21	---	[25.2]	---	12,900	---	[44.7]	---	---
LEC33.40.9.Si15.Blank3	15	3.84E-05	0.0	---	---	21	---	[25.2]	---	12,900	---	[44.7]	---	---
LEC33.40.9.Si15.1	15	3.84E-05	2.1	0.999	2.02E-02	75	2.92E-03	331	1.84E-02	13,200	1.31E-01	2,920	3.25E-02	1.21E-09
LEC33.40.9.Si15.2	15	3.77E-05	5.1	0.997	2.02E-02	103	3.94E-03	324	1.77E-02	13,000	1.27E-01	2,510	2.75E-02	8.40E-10
LEC33.40.9.Si15.3	15	3.83E-05	7.2	0.997	2.02E-02	106	4.12E-03	252	1.40E-02	13,200	1.31E-01	1,820	2.03E-02	5.37E-10
LEC33.40.9.Si15.4	15	3.84E-05	9.1	0.997	2.02E-02	102	3.97E-03	215	1.20E-02	13,000	1.30E-01	1,510	1.68E-02	4.18E-10
LEC33.40.9.Si15.5	15	3.83E-05	12.0	0.996	2.02E-02	98	3.81E-03	205	1.14E-02	13,000	1.29E-01	1,220	1.36E-02	1.88E-10
LEC33.40.9.Si15.6	15	3.87E-05	14.1	0.996	2.02E-02	99	3.89E-03	187	1.05E-02	13,000	1.31E-01	1,110	1.25E-02	1.70E-10
LEC33.40.9.Si15.7	15	3.83E-05	16.1	0.995	2.02E-02	98	3.82E-03	179	9.95E-03	13,100	1.30E-01	1,040	1.16E-02	1.40E-10
LEC33.40.9.Si15.9	15	3.89E-05	20.1	0.991	2.01E-02	94	3.72E-03	171	9.69E-03	13,000	1.32E-01	921	1.04E-02	6.52E-11
ORLEC33 40 °C 25 ppm Si														
LEC33.40.9.Si25B.Blank1	25	3.56E-05	---	---	---	34	---	[25.2]	---	22,900	---	[44.7]	---	---
LEC33.40.9.Si25B.Blank2	25	3.83E-05	---	---	---	34	---	[25.2]	---	25,100	---	[44.7]	---	---
LEC33.40.9.Si25B.Blank3	25	3.68E-05	0.0	---	---	31	---	[25.2]	---	24,500	---	[44.7]	---	---
LEC33.40.9.Si25B.1	25	3.74E-05	2.1	0.999	2.02E-02	109	4.13E-03	403	2.18E-02	24,000	2.33E-01	3,590	3.89E-02	1.47E-09
LEC33.40.9.Si25B.2	25	3.71E-05	5.1	0.998	2.02E-02	114	4.28E-03	383	2.06E-02	21,600	2.08E-01	2,860	3.08E-02	8.75E-10
LEC33.40.9.Si25B.3	25	3.62E-05	7.2	0.997	2.02E-02	111	4.07E-03	299	1.57E-02	21,300	2.00E-01	2,040	2.14E-02	4.93E-10
LEC33.40.9.Si25B.4	25	3.88E-05	9.1	0.997	2.02E-02	113	4.45E-03	275	1.55E-02	22,500	2.27E-01	1,760	1.98E-02	3.74E-10
LEC33.40.9.Si25B.5	25	3.75E-05	12.0	0.996	2.02E-02	108	4.12E-03	251	1.37E-02	22,600	2.20E-01	1,640	1.79E-02	3.62E-10
LEC33.40.9.Si25B.6	25	3.85E-05	14.1	0.995	2.02E-02	106	4.15E-03	256	1.43E-02	22,400	2.24E-01	1,410	1.58E-02	1.26E-10
LEC33.40.9.Si25B.7	25	3.66E-05	16.1	0.995	2.01E-02	98	3.65E-03	249	1.32E-02	21,800	2.08E-01	1,200	1.28E-02	< 0
ORLEC33 40 °C 35 ppm Si														
LEC33.40.9.Si35B.Blank1	35	3.61E-05	---	---	---	29	---	[25.2]	---	28,700	---	49	---	---
LEC33.40.9.Si35B.Blank2	35	3.80E-05	---	---	---	29	---	[25.2]	---	30,500	---	[44.7]	---	---
LEC33.40.9.Si35B.Blank3	35	3.63E-05	0.0	---	---	29	---	[25.2]	---	30,500	---	[44.7]	---	---
LEC33.40.9.Si35B.1	35	3.56E-05	2.1	0.999	2.02E-02	93	3.36E-03	353	1.82E-02	31,400	2.90E-01	3,410	3.52E-02	1.46E-09
LEC33.40.9.Si35B.2	35	3.56E-05	5.1	0.998	2.02E-02	99	3.57E-03	377	1.94E-02	32,500	3.00E-01	2,700	2.79E-02	7.25E-10
LEC33.40.9.Si35B.3	35	3.46E-05	7.2	0.997	2.02E-02	91	3.19E-03	327	1.64E-02	32,600	2.93E-01	2,040	2.05E-02	3.52E-10
LEC33.40.9.Si35B.4	35	3.58E-05	9.1	0.997	2.02E-02	83	3.02E-03	324	1.68E-02	28,500	2.65E-01	1,770	1.84E-02	1.35E-10
LEC33.40.9.Si35B.5	35	3.60E-05	12.0	0.995	2.02E-02	84	3.06E-03	328	1.72E-02	23,100	2.16E-01	1,690	1.77E-02	4.66E-11
LEC33.40.9.Si35B.6	35	3.60E-05	14.1	0.995	2.01E-02	87	3.17E-03	327	1.71E-02	23,300	2.18E-01	1,570	1.64E-02	< 0

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
ORLEC33 40 °C 50 ppm Si														
LEC33.40.9.50Si.Blank1	50	1.64E-05	---	---	---	42	---	[25.2]	---	44,700	---	[44.7]	---	---
LEC33.40.9.50Si.Blank2	50	2.63E-05	---	---	---	40	---	[25.2]	---	45,800	---	[44.7]	---	---
LEC33.40.9.50Si.Blank3	50	2.40E-05	0.0	---	---	44	---	[25.2]	---	45,600	---	[44.7]	---	---
LEC33.40.9.50Si.2	50	3.41E-05	6.9	0.660	1.33E-02	49	2.55E-03	139	1.04E-02	46,600	6.23E-01	1,210	1.81E-02	6.63E-10
LEC33.40.9.50Si.3	50	3.45E-05	8.9	0.660	1.33E-02	66	3.50E-03	152	1.15E-02	46,300	6.27E-01	1,050	1.59E-02	3.79E-10
LEC33.40.9.50Si.4	50	3.45E-05	12.9	0.659	1.33E-02	45	2.39E-03	158	1.20E-02	47,100	6.39E-01	1,020	1.55E-02	3.01E-10
LEC33.40.9.50Si.5	50	3.31E-05	16.0	0.658	1.33E-02	63	3.22E-03	187	1.36E-02	46,700	6.08E-01	970	1.41E-02	4.51E-11
LEC33.40.9.50Si.6	50	3.64E-05	19.9	0.657	1.33E-02	44	2.46E-03	173	1.39E-02	46,400	6.65E-01	1,010	1.62E-02	2.01E-10
LEC33.40.9.50Si.7	50	3.77E-05	22.9	0.657	1.33E-02	61	3.55E-03	203	1.68E-02	46,000	6.82E-01	1,040	1.73E-02	3.72E-11
LEC33.40.9.50Si.7	50	3.77E-05	22.9	0.657	1.33E-02	61	3.55E-03	203	1.68E-02	46,000	6.82E-01	1,040	1.73E-02	3.72E-11
LEC33.40.9.50Si.8	50	3.82E-05	27.0	0.656	1.33E-02	43	2.55E-03	203	1.71E-02	46,000	6.92E-01	1,120	1.89E-02	1.53E-10
LEC33.40.9.50Si.9	50	3.79E-05	29.9	0.655	1.33E-02	45	2.61E-03	213	1.78E-02	47,000	7.02E-01	1,210	2.02E-02	2.10E-10
LEC33.40.9.50Si.10	50	3.80E-05	34.0	0.654	1.33E-02	47	2.75E-03	220	1.84E-02	48,000	7.19E-01	1,260	2.11E-02	2.32E-10
ORLEC33 70 °C 1 ppm Si														
LEC33.70.9.1Si.Blank1	1	1.37E-05	---	---	---	[16.5]	---	[25.2]	---	969	---	55	---	---
LEC33.70.9.1Si.Blank2	1	2.10E-05	---	---	---	[16.5]	---	[25.2]	---	953	---	[44.7]	---	---
LEC33.70.9.1Si.Blank3	1	2.02E-05	0.0	---	---	[16.5]	---	[25.2]	---	968	---	[44.7]	---	---
LEC33.70.9.1Si.2	1	3.51E-05	4.9	0.449	9.10E-03	545	4.31E-02	660	7.46E-02	3,480	7.04E-02	4,160	9.42E-02	1.68E-09
LEC33.70.9.1Si.3	1	3.50E-05	7.1	0.448	9.09E-03	573	4.52E-02	454	5.12E-02	3,370	6.80E-02	2,820	6.37E-02	1.07E-09
LEC33.70.9.1Si.4	1	3.44E-05	8.9	0.448	9.08E-03	529	4.09E-02	356	3.94E-02	3,450	6.83E-02	2,260	5.01E-02	9.17E-10
LEC33.70.9.1Si.5	1	3.45E-05	12.9	0.446	9.06E-03	568	4.43E-02	362	4.04E-02	3,350	6.69E-02	2,020	4.51E-02	4.07E-10
LEC33.70.9.1Si.6	1	3.39E-05	14.2	0.446	9.06E-03	539	4.13E-02	367	4.02E-02	3,430	6.73E-02	1,880	4.13E-02	8.86E-11
LEC33.70.9.1Si.7	1	3.43E-05	16.1	0.445	9.05E-03	571	4.43E-02	397	4.40E-02	3,370	6.69E-02	1,960	4.35E-02	< 0
LEC33.70.9.1Si.8	1	3.47E-05	18.9	0.444	9.03E-03	523	4.11E-02	392	4.41E-02	3,370	6.78E-02	1,850	4.16E-02	< 0
LEC33.70.9.1Si.9	1	3.46E-05	22.9	0.442	9.01E-03	567	4.46E-02	455	5.12E-02	3,530	7.10E-02	1,970	4.44E-02	< 0
LEC33.70.9.1Si.11	1	3.53E-05	26.0	0.440	8.98E-03	576	4.64E-02	482	5.55E-02	3,610	7.44E-02	2,080	4.79E-02	< 0
LEC33.70.9.1Si.12	1	3.52E-05	28.0	0.439	8.97E-03	588	4.73E-02	483	5.55E-02	3,600	7.41E-02	2,130	4.90E-02	< 0
LEC33.70.9.1Si.13	1	3.70E-05	29.1	0.439	8.97E-03	575	4.85E-02	484	5.84E-02	3,560	7.69E-02	2,120	5.12E-02	< 0
ORLEC33 70 °C 5 ppm Si														
LEC33.70.9.5Si.Blank2	5	1.83E-05	---	---	---	[16.5]	---	[25.2]	---	3,540	---	[44.7]	---	---
LEC33.70.9.5Si.Blank3	5	2.28E-05	0.0	---	---	[16.5]	---	[25.2]	---	3,910	---	[44.7]	---	---
LEC33.70.9.5Si.2	5	3.57E-05	4.9	0.440	8.98E-03	468	3.81E-02	1,960	2.28E-01	6,650	1.39E-01	9,170	2.14E-01	< 0
LEC33.70.9.5Si.3	5	3.51E-05	7.1	0.436	8.93E-03	440	3.54E-02	2,020	2.32E-01	6,280	1.29E-01	8,960	2.06E-01	< 0

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.70.9.5Si.4	5	3.54E-05	8.9	0.433	8.89E-03	360	2.93E-02	1,830	2.13E-01	6,230	1.30E-01	8,160	1.90E-01	< 0
LEC33.70.9.5Si.5	5	3.53E-05	12.9	0.424	8.76E-03	333	2.75E-02	1,790	2.11E-01	5,810	1.23E-01	7,830	1.85E-01	< 0
LEC33.70.9.5Si.6	5	3.56E-05	14.2	0.424	8.77E-03	262	2.18E-02	1,630	1.94E-01	5,820	1.24E-01	7,340	1.75E-01	< 0
LEC33.70.9.5Si.7	5	3.61E-05	16.1	0.420	8.71E-03	293	2.48E-02	1,690	2.05E-01	5,700	1.24E-01	7,570	1.84E-01	< 0
LEC33.70.9.5Si.8	5	3.58E-05	18.9	0.415	8.64E-03	237	2.01E-02	1,520	1.84E-01	5,710	1.24E-01	7,210	1.75E-01	< 0
LEC33.70.9.5Si.10	5	3.63E-05	22.9	0.410	8.57E-03	211	1.83E-02	1,490	1.85E-01	5,720	1.27E-01	6,960	1.73E-01	< 0
LEC33.70.9.5Si.11	5	3.75E-05	26.0	0.404	8.48E-03	215	1.95E-02	1,500	1.94E-01	5,710	1.32E-01	6,830	1.77E-01	< 0
LEC33.70.9.5Si.12	5	3.68E-05	28.0	0.402	8.45E-03	214	1.91E-02	1,450	1.85E-01	5,570	1.27E-01	6,730	1.72E-01	< 0
LEC33.70.9.5Si.13	5	3.73E-05	29.1	0.400	8.44E-03	208	1.88E-02	1,430	1.85E-01	5,620	1.30E-01	6,510	1.69E-01	< 0
ORLEC33 70 °C 15 ppm Si														
LEC33.70.9.Si15.Blank1	15	3.64E-05	---	---	---	17	---	[25.2]	---	13,300	---	[44.7]	---	---
LEC33.70.9.Si15.Blank2	15	3.73E-05	---	---	---	18	---	[25.2]	---	13,300	---	[44.7]	---	---
LEC33.70.9.Si15.Blank3	15	3.68E-05	0.0	---	---	17	---	[25.2]	---	13,600	---	[44.7]	---	---
LEC33.70.9.Si15.1	15	3.71E-05	2.2	0.442	8.99E-03	483	4.09E-02	2,490	3.01E-01	15,300	3.31E-01	12,600	3.05E-01	3.40E-10
LEC33.70.9.Si15.2	15	3.75E-05	5.1	0.429	8.81E-03	654	5.70E-02	3,270	4.08E-01	16,100	3.59E-01	15,500	3.87E-01	< 0
LEC33.70.9.Si15.3	15	3.65E-05	7.2	0.424	8.75E-03	594	5.08E-02	2,890	3.53E-01	15,800	3.46E-01	13,700	3.35E-01	< 0
LEC33.70.9.Si15.4	15	3.93E-05	8.2	0.423	8.74E-03	531	4.89E-02	2,580	3.40E-01	15,500	3.65E-01	12,500	3.29E-01	< 0
LEC33.70.9.Si15.5	15	3.55E-05	9.1	0.421	8.71E-03	523	4.37E-02	2,550	3.04E-01	15,600	3.33E-01	12,300	2.94E-01	< 0
ORLEC33 70 °C 25 ppm Si														
LEC33.70.9.Si25.Blank1	25	3.63E-05	---	---	---	24	---	[25.2]	---	23,600	---	[44.7]	---	---
LEC33.70.9.Si25.Blank2	25	3.81E-05	---	---	---	27	---	[25.2]	---	25,900	---	[44.7]	---	---
LEC33.70.9.Si25.Blank3	25	3.80E-05	0.0	---	---	25	---	[25.2]	---	25,400	---	[44.7]	---	---
LEC33.70.9.Si25.1	25	3.69E-05	2.2	0.439	8.96E-03	365	3.08E-02	3,100	3.74E-01	25,500	5.50E-01	14,800	3.57E-01	< 0
LEC33.70.9.Si25.2	25	3.65E-05	5.1	0.425	8.76E-03	501	4.28E-02	3,800	4.64E-01	24,000	5.24E-01	17,600	4.30E-01	< 0
LEC33.70.9.Si25.3	25	2.99E-05	7.2	0.421	8.71E-03	511	3.59E-02	3,550	3.57E-01	23,800	4.28E-01	16,300	3.28E-01	< 0
LEC33.70.9.Si25.4	25	3.06E-05	8.2	0.420	8.69E-03	500	3.60E-02	3,340	3.44E-01	24,200	4.46E-01	15,900	3.28E-01	< 0
LEC33.70.9.Si25.5	25	2.84E-05	9.1	0.418	8.66E-03	480	3.22E-02	3,440	3.30E-01	25,200	4.32E-01	15,600	3.00E-01	< 0
ORLEC33 70 °C 50 ppm Si														
LEC33.70.9.50Si.Blank1	50	7.07E-06	---	---	---	32	---	[25.2]	---	46,000	---	134	---	---
LEC33.70.9.50Si.Blank2	50	2.12E-05	---	---	---	32	---	[25.2]	---	46,100	---	79	---	---
LEC33.70.9.50Si.Blank3	50	2.26E-05	0.0	---	---	29	---	[25.2]	---	46,200	---	82	---	---
LEC33.70.9.50Si.2	50	3.63E-05	4.9	0.433	8.88E-03	142	1.19E-02	3,040	3.63E-01	47,600	1.02E+00	13,100	3.13E-01	< 0
LEC33.70.9.50Si.3	50	3.61E-05	7.1	0.428	8.82E-03	132	1.11E-02	2,770	3.32E-01	46,500	9.98E-01	12,300	2.95E-01	< 0
LEC33.70.9.50Si.4	50	3.67E-05	8.9	0.424	8.77E-03	107	9.18E-03	2,360	2.89E-01	47,400	1.04E+00	10,600	2.60E-01	< 0

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.70.9.50Si.5	50	3.61E-05	12.9	0.413	8.61E-03	118	1.01E-02	2,140	2.63E-01	46,200	1.01E+00	9,770	2.40E-01	< 0
LEC33.70.9.50Si.6	50	3.64E-05	14.2	0.414	8.62E-03	95	8.20E-03	1,870	2.31E-01	47,200	1.04E+00	8,550	2.11E-01	< 0
LEC33.70.9.50Si.7	50	3.61E-05	16.1	0.409	8.56E-03	112	9.68E-03	1,890	2.34E-01	46,800	1.03E+00	8,850	2.19E-01	< 0
LEC33.70.9.50Si.8	50	3.53E-05	18.9	0.404	8.48E-03	92	7.81E-03	1,690	2.06E-01	47,400	1.03E+00	7,900	1.93E-01	< 0
LEC33.70.9.50Si.11	50	3.72E-05	26.0	0.390	8.28E-03	81	7.41E-03	1,770	2.33E-01	47,100	1.11E+00	7,960	2.09E-01	< 0
LEC33.70.9.50Si.12	50	3.71E-05	28.0	0.388	8.26E-03	67	6.16E-03	1,320	1.73E-01	47,500	1.12E+00	5,930	1.56E-01	< 0
LEC33.70.9.50Si.13	50	3.77E-05	29.1	0.387	8.25E-03	66	6.14E-03	1,220	1.63E-01	47,800	1.15E+00	5,580	1.50E-01	< 0
ORLEC33 70 °C 75 ppm Si														
LEC33.70.9.75Si.Blank1	75	2.39E-05	---	---	---	43	---	[25.2]	---	69,100	---	135	---	---
LEC33.70.9.75Si.Blank2	75	2.47E-05	---	---	---	47	---	[25.2]	---	69,400	---	125	---	---
LEC33.70.9.75Si.Blank3	75	2.37E-05	0.0	---	---	54	---	[25.2]	---	69,100	---	125	---	---
LEC33.70.9.75Si.2	75	3.43E-05	4.9	0.432	8.88E-03	94	7.40E-03	3,580	4.05E-01	70,400	1.42E+00	15,800	3.58E-01	< 0
LEC33.70.9.75Si.3	75	3.46E-05	7.1	0.427	8.81E-03	103	8.28E-03	3,140	3.61E-01	76,000	1.56E+00	13,800	3.18E-01	< 0
LEC33.70.9.75Si.4	75	3.52E-05	8.9	0.423	8.76E-03	79	6.47E-03	2,690	3.16E-01	70,000	1.47E+00	12,800	3.01E-01	< 0
LEC33.70.9.75Si.5	75	3.39E-05	12.9	0.410	8.59E-03	91	7.34E-03	2,460	2.84E-01	70,200	1.45E+00	11,500	2.66E-01	< 0
LEC33.70.9.75Si.6	75	3.45E-05	14.2	0.411	8.60E-03	73	6.02E-03	2,100	2.46E-01	69,700	1.46E+00	10,100	2.37E-01	< 0
LEC33.70.9.75Si.7	75	3.49E-05	16.1	0.407	8.53E-03	87	7.30E-03	2,060	2.47E-01	69,800	1.50E+00	9,870	2.37E-01	< 0
LEC33.70.9.75Si.8	75	3.38E-05	18.9	0.401	8.45E-03	72	5.89E-03	1,860	2.18E-01	71,700	1.50E+00	9,030	2.12E-01	< 0
LEC33.70.9.75Si.12	75	3.24E-05	28.0	0.386	8.25E-03	76	6.08E-03	1,790	2.06E-01	73,000	1.50E+00	8,640	1.99E-01	< 0
ORLEC33 90 °C 1 ppm Si														
LEC33.90.9.1Si.Blank1	1	1.39E-05	---	---	---	[16.5]	---	[25.2]	---	1,280	---	73	---	---
LEC33.90.9.1Si.Blank2	1	2.54E-05	---	---	---	20	---	[25.2]	---	1,030	---	[44.7]	---	---
LEC33.90.9.1Si.Blank3	1	2.55E-05	0.0	---	---	[16.5]	---	[25.2]	---	1,020	---	[44.7]	---	---
LEC33.90.9.1Si.2	1	3.91E-05	4.9	0.105	2.22E-03	731	2.63E-01	2,220	1.14E+00	3,910	3.61E-01	10,600	1.09E+00	< 0
LEC33.90.9.1Si.3	1	3.87E-05	7.1	0.102	2.19E-03	530	1.92E-01	1,720	8.89E-01	3,220	2.98E-01	7,910	8.19E-01	< 0
LEC33.90.9.1Si.4	1	3.90E-05	9.1	0.100	2.16E-03	513	1.90E-01	1,320	6.99E-01	2,980	2.82E-01	6,560	6.96E-01	< 0
LEC33.90.9.1Si.5	1	3.90E-05	12.9	0.094	2.07E-03	415	1.60E-01	1,060	5.84E-01	2,620	2.58E-01	5,380	5.93E-01	8.13E-10
LEC33.90.9.1Si.6	1	3.92E-05	14.2	0.095	2.08E-03	452	1.74E-01	838	4.61E-01	2,710	2.67E-01	4,920	5.42E-01	6.95E-09
LEC33.90.9.1Si.7	1	3.92E-05	16.1	0.093	2.06E-03	412	1.61E-01	742	4.14E-01	2,650	2.65E-01	4,170	4.66E-01	4.45E-09
LEC33.90.9.1Si.8	1	3.82E-05	18.9	0.091	2.02E-03	405	1.57E-01	628	3.47E-01	2,590	2.56E-01	3,500	3.88E-01	3.46E-09
LEC33.90.9.1Si.9	1	3.95E-05	20.9	0.090	2.01E-03	387	1.55E-01	506	2.91E-01	2,460	2.53E-01	3,050	3.51E-01	5.16E-09
LEC33.90.9.1Si.10	1	3.90E-05	22.1	0.090	2.01E-03	356	1.41E-01	456	2.59E-01	2,400	2.44E-01	2,610	2.97E-01	3.25E-09
ORLEC33 90 °C 5 ppm Si														
LEC33.90.9.5Si.Blank2	5	2.21E-05	---	---	---	[16.5]	---	[25.2]	---	3,660	---	[44.7]	---	---

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.90.9.5Si.Blank3	5	2.38E-05	0.0	---	---	[16.5]	---	[25.2]	---	4,020	---	[44.7]	---	---
LEC33.90.9.5Si.2	5	3.83E-05	4.9	0.101	2.16E-03	585	2.13E-01	2,500	1.30E+00	6,990	6.50E-01	11,600	1.21E+00	< 0
LEC33.90.9.5Si.3	5	3.86E-05	7.1	0.099	2.12E-03	401	1.49E-01	1,860	9.90E-01	6,991	6.66E-01	8,740	9.32E-01	< 0
LEC33.90.9.5Si.4	5	3.89E-05	9.1	0.096	2.08E-03	365	1.40E-01	1,440	7.88E-01	6,992	6.84E-01	7,230	7.92E-01	3.56E-10
LEC33.90.9.5Si.5	5	3.83E-05	12.9	0.090	2.00E-03	298	1.17E-01	1,180	6.63E-01	6,993	7.03E-01	5,830	6.56E-01	< 0
LEC33.90.9.5Si.6	5	3.82E-05	14.2	0.090	2.00E-03	301	1.18E-01	967	5.40E-01	6,994	6.99E-01	5,620	6.29E-01	7.60E-09
LEC33.90.9.5Si.7	5	3.86E-05	16.1	0.088	1.97E-03	285	1.14E-01	860	4.93E-01	6,995	7.17E-01	4,740	5.44E-01	4.38E-09
LEC33.90.9.5Si.8	5	3.85E-05	18.9	0.086	1.93E-03	274	1.12E-01	729	4.25E-01	6,996	7.29E-01	4,120	4.80E-01	4.80E-09
LEC33.90.9.5Si.9	5	3.87E-05	20.9	0.085	1.92E-03	253	1.04E-01	613	3.62E-01	6,997	7.39E-01	3,530	4.17E-01	4.76E-09
LEC33.90.9.5Si.10	5	3.89E-05	22.1	0.084	1.91E-03	242	1.01E-01	549	3.27E-01	5,740	6.12E-01	3,290	3.92E-01	5.61E-09
ORLEC33 90 °C 25 ppm Si														
LEC33.90.9.Si25.Blank1	25	3.63E-05	---	---	---	[16.5]	---	[25.2]	---	19,000	---	[44.7]	---	---
LEC33.90.9.Si25.Blank2	25	3.90E-05	---	---	---	18	---	[25.2]	---	19,500	---	[44.7]	---	---
LEC33.90.9.Si25.Blank3	25	3.88E-05	0.0	---	---	19	---	[25.2]	---	19,500	---	[44.7]	---	---
LEC33.90.9.Si25.1	25	3.88E-05	2.2	0.100	2.08E-03	523	2.00E-01	2,850	1.56E+00	21,600	2.11E+00	13,800	1.51E+00	< 0
LEC33.90.9.Si25.2	25	3.93E-05	5.2	0.090	1.95E-03	557	2.30E-01	2,530	1.50E+00	21,500	2.27E+00	12,600	1.49E+00	< 0
LEC33.90.9.Si25.3	25	3.89E-05	7.3	0.088	1.92E-03	432	1.79E-01	1,710	1.01E+00	21,100	2.23E+00	8,950	1.06E+00	4.17E-09
LEC33.90.9.Si25.4	25	3.85E-05	8.2	0.088	1.92E-03	366	1.50E-01	1,340	7.86E-01	20,600	2.16E+00	7,070	8.30E-01	3.81E-09
LEC33.90.9.Si25.5	25	3.96E-05	9.1	0.087	1.90E-03	371	1.58E-01	1,270	7.74E-01	22,200	2.42E+00	7,150	8.72E-01	8.46E-09
ORLEC33 90 °C 50 ppm Si														
LEC33.90.9.50Si.Blank1	50	1.38E-05	---	---	---	25	---	[25.2]	---	46,700	---	105	---	---
LEC33.90.9.50Si.Blank2	50	2.24E-05	---	---	---	25	---	[25.2]	---	47,300	---	96	---	---
LEC33.90.9.50Si.Blank3	50	2.19E-05	0.0	---	---	27	---	[25.2]	---	48,300	---	95	---	---
LEC33.90.9.50Si.2	50	3.93E-05	4.9	0.098	2.11E-03	254	9.68E-02	2,950	1.61E+00	49,800	4.86E+00	13,700	1.49E+00	< 0
LEC33.90.9.50Si.3	50	3.89E-05	7.1	0.095	2.08E-03	205	7.87E-02	2,060	1.13E+00	49,801	4.89E+00	9,980	1.10E+00	< 0
LEC33.90.9.50Si.4	50	3.99E-05	9.1	0.092	2.03E-03	175	7.04E-02	1,560	8.97E-01	49,802	5.13E+00	8,170	9.41E-01	3.75E-09
LEC33.90.9.50Si.5	50	3.97E-05	12.9	0.086	1.94E-03	166	6.95E-02	1,150	6.88E-01	49,803	5.33E+00	6,380	7.65E-01	6.55E-09
LEC33.90.9.50Si.6	50	3.99E-05	14.2	0.087	1.95E-03	153	6.40E-02	893	5.34E-01	49,804	5.33E+00	5,770	6.91E-01	1.35E-08
LEC33.90.9.50Si.7	50	3.95E-05	16.1	0.085	1.92E-03	146	6.14E-02	780	4.69E-01	49,805	5.36E+00	4,860	5.85E-01	9.98E-09
LEC33.90.9.50Si.8	50	3.87E-05	18.9	0.083	1.89E-03	140	5.87E-02	652	3.91E-01	49,806	5.34E+00	4,200	5.04E-01	9.73E-09
LEC33.90.9.50Si.9	50	9.45E-06	20.9	0.083	1.90E-03	141	1.44E-02	596	8.69E-02	49,000	1.28E+00	3,840	1.12E-01	2.16E-09
LEC33.90.9.50Si.10	50	4.91E-06	22.1	0.083	1.90E-03	234	1.24E-02	1,120	8.49E-02	49,900	6.77E-01	6,470	9.82E-02	1.14E-09
ORLEC33 90 °C 75 ppm Si														
LEC33.90.9.75Si.Blank1	75	1.89E-05	---	---	---	35	---	[25.2]	---	70,500	---	125	---	---

Sample ID	Influent [Si] (ppm)	Flow Rate, q (m ³ d ⁻¹)	Time (d)	Glass Mass (g)	Surface Area, S (m ²)	[Al] (µg L ⁻¹)	Al Norm. Diss. Rate (g m ⁻² d ⁻¹)	[B] (µg L ⁻¹)	B Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Si] (µg L ⁻¹)	Si Norm. Diss. Rate (g m ⁻² d ⁻¹)	[Na] (µg L ⁻¹)	Na Norm. Diss. Rate, r (g m ⁻² d ⁻¹)	r _{EX} (mol Na ⁻² s ⁻¹)
LEC33.90.9.75Si.Blank2	75	2.12E-05	---	---	---	41	---	[25.2]	---	70,400	---	124	---	---
LEC33.90.9.75Si.Blank3	75	2.11E-05	0.0	---	---	36	---	[25.2]	---	71,200	---	126	---	---
LEC33.90.9.75Si.2	75	3.53E-05	4.9	0.098	2.12E-03	146	4.97E-02	3,210	1.56E+00	73,200	6.37E+00	14,800	1.44E+00	< 0
LEC33.90.9.75Si.3	75	3.17E-05	7.1	0.096	2.09E-03	151	4.68E-02	2,470	1.09E+00	70,600	5.60E+00	11,800	1.05E+00	< 0
LEC33.90.9.75Si.4	75	3.10E-05	9.1	0.093	2.05E-03	134	4.15E-02	2,000	8.85E-01	73,600	5.83E+00	10,400	9.22E-01	3.13E-09
LEC33.90.9.75Si.5	75	3.05E-05	12.9	0.087	1.96E-03	155	4.94E-02	1,510	6.88E-01	69,500	5.66E+00	8,160	7.44E-01	4.84E-09
LEC33.90.9.75Si.6	75	2.84E-05	14.2	0.088	1.97E-03	136	4.01E-02	1,180	4.98E-01	73,600	5.56E+00	7,420	6.27E-01	1.11E-08
LEC33.90.9.75Si.7	75	2.90E-05	16.1	0.086	1.94E-03	129	3.94E-02	1,070	4.67E-01	74,500	5.82E+00	3,590	3.14E-01	< 0
LEC33.90.9.75Si.8	75	2.73E-05	18.9	0.084	1.91E-03	128	3.76E-02	903	3.79E-01	74,500	5.59E+00	5,660	4.75E-01	8.30E-09
LEC33.90.9.75Si.9	75	2.69E-05	20.9	0.083	1.90E-03	118	3.42E-02	767	3.18E-01	74,200	5.51E+00	4,970	4.13E-01	8.13E-09
LEC33.90.9.75Si.10	75	2.65E-05	22.1	0.083	1.89E-03	114	3.27E-02	690	2.83E-01	74,700	5.49E+00	4,690	3.86E-01	8.78E-09
ORLEC33 90 °C 100 ppm Si														
LEC33.90.9.100Si.Blank1	100	1.95E-05	---	---	---	47	---	[25.2]	---	93,800	---	204	---	---
LEC33.90.9.100Si.Blank2	100	2.58E-05	---	---	---	46	---	[25.2]	---	94,100	---	196	---	---
LEC33.90.9.100Si.Blank3	100	2.48E-05	0.0	---	---	43	---	[25.2]	---	95,600	---	183	---	---
LEC33.90.9.100Si.2	100	4.05E-05	4.9	0.097	2.09E-03	90	3.58E-02	2,950	1.67E+00	97,700	9.90E+00	13,700	1.55E+00	< 0
LEC33.90.9.100Si.3	100	4.01E-05	7.1	0.094	2.06E-03	110	4.38E-02	2,030	1.16E+00	94,800	9.67E+00	10,000	1.14E+00	< 0
LEC33.90.9.100Si.4	100	4.00E-05	9.1	0.092	2.02E-03	83	3.36E-02	1,500	8.70E-01	98,800	1.03E+01	8,250	9.58E-01	7.56E-09
LEC33.90.9.100Si.5	100	4.10E-05	12.9	0.086	1.94E-03	112	4.85E-02	1,060	6.56E-01	93,600	1.04E+01	6,330	7.85E-01	1.10E-08
LEC33.90.9.100Si.6	100	4.18E-05	14.2	0.087	1.95E-03	90	3.97E-02	786	4.94E-01	99,200	1.12E+01	5,470	6.89E-01	1.67E-08
LEC33.90.9.100Si.7	100	4.23E-05	16.1	0.085	1.92E-03	91	4.11E-02	674	4.35E-01	99,000	1.14E+01	4,490	5.80E-01	1.25E-08
LEC33.90.9.100Si.8	100	4.05E-05	18.9	0.083	1.89E-03	91	4.01E-02	566	3.56E-01	100,000	1.12E+01	3,970	5.00E-01	1.24E-08
LEC33.90.9.100Si.9	100	4.11E-05	20.9	0.082	1.88E-03	87	3.91E-02	474	3.04E-01	99,900	1.15E+01	3,430	4.40E-01	1.17E-08
LEC33.90.9.100Si.10	100	4.15E-05	22.1	0.082	1.87E-03	87	3.93E-02	414	2.69E-01	101,000	1.17E+01	3,110	4.04E-01	1.16E-08

Appendix E

Single-Pass Flow-Through (SPFT) Results for Rhenium

When the average measured value is below the EQL, the EQL value is provided in brackets. For the samples provided in this appendix, the EQL value is equal to the instrument detection limit.

Sample ID	Influent [Si] (ppm)	Time (d)	[Re] ($\mu\text{g L}^{-1}$)	Re Norm. Diss. Rate ($\text{g m}^{-2}\text{d}^{-1}$)	2 σ Re Rate Error
ORLEC28 23 °C pH(RT) 7 Reactor A					
LEC28.23.7A.Blank1		---	[0.0897]	---	---
LEC28.23.7A.Blank2		---	[0.0897]	---	---
LEC28.23.7A.Blank3		0.0	[0.0897]	---	---
LEC28.23.7A.2		6.9	2.810	3.90E-03	1.53E-03
LEC28.23.7A.4		13.8	1.370	2.00E-03	7.83E-04
LEC28.23.7A.6		20.9	0.860	1.31E-03	5.13E-04
LEC28.23.7A.7		23.9	0.824	1.36E-03	5.30E-04
LEC28.23.7A.8		27.8	0.655	1.14E-03	4.46E-04
LEC28.23.7A.9		30.8	0.710	1.02E-03	4.00E-04
LEC28.23.7A.10		34.9	0.709	9.84E-04	3.85E-04
LEC28.23.7A.11		38.1	0.684	1.03E-03	4.02E-04
LEC28.23.7A.12		41.9	0.668	9.85E-04	3.85E-04
LEC28.23.7A.13		44.9	0.591	8.82E-04	3.45E-04
ORLEC28 23 °C pH(RT) 7 Reactor B					
LEC28.23.7B.Blank1		---	[0.0897]	---	---
LEC28.23.7B.Blank2		---	[0.0897]	---	---
LEC28.23.7B.Blank3		0.0	[0.0897]	---	---
LEC28.23.7B.2		6.9	2.680	5.57E-03	2.04E-03
LEC28.23.7B.4		13.8	1.540	3.17E-03	1.16E-03
LEC28.23.7B.6		20.9	0.970	2.03E-03	7.44E-04
LEC28.23.7B.7		23.9	0.971	1.97E-03	7.24E-04
LEC28.23.7B.8		27.8	0.871	1.81E-03	6.64E-04
LEC28.23.7B.9		30.8	0.812	1.75E-03	6.41E-04
LEC28.23.7B.10		34.9	0.778	1.64E-03	6.00E-04
LEC28.23.7B.11		38.1	0.764	1.61E-03	5.91E-04
LEC28.23.7B.12		41.9	0.733	1.52E-03	5.57E-04
LEC28.23.7B.13		44.9	0.759	1.55E-03	5.70E-04
ORLEC28 23 °C pH(RT) 8 Reactor A					
LEC28.23.8A.Blank1		---	[0.0897]	---	---
LEC28.23.8A.Blank2		---	[0.0897]	---	---
LEC28.23.8A.Blank3		0.0	[0.0897]	---	---
LEC28.23.8A.2		6.9	1.490	3.34E-03	1.23E-03
LEC28.23.8A.4		13.8	0.696	1.53E-03	5.64E-04
LEC28.23.8A.6		20.9	0.652	1.42E-03	5.22E-04
LEC28.23.8A.7		23.9	0.567	1.25E-03	4.60E-04
LEC28.23.8A.8		27.8	0.606	1.33E-03	4.89E-04
LEC28.23.8A.9		30.8	0.550	1.21E-03	4.46E-04
LEC28.23.8A.10		34.9	0.560	1.20E-03	4.42E-04
LEC28.23.8A.11		38.1	0.531	1.13E-03	4.16E-04
LEC28.23.8A.12		41.9	0.584	1.24E-03	4.56E-04
LEC28.23.8A.13		44.9	0.520	1.08E-03	3.99E-04
ORLEC28 23 °C pH(RT) 8 Reactor B					
LEC28.23.8B.Blank1		---	[0.0897]	---	---
LEC28.23.8B.Blank2		---	[0.0897]	---	---
LEC28.23.8B.Blank3		0.0	[0.0897]	---	---
LEC28.23.8B.2		6.9	1.640	3.34E-03	1.22E-03
LEC28.23.8B.4		13.8	0.805	1.70E-03	6.24E-04

Sample ID	Influent [Si] (ppm)	Time (d)	[Re] ($\mu\text{g L}^{-1}$)	Re Norm. Diss. Rate ($\text{g m}^{-2}\text{d}^{-1}$)	2 σ Re Rate Error
LEC28.23.8B.6		20.9	0.644	1.35E-03	4.93E-04
LEC28.23.8B.7		23.9	0.622	1.29E-03	4.74E-04
LEC28.23.8B.8		27.8	0.597	1.24E-03	4.55E-04
LEC28.23.8B.9		30.8	0.540	1.12E-03	4.10E-04
LEC28.23.8B.10		34.9	0.563	1.19E-03	4.36E-04
LEC28.23.8B.11		38.1	0.505	1.05E-03	3.86E-04
LEC28.23.8B.12		41.9	0.488	1.03E-03	3.79E-04
LEC28.23.8B.13		44.9	0.464	9.48E-04	3.47E-04
ORLEC28 23 °C pH(RT) 9 Reactor A					
LEC28.23.9A.Blank1		---	[0.0897]	---	---
LEC28.23.9A.Blank2		---	[0.0897]	---	---
LEC28.23.9A.Blank3		0.0	[0.0897]	---	---
LEC28.23.9A.2		6.9	1.880	3.50E-03	1.30E-03
LEC28.23.9A.4		13.8	1.870	3.53E-03	1.31E-03
LEC28.23.9A.6		20.9	1.470	2.71E-03	1.01E-03
LEC28.23.9A.7		23.9	1.650	3.02E-03	1.12E-03
LEC28.23.9A.8		27.8	1.650	3.03E-03	1.13E-03
LEC28.23.9A.9		30.8	1.680	2.95E-03	1.09E-03
LEC28.23.9A.10		34.9	1.630	3.01E-03	1.12E-03
LEC28.23.9A.11		38.1	1.500	2.91E-03	1.08E-03
LEC28.23.9A.12		41.9	1.770	3.43E-03	1.27E-03
LEC28.23.9A.13		44.9	1.670	2.94E-03	1.09E-03
ORLEC28 23 °C pH(RT) 9 Reactor B					
LEC28.23.9B.Blank1		---	[0.0897]	---	---
LEC28.23.9B.Blank2		---	[0.0897]	---	---
LEC28.23.9B.Blank3		0.0	[0.0897]	---	---
LEC28.23.9B.2		6.9	1.780	3.39E-03	1.26E-03
LEC28.23.9B.4		13.8	2.070	4.13E-03	1.53E-03
LEC28.23.9B.6		20.9	1.490	2.89E-03	1.07E-03
LEC28.23.9B.7		23.9	1.560	2.94E-03	1.09E-03
LEC28.23.9B.8		27.8	1.710	3.25E-03	1.21E-03
LEC28.23.9B.9		30.8	1.590	2.96E-03	1.10E-03
LEC28.23.9B.10		34.9	1.610	3.09E-03	1.15E-03
LEC28.23.9B.11		38.1	1.570	3.10E-03	1.15E-03
LEC28.23.9B.12		41.9	1.660	3.31E-03	1.23E-03
LEC28.23.9B.13		44.9	1.660	2.97E-03	1.10E-03
ORLEC28 23 °C pH(RT) 10 Reactor A					
LEC28.23.10A.Blank1		---	[16.5]	---	
LEC28.23.10A.Blank2		---	[16.5]	---	
LEC28.23.10A.Blank3		0.0	[16.5]	---	
LEC28.23.10A.2		6.9	151	4.76E-03	
LEC28.23.10A.4		13.8	206	6.49E-03	
LEC28.23.10A.6		20.9	211	6.39E-03	
LEC28.23.10A.7		23.9	206	6.22E-03	
LEC28.23.10A.8		27.8	211	6.46E-03	
LEC28.23.10A.9		30.8	203	6.13E-03	
LEC28.23.10A.10		34.9	211	6.37E-03	
LEC28.23.10A.11		38.1	210	6.42E-03	

Sample ID	Influent [Si] (ppm)	Time (d)	[Re] ($\mu\text{g L}^{-1}$)	Re Norm. Diss. Rate ($\text{g m}^{-2}\text{d}^{-1}$)	2 σ Re Rate Error
LEC28.23.10A.12		41.8	212	6.42E-03	
LEC28.23.10A.13		44.9	197	5.96E-03	
ORLEC28 23 °C pH(RT) 10 Reactor B					
LEC28.23.10B.Blank1		---	[0.0897]	---	---
LEC28.23.10B.Blank2		---	[0.0897]	---	---
LEC28.23.10B.Blank3		0.0	[0.0897]	---	---
LEC28.23.10B.2		6.9	2.75	5.74E-03	2.13E-03
LEC28.23.10B.4		13.8	3.82	7.91E-03	2.92E-03
LEC28.23.10B.6		20.9	3.74	7.82E-03	2.89E-03
LEC28.23.10B.7		23.9	4.03	8.23E-03	3.04E-03
LEC28.23.10B.8		27.8	3.96	8.28E-03	3.06E-03
LEC28.23.10B.9		30.8	3.53	7.35E-03	2.72E-03
LEC28.23.10B.10		34.9	3.79	7.67E-03	2.84E-03
LEC28.23.10B.11		38.1	4.02	8.02E-03	2.96E-03
LEC28.23.10B.12		41.8	3.85	7.84E-03	2.90E-03
LEC28.23.10B.13		44.9	3.80	7.87E-03	2.91E-03
ORLEC28 23 °C pH(RT) 11 Reactor A					
LEC28.23.11A.Blank1		---	[0.0897]	---	---
LEC28.23.11A.Blank2		---	[0.0897]	---	---
LEC28.23.11A.Blank3		0.0	[0.0897]	---	---
LEC28.23.11A.2		6.9	3.27	4.40E-02	1.62E-02
LEC28.23.11A.4		13.8	3.10	4.15E-02	1.53E-02
LEC28.23.11A.6		20.9	2.77	3.74E-02	1.38E-02
LEC28.23.11A.7		23.9	3.01	4.04E-02	1.49E-02
LEC28.23.11A.8		27.8	2.91	3.95E-02	1.46E-02
LEC28.23.11A.9		30.8	2.74	3.75E-02	1.39E-02
LEC28.23.11A.10		34.9	2.64	3.59E-02	1.33E-02
LEC28.23.11A.11		38.1	2.59	3.58E-02	1.32E-02
LEC28.23.11A.12		41.8	2.81	3.83E-02	1.41E-02
LEC28.23.11A.13		44.9	2.76	3.77E-02	1.39E-02
ORLEC28 23 °C pH(RT) 11 Reactor B					
LEC28.23.11B.Blank1		---	[0.0897]	---	---
LEC28.23.11B.Blank2		---	[0.0897]	---	---
LEC28.23.11B.Blank3		0.0	[0.0897]	---	---
LEC28.23.11B.2		6.9	3.95	4.25E-02	1.61E-02
LEC28.23.11B.6		20.9	2.49	3.16E-02	1.21E-02
LEC28.23.11B.7		23.9	2.54	3.24E-02	1.23E-02
LEC28.23.11B.8		27.8	2.62	3.34E-02	1.28E-02
LEC28.23.11B.9		30.8	2.33	2.98E-02	1.14E-02
LEC28.23.11B.10		34.9	2.34	2.98E-02	1.14E-02
LEC28.23.11B.11		38.1	2.34	2.97E-02	1.13E-02
LEC28.23.11B.12		41.8	2.48	3.14E-02	1.20E-02
LEC28.23.11B.13		44.9	2.50	3.19E-02	1.22E-02
ORLEC28 23 °C pH(RT) 12 Reactor A					
LEC28.23.12A.Blank1		---	[0.0897]	---	---
LEC28.23.12A.Blank2		---	[0.0897]	---	---
LEC28.23.12A.Blank3		0.0	[0.0897]	---	---
LEC28.23.12A.2		6.9	5.39	1.51E-01	5.58E-02

Sample ID	Influent [Si] (ppm)	Time (d)	[Re] ($\mu\text{g L}^{-1}$)	Re Norm. Diss. Rate ($\text{g m}^{-2}\text{d}^{-1}$)	2 σ Re Rate Error
LEC28.23.12A.4		13.8	5.45	1.59E-01	5.86E-02
LEC28.23.12A.6		20.9	5.87	1.69E-01	6.24E-02
LEC28.23.12A.7		23.9	5.58	1.60E-01	5.91E-02
LEC28.23.12A.8		27.8	5.47	1.60E-01	5.91E-02
LEC28.23.12A.9		30.8	5.33	1.50E-01	5.53E-02
LEC28.23.12A.10		34.9	5.31	1.60E-01	5.90E-02
LEC28.23.12A.11		38.1	5.11	1.50E-01	5.54E-02
LEC28.23.12A.12		41.8	5.43	1.61E-01	5.93E-02
LEC28.23.12A.13		44.9	5.38	1.56E-01	5.78E-02
ORLEC28 23 °C pH(RT) 12 Reactor B					
LEC28.23.12B.Blank1		---	[0.0897]	---	---
LEC28.23.12B.Blank2		---	[0.0897]	---	---
LEC28.23.12B.Blank3		0.0	[0.0897]	---	---
LEC28.23.12B.2		6.9	5.85	1.49E-01	5.48E-02
LEC28.23.12B.4		13.8	6.16	1.60E-01	5.89E-02
LEC28.23.12B.6		20.9	6.11	1.60E-01	5.89E-02
LEC28.23.12B.7		23.9	6.16	1.59E-01	5.85E-02
LEC28.23.12B.8		27.8	6.09	1.61E-01	5.93E-02
LEC28.23.12B.9		30.8	6.60	1.77E-01	6.51E-02
LEC28.23.12B.10		34.9	6.06	1.65E-01	6.05E-02
LEC28.23.12B.11		38.1	6.04	1.62E-01	5.97E-02
LEC28.23.12B.12		41.8	6.35	1.71E-01	6.28E-02
LEC28.23.12B.13		44.9	5.94	1.62E-01	5.97E-02
ORLEC28 23 °C pH(RT) 9 1 ppm Si					
LEC28.23.9.1Si.Blank1	1	---	0.15	---	---
LEC28.23.9.1Si.Blank2	1	---	[0.0897]	---	---
LEC28.23.9.1Si.Blank3	1	0.00	[0.0897]	---	---
LEC28.23.9.1Si.2	1	4.86	1.53	2.71E-03	1.03E-03
LEC28.23.9.1Si.5	1	15.97	0.83	1.46E-03	5.72E-04
LEC28.23.9.1Si.8	1	26.98	0.84	1.50E-03	5.87E-04
LEC28.23.9.1Si.14	1	47.02	0.89	1.71E-03	6.67E-04
LEC28.23.9.1Si.17	1	57.88	0.86	1.65E-03	6.45E-04
ORLEC28 23 °C pH(RT) 9 5 ppm Si					
LEC28.23.9.5Si.Blank1	5	---	[0.0897]	---	---
LEC28.23.9.5Si.Blank2	5	---	[0.0897]	---	---
LEC28.23.9.5Si.Blank3	5	0.00	[0.0897]	---	---
LEC28.23.9.5Si.2	5	4.86	1.47	2.92E-03	1.09E-03
LEC28.23.9.5Si.5	5	15.97	0.70	1.36E-03	5.24E-04
LEC28.23.9.5Si.8	5	26.98	0.70	1.34E-03	5.18E-04
LEC28.23.9.5Si.14	5	47.02	0.65	1.20E-03	4.65E-04
LEC28.23.9.5Si.17	5	57.88	0.58	1.10E-03	4.30E-04
LEC28.23.9.5Si.18	5	61.90	0.63	1.20E-03	4.67E-04
ORLEC28 23 °C pH(RT) 9 15 ppm Si					
LEC28.23.9.15Si.Blank1	15	---	[0.0897]	---	---
LEC28.23.9.15Si.Blank2	15	---	[0.0897]	---	---
LEC28.23.9.15Si.Blank3	15	0.00	[0.0897]	---	---
LEC28.23.9.15Si.2	15	4.86	1.34	2.53E-03	1.01E-03
LEC28.23.9.15Si.5	15	15.97	0.47	9.00E-04	3.79E-04

Sample ID	Influent [Si] (ppm)	Time (d)	[Re] ($\mu\text{g L}^{-1}$)	Re Norm. Diss. Rate ($\text{g m}^{-2}\text{d}^{-1}$)	2 σ Re Rate Error
LEC28.23.9.15Si.8	15	26.98	0.39	7.49E-04	3.22E-04
LEC28.23.9.15Si.14	15	47.02	0.33	5.68E-04	2.51E-04
LEC28.23.9.15Si.17	15	57.88	0.33	5.11E-04	2.26E-04
LEC28.23.9.15Si.18	15	61.90	0.37	6.13E-04	2.66E-04
ORLEC28 90 °C pH(RT) 9 1 ppm Si					
LEC28.90.9.1Si.Blank1	1	---	[0.0897]	---	---
LEC28.90.9.1Si.Blank2	1	---	[0.0897]	---	---
LEC28.90.9.1Si.Blank3	1	0.00	[0.0897]	---	---
LEC28.90.9.1Si.2	1	4.94	11.50	2.33E-01	8.59E-02
LEC28.90.9.1Si.3	1	7.06			
LEC28.90.9.1Si.4	1	9.06	9.53	1.95E-01	7.19E-02
LEC28.90.9.1Si.5	1	12.94			
LEC28.90.9.1Si.6	1	14.19	8.81	1.85E-01	6.80E-02
LEC28.90.9.1Si.7	1	16.07	8.32	1.83E-01	6.76E-02
LEC28.90.9.1Si.8	1	18.95	8.17	1.73E-01	6.38E-02
LEC28.90.9.1Si.9	1	20.93	8.59	1.86E-01	6.84E-02
LEC28.90.9.1Si.10	1	22.06	9.36	1.98E-01	7.28E-02
ORLEC28 90 °C pH(RT) 9 5 ppm Si					
LEC28.90.9.5Si.Blank2	5	---	[0.0897]	---	---
LEC28.90.9.5Si.Blank3	5	0.00	[0.0897]	---	---
LEC28.90.9.5Si.2	5	4.94	8.28	1.77E-01	6.51E-02
LEC28.90.9.5Si.4	5	9.06	6.48	1.40E-01	5.15E-02
LEC28.90.9.5Si.6	5	14.19	5.42	1.23E-01	4.56E-02
LEC28.90.9.5Si.7	5	16.07	5.23	1.15E-01	4.26E-02
LEC28.90.9.5Si.8	5	18.95	5.41	1.19E-01	4.38E-02
LEC28.90.9.5Si.9	5	20.93	5.09	1.11E-01	4.11E-02
LEC28.90.9.5Si.10	5	22.06	5.66	1.24E-01	4.57E-02
ORLEC28 90 °C pH(RT) 9 50 ppm Si					
LEC28.90.9.50Si.Blank1	50	---	[0.0897]	---	---
LEC28.90.9.50Si.Blank2	50	---	[0.0897]	---	---
LEC28.90.9.50Si.Blank3	50	0.00	[0.0897]	---	---
LEC28.90.9.50Si.2	50	4.94	3.90	7.75E-02	2.87E-02
LEC28.90.9.50Si.4	50	9.06	2.10	4.20E-02	1.56E-02
LEC28.90.9.50Si.6	50	14.19	1.94	3.90E-02	1.45E-02
LEC28.90.9.50Si.7	50	16.07	1.89	4.01E-02	1.50E-02
LEC28.90.9.50Si.8	50	18.95	1.99	4.05E-02	1.51E-02
ORLEC28 90 °C pH(RT) 9 75 ppm Si					
LEC28.90.9.75Si.Blank1	75	---	[0.0897]	---	---
LEC28.90.9.75Si.Blank2	75	---	[0.0897]	---	---
LEC28.90.9.75Si.Blank3	75	0.00	[0.0897]	---	---
LEC28.90.9.75Si.2	75	4.94	3.39	7.26E-02	2.69E-02
LEC28.90.9.75Si.6	75	14.19	1.51	3.40E-02	1.27E-02
LEC28.90.9.75Si.7	75	16.07	0.78	1.87E-02	7.16E-03
LEC28.90.9.75Si.8	75	18.95	0.76	1.94E-02	7.43E-03
LEC28.90.9.75Si.9	75	20.93	0.73	1.99E-02	7.63E-03
LEC28.90.9.75Si.10	75	22.06	0.83	2.44E-02	9.33E-03
ORLEC28 90 °C pH(RT) 9 100 ppm Si					
LEC28.90.9.100Si.Blank1	100	---	0.186	---	---

Sample ID	Influent [Si] (ppm)	Time (d)	[Re] ($\mu\text{g L}^{-1}$)	Re Norm. Diss. Rate ($\text{g m}^{-2}\text{d}^{-1}$)	2σ Re Rate Error
LEC28.90.9.100Si.Blank2	100	---	0.150	---	---
LEC28.90.9.100Si.Blank3	100	0.00	0.141	---	---
LEC28.90.9.100Si.2	100	4.94	2.980	5.53E-02	2.22E-02
LEC28.90.9.100Si.4	100	9.06	0.889	1.73E-02	7.29E-03
LEC28.90.9.100Si.6	100	14.19	0.495	9.45E-03	4.34E-03
LEC28.90.9.100Si.7	100	16.07	0.502	9.71E-03	4.45E-03
LEC28.90.9.100Si.8	100	18.95	0.460	8.94E-03	4.19E-03
LEC28.90.9.100Si.9	100	20.93	0.483	9.16E-03	4.24E-03
LEC28.90.9.100Si.10	100	22.06	0.477	9.19E-03	4.27E-03

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