SGW-54848
Revision 0

Sampling Instruction for Characterization of Well 299-E25-236 during Decommissioning

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

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company
P.O. Box 1600
Richland, Washington 99352

Approved for Public Release;
Further Dissemination Unlimited

SGW-54848
Revision 0

Sampling Instruction for Characterization of Well 299-E25-236 during Decommissioning

Document Type: TR Program/Project: S&GRP

K. M. Whitley
CH2M HILL Plateau Remediation Company

Date Published
April 2013

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

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company
P.O. Box 1600
Richland, Washington 99352

APPROVED
By Julia R. Raymer at 1:03 pm, May 28, 2013

Release Approval Date

Approved for Public Release;
Further Dissemination Unlimited

TRADEMARK DISCLAIMER

Reference herein to any specific commercial product, process, or service by tradename, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

This report has been reproduced from the best available copy.

Printed in the United States of America

Contents

1 Introduction 1

1.1 Well Description and Current Status 1

2 Target Analytes 3

3 Sampling Design 3

3.1 Basic Design Elements 3

3.1.1 Sample Collection 3

3.1.2 Radiological Field Data 6

3.1.3 Corrective Actions and Deviations for Sampling Activities 7

3.2 Field Quality Control Sampling 7

3.3 Laboratory Quality Control Samples 7

3.4 Sample Handling, Shipping, and Custody Requirements 7

4 References 8

Figures

Figure 1. Location of Wells in WMA A-AX (prefix 299 removed from well names) 2

Figure 2. Casing Corrosion in Well 299-E25-236 (taken on November 8, 2012). 2

Figure 3. Shape Trap Device for Water Collection (not to scale) 4

Tables

Table 1. Water Sample Preservation, Container and Holding-Time Guidelines 5

Table 2. Sample Collection and Analysis Priorities Based Upon Sample Volume Collected 5

Table 3. Analytical Performance Requirements for Water Samples 6

Terms

ASAP	as soon as possible
bgs	below ground surface
EPA	U.S. Environmental Protection Agency
G	glass
HASQARD	*Hanford Analytical Services Quality Assurance Requirements Documents*
HEIS	Hanford Environmental Information System
IC	ion chromatography
ICP-MS	inductively coupled plasma mass spectrometry
LSC	liquid scintillation
N/A	not applicable
NTU	nephelometric turbidity unit
P	plastic
PNNL	Pacific Northwest National Laboratory
QC	quality control
RCRA	*Resource Conservation and Recovery Act*
Redox	reduction-oxidation
DOE/RL	U.S. Department of Energy, Richland Operations Office
SI	sampling instruction
SMR	Sample Management and Reporting
WMA	Waste Management Area

1 Introduction

These sampling instructions (SI) contribute to the ongoing assessment of accelerated casing corrosion evaluation within wells along the southeast boundary of Waste Management Area (WMA) A-AX . These SIs are designed to define the sample collection and analysis processes associated with potentially drainable porewater along the annulus of monitoring well 299-E25-236, at a depth within the well of 80.2 to 81.4 m (263 to 267 ft) below ground surface (bgs). This information will be used in determining the potential cause of the accelerated casing corrosion and in defining potential future monitoring assessment requirements. In addition, it will provide information for placement of the replacement well as required by 40 CFR 265.91(a)(2).

1.1 Well Description and Current Status

Monitoring well 299-E25-236 is within the WMA A-AX which was placed in assessment monitoring in 2005, due to elevated specific conductance observed in the groundwater monitoring network (Pacific Northwest National Laboratory, PNNL-15315). Well 299-E25-236 was installed in 2008 on the south side of the WMA (Figure 1) as a 10 cm (4 in.) resource protection well in accordance with Washington State Administrative Code (WAC)-173-160. The well replaced two nearby wells that also exhibited corrosion and subsequently were decommissioned (299-E24-19 and 299-E25-46). A study by PNNL (PNNL-15141) concluded that the chloride content in the bentonite material used in well construction along with high moisture content may have contributed to the accelerated casing corrosion at these two wells. However, other wells where bentonite has been used as the annular seal across a saturated zone have not shown evidence of casing corrosion. PNNL-15141 also indicated that the presence of Hanford liquid waste contaminants, technetium-99 and nitrate, could be another source of elevated chloride. As a precaution, PNNL-15141 recommended future well designs use Type I/II Portland cement, rather than bentonite, as the annular seal when completing wells in high moisture zones. Borehole logging of 299-E25-236 performed prior to well completion in 2008 showed an area of high moisture from 84.1 to 85.4 m (276 to 280 ft) bgs. Following PNNL's recommendation, Type I/II Portland cement was used for the annular seal rather than bentonite through the high moisture zone between 82 to 86.1 m (269 to 282.5 ft) bgs.

Over the past year, routine groundwater sampling of well 299-E25-236 showed increased concentrations of metals (chromium, iron, manganese, and nickel) indicative of well casing corrosion. On November 8, 2012, a video survey of the well casing was performed and reviewed confirming the presence of accelerated corrosion. The video showed casing degradation above the water table, between 80.2 and 81.4 m (263 and 267 ft) bgs. Small holes compromised the integrity of the casing creating a pathway for fluid movement into the casing and onto groundwater. Visible signs of oxidation in this interval and black staining from the corroded casing extend downward approximately 8.5 to 9.8 m (28 to 32 ft) to groundwater at 89.9 m (295 ft) bgs (Figure 2). This interval coincides with annular completion materials of bentonite above the cement and is approximately 2 meters above the previous saturated zone.

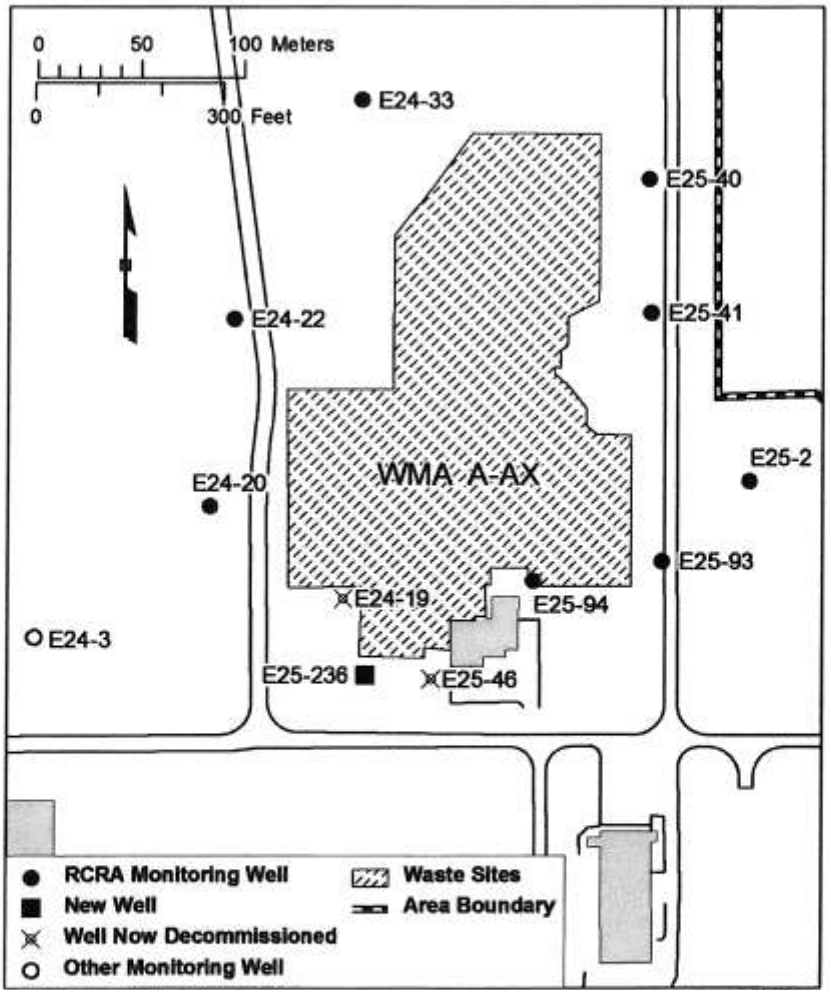

Figure 1. Location of Wells in WMA A-AX (prefix 299 removed from well names)

Figure 2. Casing Corrosion in Well 299-E25-236 (taken on November 8, 2012).

2 Target Analytes

The target analytes for this sampling event include technetium-99, chloride, pH, and tritium. These analytes were chosen for assessing the source of the corrosion, extent of elevated moisture, and the nature of the moisture zone. The presence of technetium-99 and/or tritium will provide evidence of contributions from a Hanford waste stream. Chloride and pH will provide a comparison of the nature of the corrosive liquid with past results from the adjacent wells.

3 Sampling Design

This section describes the site-specific sampling and analysis activities. Requirements for sample handling, custody, preservation, containers, holding times, field quality control (QC), field documentation, precision, and accuracy are summarized in the following sections.

3.1 Basic Design Elements

The goal of this sampling is to collect a sample of the drainable porewater from the depth at which the corrosion is occurring. Radionuclide and soil moisture content along the borehole will be evaluated from the ground surface to the point of cement completion (0 to 82 m [0 to 269 ft] bgs) by geophysical logging prior to well decommissioning. The borehole will be geophysically logged with a high-resolution, spectral gamma-ray logging system to determine the vertical distribution and concentration of gamma-emitting radionuclides. Soil moisture will be determined using a neutron-logging tool.

Following geophysical logging, the well will be backfilled from the bottom of the sump (100 m [328.1 ft] bgs) to approximately 82.9 m (272 ft) bgs with bentonite as part of the well decommissioning process. At this point, a shale sample trap (Figure 3) will be installed with the top of the trap at 82.3 m (270 ft) bgs which is below the point of observed corrosion. There will be two shale traps connected by a 5.1 cm (2 in.) diameter pipe capped at the top end creating a basin for liquid collection. Once the trap is installed, the casing above the shale trap will be perforated from approximately 80.2 to 81.4 m (263 to 267 ft) bgs allowing potentially drainable porewater to accumulate for sample collection. These depths may vary based on the geophysical logging results or as directed by the Project Technical Lead.

It is unknown if sufficient accumulation of drainable porewater will be available for sample collection and analysis. The drainable porewater may be allowed to accumulate in the shale trap for up to 2 weeks. A video survey will be performed after perforating the casing to determine if there is sufficient water to proceed to sample collection or if more time is needed. Based on the observations made from this initial video survey, a decision will be made as to whether another video survey would be needed to assess the accumulation of drainable porewater for sample collection. Either after sampling, or if no liquid accumulates, the shale trap will be removed (if possible) and the well decommissioned.

3.1.1 Sample Collection

Sample collection volumes, bottle type, preservation requirements, and analytical hold times are contained in Table 1. Water samples will be collected from the shale trap using a bailer. Due to the potential for low porewater accumulation, sample collection volumes and analysis guidance (provided in Table 2) is based upon analysis priority and various sample collection volumes. Field measurements listed in Table 3 may be obtained provided there is sufficient sample volume available in excess of the necessary laboratory analytical volumes. Guidance for field measurement collection is also included Table 2.

Analytical method performance requirements are provided in Table 3.

Filtering is required only if there are visible particulates in the water sample.

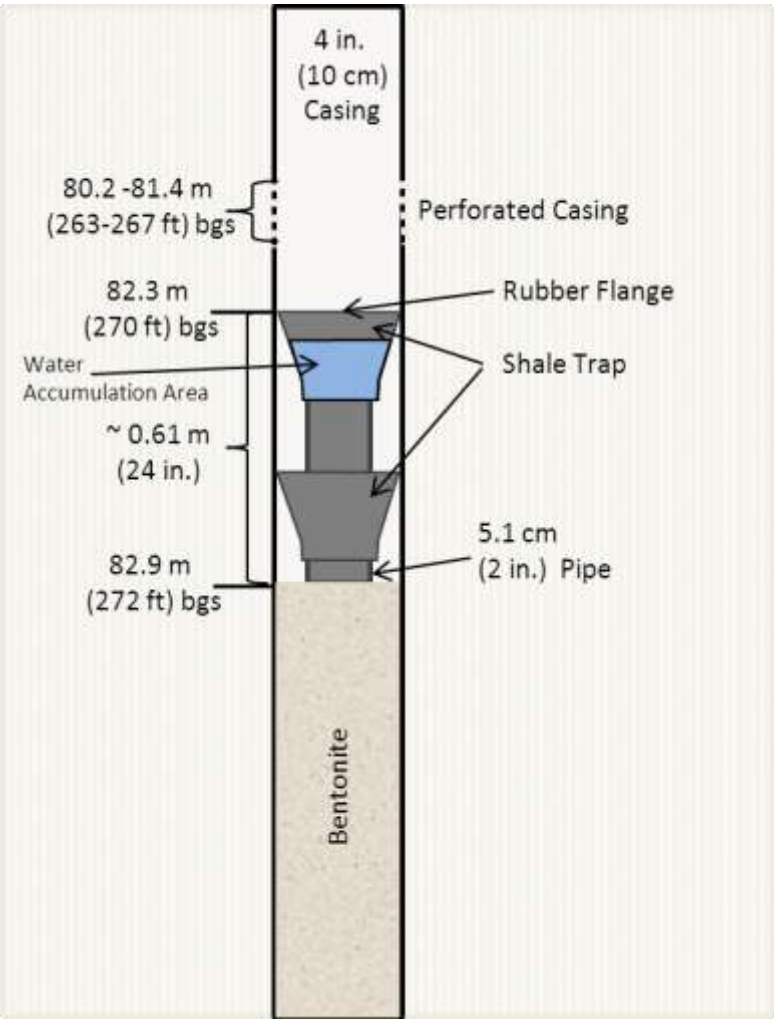

Figure 3. Shape Trap Device for Water Collection (not to scale)

Table 1. Water Sample Preservation, Container and Holding-Time Guidelines

Priority	Analytes	Bottle		Amount (mL)		Preservation	Packing Requirements	Holding Time
		Number	Type	w/ QC	w/o QC			
1	Technetium-99 by LSC	1	G/P	600	200	HCl to pH <2	None	6 months
1	Technetium-99 by ICP-MS	1	P	n/a*	10	HNO_3 to pH <2	None	6 months
2	Anions	1	P	20	5	None	Cool 4°C	48 hours
3	Tritium	1	G	30	10	None	None	6 months
4	pH	1	G/P	30	15	None	None	ASAP

* No laboratory QC analysis for Technetium-99 by ICP-MS
ASAP = as soon as possible
G = glass
ICP-MS = inductively coupled plasma mass spectrometry
LSC = liquid scintillation
P = plastic
QC = quality control
w/ QC = with laboratory quality control sample analysis
w/o QC = without laboratory quality control sample analysis

Table 2. Sample Collection and Analysis Priorities Based Upon Sample Volume Collected

Volume Captured (mL)	Analysis to be Performed
10	Tc-99 by ICP-MS
15	Tc-99 by ICP-MS, anions [a]
25	Tc-99 by ICP-MS, anions [a], H-3 [a]
40	Tc-99 by ICP-MS, anions [a], H-3 [a], pH [a]
55	Tc-99 by ICP-MS, anions [b], H-3 [a], pH [a]
75	Tc-99 by ICP-MS, anions [b], H-3 [b], pH [a]
90	Tc-99 by ICP-MS, anions [b], H-3 [b], pH [b]
>90 and <230	Tc-99 by ICP-MS, anions [b], H-3 [b], pH [b], field measurements
230	Tc-99 by LSC [a], anions [a], H-3 [a], pH [a]
245	Tc-99 by LSC [a], anions [b], H-3 [a], pH [a]
265	Tc-99 by LSC [a], anions [b], H-3 [b], pH [a]
280	Tc-99 by LSC [a], anions [b], H-3 [b], pH [b]
>280 and <630	Tc-99 by LSC [a], anions [b], H-3 [b], pH [b], field measurements
630	Tc-99 by LSC [b], anions [a], H-3 [a], pH [a]
645	Tc-99 by LSC [b], anions [b], H-3 [a], pH [a]
665	Tc-99 by LSC [b], anions [b], H-3 [b], pH [a]
680	Tc-99 by LSC [b], anions [b], H-3 [b], pH [b]
780	Tc-99 by LSC [b], anions [b], H-3 [b], pH [b], field measurements

a = Laboratory QC analysis NOT required
b = Laboratory QC analysis required
H-3 = Tritium
ICP-MS = inductively coupled plasma mass spectrometry
LSC = liquid scintillation
Tc-99 = Technetium -99

Table 3. Analytical Performance Requirements for Water Samples

Analyte	Analytical Method[a]	Required Detection Limit[b]	Precision Requirement (%)[c]	Accuracy Requirement (%)[c]
Laboratory Analysis				
Technetium-99	Liquid scintillation	15 pCi/L	≤20	70-130
Technetium-99	ICP-MS	17.1 pCi/L	N/A	N/A
Chloride [d]	EPA IC 300.0	200 µg/L	≤20	80-120
pH	EPA 150.1	N/A	≤20	80-120
Tritium	Liquid scintillation	400 pCi/L	≤20	70-130
Field Measurements				
pH	Probe	N/A	N/A	N/A
Specific conductance	Probe	1 µS/cm [e]	N/A	N/A
Temperature	Probe	N/A	N/A	N/A
Oxidation-reduction potential	Redox probe	N/A	N/A	N/A
Dissolved oxygen	Probe	N/A	N/A	N/A
Turbidity	Probe	0.1 NTU [e]	N/A	N/A

a. All samples analyzed in accordance with SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B* or *Standard Methods for the Examination of Water and Wastewater* unless otherwise noted.

b. The required detection limit (RDL) is specified in the Statement of Work for a laboratory and is generally based upon method detection limits and minimum detectable activities routinely achievable by a laboratory. Project specific RDLs may be specified to meet special project requirements.

c. Precision and accuracy requirements as identified and defined in analytical and quality assurance procedures implemented by the laboratory.

d. Report all anions available by EPA 300.0.

e. For specific conductance and turbidity the RDL values are considered sensitivities.

EPA = U.S. Environmental Protection Agency
IC = ion chromatography
ICP-MS = inductively coupled plasma mass spectrometry
N/A = not applicable
NTU = nephelometric turbidity unit
Redox = reduction-oxidation

3.1.2 Radiological Field Data

Alpha and beta/gamma field measurements will be used to support sampling and analysis efforts. Generally, sample bottles will be field screened for evidence of radiological contamination. Radiological screening will be performed by a radiological control technician or other qualified field personnel. The radiological control technician will record field measurements, noting the depth of the sample and the instrument reading. Radiological screening measurements will be included into the Field Sampling Organization field logbook.

All radiological surveys will be documented. Final reporting documentation (Radiological Survey Report) shall include, but is not limited to, the following:

- Sufficient detail to show connection between sample depth and location to radiological surveys performed.

- Established background readings. If background varies widely in the general area, the high and low readings shall be noted on the survey report, along with a basis or detail for any calculations or assumptions with regard to recorded survey results.

3.1.3 Corrective Actions and Deviations for Sampling Activities

The project manager, field team lead, or designee must document deviations from procedures or other issues related to sample collection, chain of custody, analytes or sample transport. Examples of deviations include samples not collected because of field conditions or insufficient water available for sample collection.

As appropriate, deviations will be documented in the field logbook or on nonconformance report forms in accordance with internal corrective action procedures. The project manager, field team lead, or designee will be responsible for communicating field corrective action requirements and for ensuring that immediate corrective actions are applied to field activities.

3.2 Field Quality Control Sampling

Appropriate field QC samples will be collected to evaluate the potential for cross-contamination. One equipment blank sample may be collected. The equipment blank will be collected from any sampling device that is reused. The equipment blank will be collected using high-purity water and will be analyzed for the same analytes as the porewater sample. If disposable (i.e., single-use) equipment is used, the equipment blank is not required.

3.3 Laboratory Quality Control Samples

Laboratory QC samples (e.g., method blanks, laboratory control samples/blank spikes, and matrix spikes) are defined for the four-digit EPA methods (SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B*) and are also defined in *Hanford Analytical Services Quality Requirements Documents* (HASQARD) (DOE/RL-96-68). The laboratory QC samples will be run at the frequency specified in the respective reference unless superseded by agreement between the primary contractor and the laboratory. If there is insufficient water volume minimum volumes may be sent to the laboratory for analysis and full laboratory quality control sample analysis may not be possible and will be noted in the narrative of the analytical report.

3.4 Sample Handling, Shipping, and Custody Requirements

A sampling and data tracking database is used to track the samples from the point of collection through the laboratory analysis process. Samplers should note any anomalies (e.g., sample appears unusual or sample is sludge) with the samples to prevent batching across dissimilar matrices. If anomalies are found, the sampler should write “DO NOT BATCH” on the chain-of-custody form and inform Sample Management and Reporting (SMR).

Laboratory analytical results are entered and maintained in the Hanford Environmental Information System (HEIS) database. The HEIS sample numbers are issued to the sampling organization for the project. Each chemical, radiological, and physical properties sample is identified and labeled with a unique HEIS sample number.

Sample packaging, container labeling, sample custody requirements, sample transportation will follow applicable procedures as well as the HASQARD. Sample custody during laboratory analysis is addressed in the applicable laboratory standard operating procedures. Laboratory custody procedures will ensure

that sample integrity and identification are maintained throughout the analytical process. Storage of samples at the laboratory will be consistent with laboratory instructions prepared by SMR.

4 References

40 CFR 265.91 (a)(2), "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," "Groundwater Monitoring System," *Code of Federal Regulations*. Available at: http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=cc13892be0e34b26e5d5f4744c48677f&rgn=div8&view=text&node=40:27.0.1.1.6.6.1.2&idno=40

AWWA, APHA, and WEF, 2012, *Standard Methods for the Examination of Water and Wastewater*, 22nd ed., American Water Well Association, Denver, Colorado; American Public Health Association, Washington, D.C.; and Water Environment Federation, Alexandria, Virginia.

DOE/RL-96-68, 2007, *Hanford Analytical Services Quality Assurance Requirements Documents*, Rev. 3, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www.hanford.gov/orp/?page=141&parent=14.

PNNL-15141, 2008, *Investigation of Accelerated Casing Corrosion in Two Wells at Waste Management Area A-AX*, Revision 1. C.F. Brown, M.J. Lindberg, R.J. Serne, K.N. Geiszler, H.T. Schaef, S.R. Baum, B.A. Williams, I.V. Kutnyakov, M.M. Valenta, T.S. Vickerman, V.L. LeGore, R.E. Clayton, Pacific Northwest National Laboratory, Richland, Washington

PNNL-15315, 2006, *RCRA Assessment Plan for Single-Shell Tank Waste Management Area A-AX at the Hanford Site, Hanford, Washington*. S.M. Narbutovskih and C.J. Chou, Pacific Northwest National Laboratory, Richland, Washington

SW-846, 2007, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update IV-B*, as amended, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://www.epa.gov/epawaste/hazard/testmethods/sw846/online/index.htm.

WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-160.

Distribution

	MS
U.S. Department of Energy, Richland Operations Office	
R. D. Hildebrand (Electronic Distribution & 1 copy)	A6-38
DOE Public Reading Room	H2-53
CH2M HILL Plateau Remediation Company – Electronic Distribution Only	
W. R. Faught	R3-50
D. E. Dooley	R3-50
L. C. Swanson	R3-60
S. L. Huggins	R3-21
R. W. Oldham	R3-60
C. Sutton	R3-50
G. S. Thomas	R3-50
Administrative Record - Electronic Distribution & 1 copy	
H. M. Childers	H6-08
Document Clearance - Electronic Distribution Only	H6-08

This page intentionally left blank.