COMMONWEALTH OF MASSACHUSETTS

MIDDLESEX, ss.

Superior Court Department
Civil Action No.
2013-04131-J

TOWN OF ACTON, and JANET K. ADACHI, MIKE GOWING, KATIE GREEN, DAVID CLOUGH AND JOHN SONNER AS THEY ARE THE MEMBERS OF THE BOARD OF SELECTMEN OF THE TOWN OF ACTON, Plaintiff,	)
v.	)
W.R. GRACE & CO. — CONN. Defendant.	)

AFFIDAVIT OF JAMES D. OKUN

I, James D. Okun, state under oath as follows:

1. I have been retained by the Plaintiffs as an expert in this matter. I have personal knowledge of the matters stated in this affidavit.

2. I am a Principal at O'Reilly, Talbot & Okun Associates, Inc.

3. I am an environmental toxicologist and a Massachusetts Licensed Site Professional ("LSP") with over 30 year of experience in environmental science.

4. I hold a B.S. in Chemistry and an M.S. in Toxicology, both from the Massachusetts Institute of Technology.

5. A copy of my *Curriculum Vitae* further describing my qualifications is attached as Exhibit A.

6. I have served as the Town of Acton's (the "Town's") consultant regarding the W.R. Grace Superfund Site (the "Site") in the Town since 1994.

7. In that capacity, I have reviewed numerous reports prepared by the defendants, W.R. Grace & Co.—Conn. ("Grace"), the U.S. Environmental Protection Agency ("EPA"), the Massachusetts Department of Environmental Protection ("DEP"), the Acton Water District ("AWD") and others regarding the Site and related environmental issues, including, without limitation, the following documents which I have reviewed in connection with the preparation of this Affidavit:

- Record of Decision; W. R. Grace & Co. (Acton Plant) Superfund Site; Operable Unit Three; Towns of Acton & Concord, Middlesex County, Massachusetts; September 2005.
- Remedial Design/Remedial Action Statement of Work; W.R. Grace (Acton Plant) Superfund Site, Acton & Concord, MA; September 2006.
- Northeast Area Groundwater Pre-Design Work Plan (Revised); Operable Unit Three; W.R. Grace Superfund Site, Acton, Massachusetts; GeoTrans, Inc.; July 26, 2007.
- Letter dated August 30, 2007 to Ms. Maryellen Johns W.R. Grace & Co. from Mr. Derrick Golden EPA; Re: Review of Revised Final Northeast Area Groundwater Pre-Design Work Plan, Revised July 26, 2007, W.R. Grace Superfund site, Acton, Massachusetts.
- Northeast Area Groundwater Pre-Design Results Report; W.R. Grace Superfund Site, Acton Massachusetts; GeoTrans, Inc.; May 5, 2008.
- Letter dated July 10, 2008 to Ms. Maryellen Johns W.R. Grace & Co. from Mr. Derrick Golden EPA; Re: Comments on the Northeast Area Groundwater Pre-Design Results Report, May 2008, for the Remedial Design/Remedial Action (RD/RA) - W.R. Grace (Acton Plant) Superfund (site) and Concord, Acton, MA.
- Letter report to Mr. Derrick Golden, EPA and Ms. Jennifer McWeeney, DEP, dated October 30, 2008; Re: Sensitivity of Model Results for Northeast Area Groundwater Remedy, W.R. Grace Superfund Site, Acton, Massachusetts; GeoTrans, Inc.
- Northeast Area Groundwater Concept Design; W.R. Grace Superfund Site, Acton, Massachusetts; GeoTrans, Inc.; March 19, 2009.
- Operable Unit Three Monitoring Program Report, 2006; W.R. Grace Superfund Site, Acton, Massachusetts; GeoTrans, Inc.; April 24, 2007.
- Operable Unit Three Monitoring Program Report, 2007; W.R. Grace Superfund Site, Acton, Massachusetts; GeoTrans, Inc.; July 31, 2008.
- Operable Unit Three Monitoring Program Report, 2008; W.R. Grace Superfund Site, Acton, Massachusetts; GeoTrans, Inc.; April 30, 2009.
- Operable Unit Three Monitoring Program Report, 2009; W.R. Grace Superfund Site, Acton, Massachusetts; GeoTrans, Inc.; April 29, 2010.

- Operable Unit Three Monitoring Program Report, 2010; W.R. Grace Superfund Site, Acton, Massachusetts; GeoTrans, Inc.; January 27, 2011.
- Operable Unit Three Monitoring Program Report, 2011; W.R. Grace Superfund Site, Acton, Massachusetts; Tetra Tech Geo; February 28, 2012.
- Operable Unit Three Monitoring Program Report, 2012; W.R. Grace Superfund Site, Acton, Massachusetts; Tetra Tech Geo; December 20, 2012.
- Letter report from Grace's consultant, Tetra Tech, Inc., to EPA and DEP dated February 25, 2013 proposing to shut down, decommission, and remove the Treatment System discussed below.
- The Feasibility Study: Detailed Analysis of Remedial Action Alternatives; EPA OSWER Directive No. 9355.3-01FS4; March 1990.
- Conducting Feasibility Evaluations under the MCP; DEP Policy #WSC-04-160; July, 16, 2004.
- Groundwater Road Map: Recommended Process for Restoring Contaminated Groundwater at Superfund Sites; EPA OSWER 9283.1-34; July 2011.
- SW-846 EPA Method 8270C – Semivolatile Organic Compounds By Gas Chromatography/Mass Spectrometry (GC/MS); Revision 3, December 1996.
- Method 522 Determination of 1,4-Dioxane in Drinking Water by Solid Phase Extraction (SPE) and Gas Chromatography (GC/MS) With Selected Ion Monitoring (SIM); EPA/600/R-08/101; Version 1.0, September 2008.

The Bylaw

8. I am familiar with the Town's Groundwater Cleanup Standards Bylaw, Chapter R of the Town's General Bylaws (the "Bylaw").

9. Pursuant to Bylaw § 4.10, the Bylaw's Groundwater Cleanup Standards are equivalent to Maximum Contaminant Level Goals ("MCLGs") established under the Federal Safe Drinking Water Act for each contaminant for which an MCLG has been established, or, if the MCLG is zero or no MCLG has been established, 1 part per billion ("ppb") for any volatile organic compound ("VOC") and 5 ppb total for all VOCs.

10. I have reviewed the Plaintiffs' Verified Complaint in this matter. Based on my personal knowledge of the Site, and my professional education, training and experience, and my review of environmental reports concerning the Site, to the best of my knowledge, information and belief the facts set forth in paragraphs 16-29, 35-37, 39-181 and 185 of the Verified Complaint are true and accurate.

11. Without limitation the Verified Complaint accurately describes the Bylaw (¶¶ 16-30, 37), Grace's Contamination of Resource Areas in the Town (¶¶ 45-60), and the Current Status of Contaminants at and from the Site (¶¶ 61-90). The Verified Complaint also accurately summarizes levels of 1,1-dichloroethene (also known as "1, 1-dichloroethylene" and "vinylidene chloride" ("VDC")), vinyl chloride, 1,4 dioxane ("dioxane"), benzene and total VOCs present in groundwater Resource Areas at and downgradient of the Site based on the latest data made available by Grace and its consultants.

12. VOC concentrations in groundwater Resource Areas at and downgradient of the Site currently exceed the Groundwater Cleanup Standards of the Bylaw particularly for VDC, as well as vinyl chloride, benzene, dioxane, and total VOCs.

13. Because VOC concentrations in groundwater Resource Areas at and downgradient of the Site exceed the Bylaw's Groundwater Cleanup Standards, this groundwater has not been restored to a "Fully Useable Condition" within the meaning of the Bylaw and should not be used by the public for otherwise lawful uses such as consumption, bathing, or irrigation because of the risks such uses would pose.

14. The Bylaw's Groundwater Cleanup Standards are appropriate remedial goals for Resource Areas (as defined in the Bylaw) that are current or potential sources of drinking water.

15. The 1974 Safe Drinking Water Act requires EPA to determine the level of contaminants in drinking water at which no adverse health effects are likely to occur. These criteria, based on lifetime exposures and resulting health risks (with an adequate margin of safety), are the MCLGs. In using non-zero MCLGs as cleanup criteria the Bylaw has adopted safe and achievable criteria that place strict emphasis on the protection of human health and the

environment for the remediation of Resource Areas that are current and potential future drinking water aquifers.

16. For those Contaminants where an MCLG has not been promulgated or the MCLG is zero, the Bylaw defines the cleanup standard as equal to 1 ppb any and 5 ppb total VOCs. The Bylaw's definition of Contaminant includes oil and hazardous material as defined in MGL 21E or 310 CMR 40.0000, the Massachusetts Contingency Plan (the "MCP").

17. According to the EPA:

> "If there is evidence that a chemical may cause cancer, and there is no dose below which the chemical is considered safe, the MCLG is set at zero. If a chemical is carcinogenic and a safe dose can be determined, the MCLG is set at a level above zero that is safe".[1]

18. The Bylaw's approach for establishing groundwater cleanup standards thus parallels EPA's approach to establishing safe MCLGs.

19. MCLs and Non-zero MCLGs established under the Safe Drinking Water Act are appropriate remedial goals for groundwater and surface waters that are current or potential sources of drinking water pursuant to EPA's National Contingency Plan.[2]

20. The Groundwater Cleanup approach established in the Bylaw is also generally consistent with groundwater cleanup standards established in the MCP.

21. Generally speaking, there are three principal components needed to establish an approach to groundwater cleanup:

- Knowledge of current and potential future groundwater uses;

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[1] http://water.epa.gov/lawsregs/rulesregs/regulatingcontaminants/basicinformation.cfm#What%20are%20drinking%20water%20standards.

[2] *See* Memorandum dated June 26, 2009; OSWER Directive 9283.1-33; Summary of Key Existing EPA CERCLA Policies for Groundwater Restoration; From: James E. Woolford, Director, Office of Superfund Remediation and Technology Innovation and John E Reeder, Director, Federal Facilities Restoration and Reuse Office; To: Superfund National Policy Managers, Regions 1-10 at pp. 2-3.

- The identification of appropriate locations within an aquifer at which to assess compliance; and
- Numerical standards to serve as a basis for comparison to determine compliance status.

22. The MCP and the Bylaw each begin by evaluating the present and future uses of groundwater. The Bylaw focusses on current and potential future potable groundwater supplies (because the Town relies exclusively on groundwater as the source of public drinking water); the MCP is concerned with potable and non-potable groundwater uses.

23. The Bylaw and the MCP identify current and potential future potable groundwater supplies using effectively the same selection criteria. The Town Bylaw defines Resource Area to include: Zone 1s of public supply wells; DEP approved wellhead protection areas; Zone 2s of public supply wells; public water supply Interim Wellhead Protection Areas ("IWPAs"); and potentially productive aquifers. The MCP defines GW-1 groundwater (which includes current and potential future water sources) as including: Zone 2s of public supply wells (which generally incorporate the wells' Zone 1); public water supply IWPAs; areas designated by local ordinance or bylaw for the protection of groundwater; and groundwater within a potentially productive aquifer. 310 CMR 40.0006; 40.0932.

24. The MCP and the Bylaw are also similar in the manner in which they assess compliance. The objective of each is for the water quality standard to apply at all locations within the aquifer, not only at the production wellhead. This means that full compliance is achieved when a sample collected from any location in the aquifer is tested and found to contain contaminants at concentrations less than the applicable numerical compliance standard.

25. The MCP uses Massachusetts Maximum Contaminant Levels (MMCLs) promulgated pursuant to 310 CMR 22.000 as its preferred groundwater cleanup standards.

MMCLs are enforceable standards adopted by the DEP. For cases where MMCLs are not available, the MCP's second preferred source is the DEP Office of Research and Standards (ORS) guideline values. Where there is no MMCL or ORS guideline, the MCP uses a risk-based approach to establish the groundwater cleanup standard.

26. The Bylaw's approach is similar and is also risk-based. The Bylaw uses MCLGs promulgated by the EPA pursuant to the Safe Drinking Water Act as groundwater cleanup standards. Where an MCLG does not exist, the Bylaw's standard is set at 1 ppb for any such VOC and 5ppb total for all such VOCs.

27. For VDC, the Bylaw's MCLG cleanup standard of 7 ppb matches the EPA NCP MCLG standard of 7 ppb and the DEP MCP MMCL standard of 7 ppb.

28. For some contaminants, including VOCs with an MCLG of zero ppb, the Groundwater Cleanup Standards established in the Bylaw are more stringent and protective of public health than those established in the MCP.

29. The MCP permits local governments to promulgate, and requires private parties performing a cleanup to comply with, local cleanup standards that are more stringent than the MCP under numerous provisions, including without limitation, the following:

- 310 CMR § 40.0007(7) (providing "No provision of 310 CMR 40.0000 shall be construed to relieve any person of the necessity of complying with all other applicable federal, state or **local** laws") (emphasis added).
- 310 CMR § 40.0031 (requiring that "[Responsible Parties, Potentially Responsible Parties], and Other Persons undertaking response actions ... shall handle, store, transport, treat, recycle, reuse, dispose, or discharge Remediation Waste in compliance with ... all other applicable federal, state, and **local** laws, regulations, and bylaws") (emphasis added).
- 310 CMR § 40.0740(1) (requiring that a "permittee performing a response action pursuant to a Tier I Permit shall comply at all times with M.G.L. c. 21E, 310 CMR 40.0000, the terms and conditions of the permit and any other applicable federal, state or **local** laws") (emphasis added).

- 310 CMR § 40.0731(1)(c) (providing that the "Department may deny a permit application if it determines that: ... the Department is not persuaded that the applicant is able or willing to perform necessary response actions in accordance with M.G.L. c. 21E, 310 CMR 40.0000 and **other applicable laws**") (emphasis added).

30. The Bylaw's Groundwater Cleanup Standards therefore have a rational basis and are generally consistent with the NCP and the MCP.

The Treatment System

31. I am familiar with Grace's operation of a groundwater pumping and treatment remediation system (the active component of a remedy known as the "Northeast Area Remedial Action") (hereafter the "Treatment System") at the Site.

32. According to GeoTrans, Inc. and Tetra Tech Geo (now Tetra Tech, Inc.) (Grace's technical consultants), groundwater in the Northeast Area became contaminated as the result of hazardous material disposal in portions of the Grace Acton plant known as the blow-down pit. Chemical contaminants including, but not limited to VDC and vinyl chloride, migrated with groundwater from the blow-down pit toward the Town's School Street drinking water supply wells. Each of these contaminants is considered by the EPA and DEP to be a known or probable carcinogen.

33. Grace's chemicals, disposed of in the blow-down pit, have contaminated the Northeast Area groundwater aquifer and the AWD's School Street supply wells. As a result, to meet DEP drinking water standards, the AWD must treat its well water to remove Grace's chemical contaminants before the water is delivered to the Town's citizens for consumption.

34. In September 2005, the EPA, pursuant to its authority under CERCLA, issued a Record of Decision (the "ROD") requiring Grace to remediate the contaminated groundwater in the Northeast Area aquifer. The ROD's groundwater Remediation Objectives, presented on page 47, are as follows:

- "Prevent potential exposure to concentrations of contaminated groundwater from the Site having carcinogens in excess of ARARs[3] (i.e., [Maximum Contaminant Levels ("MCLs"), non-zero MCLGs), and prevent exposure to groundwater that may pose a total excess cancer risk in groundwater in excess of USEPA's cancer risk range of 10^{-4} to 10^{-6} and/or which exceed a target non-cancer hazard index of one.

- "Restore groundwater quality consistent with ARARs and cleanup goals so that the aquifer is suitable as a public water supply and for irrigation purposes without pre-treatment for Site-related contaminants".

35. The ROD (at page 68) includes a description of the conceptual design for the Treatment System. The Treatment System was designed to include 3-5 extraction wells pumping at a combined flow rate of approximately 50 gallons per minute (gpm). These wells were to be located in the area of highest contaminant concentration in the Northeast Area contaminant plume.

36. The ROD states (at page 69) that, given the nature of the groundwater contaminant plume and the parameters of the remedial design, an initial operating period of three years was anticipated. An evaluation at the end of the initial period would be followed by two year extensions until such time that the remedial objectives for groundwater quality were met.

37. The Remedial Design/Remedial Action Statement of Work (the "RD/RA SOW") defines more specifically than the ROD the deliverables and remedial response actions that Grace was required to undertake to satisfy the ROD. The RD/RA SOW remedial objectives echo the language included in the ROD:

> **PERFORMANCE STANDARDS**
>
> W. R. Grace shall design, construct, operate, monitor, and maintain the Remedial Action in compliance with the ROD and all requirements of the Consent Decree and this SOW.

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[3] The term "ARARs" is an EPA acronym meaning "applicable, relevant and appropriate requirements."

W. R. Grace shall clean-up the contaminated groundwater and sediment at the Site that exceed the Performance Standards, which include the groundwater and sediment cleanup levels listed in the following tables and all ARARS identified in the ROD.

The Interim Cleanup Levels for groundwater and Cleanup Levels for sediment, as presented in the September 2005 ROD, are as follows:

Interim Groundwater Cleanup Levels Contaminant	**Interim Cleanup Level (µg/l)**
Antimony	6
Arsenic	10
Beryllium	4
Benzene	5
bis(2-Chloroethyl)ether	5
Bis(2-Ethylhexyl)phthalate	6
Chromium (Total)	100
1,2-Dichloroethane	5
1,1-Dichloroethene (VDC)	7
1,2-Dichloropropane	5
Lead	15
Manganese	300 [1]
Methylene chloride	5
Methyl tert-butyl ether (MTBE)	16
Nickel	100
Trichloroethene	5
Vinyl chloride (VC)	2
1. A background value, to be determined during the remedial design, may be selected as the interim groundwater cleanup level for Manganese." 2. ug/l = micrograms per liter.	

38. Thus, as with the ROD and the Bylaw, the RD/RA SOW identified an interim cleanup level of 7 ppb for VDC. VDC is the dominant, but not the only Grace contaminant in the Northeast aquifer.

39. Pursuant to the RD/RA SOW, the Treatment System was planned and modeled to pump at a rate of 50 gallons per minute. Instead, it has been operated at an average rate of less than twenty gallons per minute since it began operation in 2010. This represents an actual pumping rate of only 40% of the initial design rate.

40. Since the amount of contaminated water treated by the remedial system is less than half of the volume projected to be treated in the ROD and RD/RA SOW, it can be inferred that the amount of contamination removed from the aquifer is significantly less than anticipated in the ROD and the RD/RA.

41. Although the extent of Northeast Area groundwater contamination treated is less than anticipated, the improvement in groundwater quality caused by the operation of the Treatment System has been significantly greater than had occurred through natural attenuation prior to the start of the Treatment System.

42. In Tetra Tech's February 25, 2013 Evaluation of the Treatment System, Tetra Tech provided Plume Maps showing the distribution of Northeast Area groundwater contaminants, for three times: 2001/2002; 2009; and 2012.

43. I have calculated the rate of VDC natural attenuation for the period beginning in 2001/2002 and extending to 2009. During this period, the Treatment System was not in operation and there was not active remediation occurring. In addition I have calculated the rate of VDC attenuation beginning in 2009 and extending until 2012. For most, but not all, of this period, the Treatment System was in operation and active remediation was taking place. In Exhibit B attached to this Affidavit, I have described the method used to calculate these rates of VDC attenuation during these periods.

44. For the period when no active remediation was taking place, the rate of VDC attenuation was an average of approximately 8% per year. At this rate (all other things being equal) the groundwater concentration of VDC is projected to be less than the 7 ppb standard required by the ROD and the Bylaw throughout the Northeast Area within about 31 years.

45. For the period when there was active remediation for most of the time, the rate of VDC attenuation was an average of 16% per year. At this rate (all other things being equal) the groundwater concentration of VDC is projected to be less than the 7 ppb standard required by the ROD and the Bylaw throughout the Northeast Area in about 15 years.

46. In my professional opinion (all other things being equal): (a) Continued operation of the Treatment System at its historical pumping rate will achieve the ROD's and the Bylaw's remediation standard of 7 ppb for VDC approximately twice as quickly as would be the case without the Treatment System operating (all other things being equal); (b) If the Treatment System were to be operated at its higher design rate of 50 gallons per minute, the ROD's and the Bylaw's remediation standard of 7 ppb for VDC would be achieved even more quickly than without the Treatment System; and (c) If the Treatment System were to be discontinued now, groundwater at and downgradient of the Site would not meet the Groundwater 1 ("GW-1") standard under the MCP for approximately 31 years.

47. In addition to directly removing contaminants, the Treatment System likely enhances the effects of natural attenuation within the contaminant plume even in areas that are beyond the immediate extraction zone of the pump and treat system.

48. By inducing cleaner groundwater to enter the bedrock aquifer (to make up the volume of contaminated water being withdrawn), the Treatment System has the added benefit of causing cleaner water to penetrate the core of the plume. This cleaner water, by virtue of its greater degree of oxygenation, will increase the rate of natural attenuation in the plume even when it is beyond the influence zone of the extraction well.

49. This cleaner, relatively oxygenated groundwater can help restore aquifer regions beyond the immediate reach of the pump and treat system. This is because contaminants tend to

move more slowly through groundwater than does the groundwater itself. This slower movement is due to the interaction between the contaminants and the subsurface conditions in the aquifer.

Grace's Proposal and EPA's Conditional Approval to Shut Down the Treatment System

50. I have reviewed the letter from Grace's consultant, Tetra Tech, to EPA and DEP dated February 25, 2013, proposing to shut down, decommission, and remove the Treatment System.

51. I assisted the Town in preparing an objection to Grace's proposal, which was included in the Town's letter to EPA and DEP dated April 30, 2013.

52. In Tetra Tech's letter, Grace has provided the following reasons to justify its proposal to shut down, decommission and remove the Treatment System: a) the rate of contaminant removal has dropped off during the operation of the treatment system; b) groundwater quality in the Northeast Area has improved during the operation of the system; c) even without treatment, contaminant concentrations will continue to decline; d) contaminant concentrations in AWDs School Street wells are not expected to increase; and e) operation of the treatment system may pull in non-Grace contaminants.

53. On August 12, 2013, I attended a meeting with EPA, DEP and Town officials regarding Grace's proposed shut down of the Treatment System during which arguments for and against shutting down the Treatment System were discussed.

54. By letter dated September 20, 2013, EPA, in consultation with DEP, provided "conditional approval for shutdown of the Northeast treatment system."

55. The conditional shutdown approval letter cited the following information to support the decision to allow conditional approval of the shutdown:

- "Concentrations of vinylidene chloride (VDC)(the main site-related contaminant) in the School Street Town Wells are currently below the Maximum Contaminant Level of 7 ppb, and have been since before the Northeast Area remedial system became operational;

- Approximately 1.4 pounds of total Volatile Organic Compounds (VOCs) was removed during the first month of system operation. After three years of operation, the VOC removal rate has decreased to only 0.3 pounds (removed during December 2012);

- A comparison of 2001 and 2012 data indicates that the residual mass of VDC in the most concentrated part of the plume since has significantly reduced since the system became operational. For example, in 2001, prior to start-up of the Northeast Area remedial system, VDC was detected in MW-06B at a concentration of 260 ug/L. After three years of operation, VDC concentrations in MW-068 decreased to 25 ug/L.

- Water level and extraction rate data collected by the Acton Water District for the three School Street public wells do not show any obvious impacts to yield or drawdown from operation of the Northeast Area remedial system, indicating that impacts to the School Street well field and Fort Pond Brook were minimal. Tetra Tech, 2013

- The Northeast Area treatment system was located and operated on an industrial property, the Linde Company, thereby minimizing impacts to residential property owners in the Northeast Area."

56. The conditional shutdown approval letter provided conditional approval to shut down the Northeast Area System based on five conditions. Two of the conditions are preconditions to Grace shutting down the Treatment System.[4] The other three conditions related to conditions for ongoing monitoring and Grace's dismantling and removing the Treatment System.[5]

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[4] The preconditions are: (a) "The 2013 annual groundwater sampling and elevation measurements must be completed prior to shutdown (it is our understanding from recent discussions that the annual groundwater event has already been completed);" and "We understand that W. R. Grace has sampled the four individual Scriber wells on September 19, 2013. Once W. R. Grace confirms that they will perform three additional rounds of quarterly sampling for the Scribner well, the Northeast Area treatment system may be shut down." See Letter at page 2, ¶¶ 2 and 5.

[5] Specifically, these other three conditions related to Grace's (a) not dismantling or removing the Treatment System "until EPA and MassDEP review and provide comments on the 2014 annual groundwater monitoring report for the site," (b) sampling and analyzing for 1,4 dioxane the "four individual wells that make up the Scribner town well … quarterly for at least a one-year period," and (c) providing these sampling results to AWD and DEP "as soon as the

57. The conditional shutdown approval letter does not address the Bylaw's Ground Water Cleanup Standards in any way.

Shutting Down the Treatment System is Inappropriate under the Bylaw

58. In my professional opinion, the Treatment System should not be shut down at this time because (a) the Treatment System has not met the goals Grace is required to meet as the party responsible for the contamination under the Bylaw, the RD/RA and the ROD, particularly for VDC and (b) the Treatment System has not remediated groundwater at and downgradient of the Site to the level necessary to make the aquifer fully usable under the Bylaw.

59. Groundwater at and downgradient of the Site does not currently meet the Bylaw's Cleanup Standard for VDC (which matches the federal and state public drinking water standards for VDC), among other contaminants. The Bylaw's Cleanup Standard (and the Federal MCLG, MCL, and state MMCL) for VDC are all the same: 7 ppb.

60. EPA's reasons for allowing the shutdown of the Treatment System under the ROD do not justify shutting down the Treatment System under the Bylaw.

61. First, EPA's statement that "Concentrations of vinylidene chloride (VDC) (the main site-related contaminant) in the School Street Town Wells are currently below the Maximum Contaminant Level of 7 ppb, and have been since before the Northeast Area remedial system became operational" does not address the significant remaining concentrations of VDC in the aquifer itself. From Figure 4 to the Tetra Tech Letter, Contaminant concentrations of VDC exceed the Bylaw's Ground Water Cleanup Standard of 7 ppb in a continuous plume affecting Resource Areas extending from the Grace Site (in the area of the former blow down pit) to the Lawsbrook and Scribner wells. From Figure 4 to the Tetra Tech Letter, this plume appears to be

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results are available or, at a minimum, within 10 days of the end of the quarterly monitoring period." Exhibit E, page 2, ¶¶ 1, 3 and 4.

about a mile long and about 1200 feet wide. Within the plume there are Contaminant concentrations of VDC in concentration ranges of 7-30 ppb, 30-60 ppb and 60-86 ppb, up to an order of magnitude greater than the MCLG of 7 ppb. The highest concentrations are proximate to the Lawsbrook and Scribner wells, and a substantial area of elevated concentrations exists beneath the residential subdivision in the Lisa Lane area. The Bylaw measures compliance by meeting the Ground Water Cleanup Standards "throughout the Resource Area," not at any single point. See Bylaw §§ 4.7, 5, and 6.

62. Second, EPA's observes that, "Approximately 1.4 pounds of total Volatile Organic Compounds (VOCs) was removed during the first month of system operation. After three years of operation, the VOC removal rate has decreased to only 0.3 pounds (removed during December 2012)." This observation does not justify shutting sown the Treatment System under the Bylaw because the Treatment System continues to be effective in removing Contaminants from the Resource Areas. In my professional experience it is typical of groundwater treatment systems to be most effective early in their operation. However, this does not mean that they are no longer effective at reducing contamination later in their operation. The Northeast Treatment System is still operating at a significantly effective level.

63. Third, EPA observes that a "comparison of 2001 and 2012 data indicates that the residual mass of VDC in the most concentrated part of the plume since has significantly reduced since the system became operational. For example, in 2001, prior to start-up of the Northeast Area remedial system, VDC was detected in MW-06B at a concentration of 260 ug/L. After three years of operation, VDC concentrations in MW-068 decreased to 25 ug/L." This observation is a better justification for keeping the Treatment System on rather than shutting the Treatment System down because it demonstrates that the Treatment System is effective: "the

plume since has significantly reduced since the system became operational." This improvement is readily illustrated by a comparison of the plume maps from 2001/2002 (Tetra Tech Letter Figure 1) and 2009 (Tetra Tech Letter Figure 3) - before the Treatment System was operating - with the plume map from 2012 (Tetra Tech Letter Figure 4) – after the initial two and a half years of Treatment System operations.

64. Fourth, EPA observes that, "Water level and extraction rate data collected by the Acton Water District for the three School Street public wells do not show any obvious impacts to yield or drawdown from operation of the Northeast Area remedial system, indicating that impacts to the School Street well field and Fort Pond Brook were minimal. Tetra Tech, 2013." Again, since there are no "obvious impacts to yield or drawdown from operation of the Northeast Area remedial system" on the School Street public wells, there is no justification to shut down the Treatment System for that reason.

65. Fifth, EPA observes that, "The Northeast Area treatment system was located and operated on an industrial property, the Linde Company, thereby minimizing impacts to residential property owners in the Northeast Area." Once again, this observation provides no basis to shut down the Treatment System for that reason.

66. Moreover, if the Treatment System is shut down, contaminant concentrations would be expected to rise in the short run. In my experience it is very common for groundwater contaminant concentrations to "rebound" when remedial treatment is discontinued. This occurs because groundwater contaminants are in equilibrium with contaminants adsorbed on to solid aquifer materials like soil particles and rock. After treatment stops, this equilibrium needs time to be reestablished and groundwater concentrations frequently increase during this process.

67. In addition, portions of the contaminant plume may move during a shutdown, placing those portions of the plume out of the reach of the pump and treat system and making it more difficult to remediate those portions of the plume if the Treatment System were to be reactivated.

68. Shutting down the Treatment System would slow the rate of natural attenuation of VOCs in the groundwater by limiting the supply of clean, oxygenated water into the aquifer.

69. In addition, Grace and EPA have advocated for Institutional Controls on the private use of groundwater from the contaminated aquifer precisely because the groundwater has not been restored to safe levels following its contamination by Grace, preventing the public from making otherwise lawful uses of groundwater on properties downgradient of the Site such as for irrigation.

70. Shutting down the Treatment System also removes a level of redundancy that currently protects users of the Town's public water supply. When Grace shuts down the Treatment System there would be no active treatment of Grace's plume of contaminated groundwater before it reaches the School Street supply wells, and the only remaining treatment would be that performed by AWD, which treats the groundwater at the public's expense prior to its distribution in the public water supply distribution system. Shutting down this level of redundancy provided by the Treatment System prolongs the time frame during which groundwater contaminated by Grace will continue to pose a threat to public health and safety if not properly treated.

71. For these reasons, Grace's proposal to shut down the Treatment System does not comply with the Bylaw.

Concerns about Dioxane Do Not Justify Shutting Down the Treatment System

72. Based on my participation in the August 12 meeting, it is my understanding that DEP has supported the shutdown of the Treatment System, in part, due to concerns that it is exacerbating the presence of dioxane in drinking water aquifers at and downgradient of the Site.

73. My understanding is that DEP is concerned that the treatment system is withdrawing bedrock groundwater with higher concentrations of dioxane and reintroducing it to a shallow aquifer location where it is more likely to be withdrawn by AWD's School Street wells.

74. Contrary to these suggestions, there has been no scientifically credible presentation made that the alleged redistribution of dioxane is actually occurring, and, even if the alleged redistribution of dioxane were occurring, there has been no showing that Grace could not otherwise address the dioxane contamination without shutting down the Treatment System.

75. As a result, in my professional opinion, these concerns are misplaced and are not a valid justification for shutting down the Treatment System.

76. From a hydrogeological standpoint, even if the pumping and treatment system were to cease its operation, groundwater from the bedrock would continue to naturally rise in the aquifer as it approaches the School Street wells. This flow path reflects the influence exerted by the pumping of the School Street wells themselves as well as the natural flow path for the Northeast Area groundwater which is to discharge to nearby Fort Pond Brook.

77. DEP supports its position by noting that dioxane concentrations measured in School Street well water samples increased after the treatment system began operation. My review of this data demonstrates that dioxane concentrations have decreased in the Christofferson well, remained nearly constant in the Lawsbrook well and increased slightly in the Scribner well, the three wells that draw water from the School Street Well Field.

78. In my professional opinion the changes in dioxane concentrations in samples from each of the three wells is also too small to be considered statistically significant. Additionally there are quality problems with the pre-2010/2011 dioxane data resulting of the analytical protocol used to measure dioxane concentrations at that time. EPA corrected this problem in 2008 by publishing a completely new dioxane test method, which AWD began using in 2010/2011. In my professional opinion comparison of pre- and post- 2010/2011 dioxane data is of limited utility because of low quality results produced by the pre-2010/2011 test method.

79. Even if the dioxane in bedrock groundwater was determined to be a concern, Grace could (if feasible) treat the pumped water to remove dioxane prior to discharge or, if such treatment is infeasible, Grace (with the permission of EPA and DEP) could discharge the dioxane-contaminated water to Sinking Pond, which is not used as a public water supply, or to nearby Fort Pond Brook, after obtaining the appropriate discharge permit. Discharge to the brook would also alleviate concerns about the water volume balance in the watershed.

80. Thus, even if the alleged redistribution of dioxane is occurring, there has been no showing that Grace (the party responsible for the dioxane contamination and its redistribution) could not otherwise address its dioxane contamination without shutting down the Treatment System.

Concerns about Linde's Plume Do Not Justify Shutting Down the Treatment System

81. Tetra Tech, on Grace's behalf, has also raised a concern that the Treatment System is "pulling" a hydrocarbon plume originating from a nearby property, the Linde property, toward water supply wells at and downgradient of the Site. I have reviewed information regarding this claim and find that it is unsubstantiated.

82. In its pre-design report GeoTrans, Inc., on behalf of Grace, conducted a detailed evaluation of the potential for altering the Linde hydrocarbon plume as a result of the pump and treat system and concluded such an effect on the hydrocarbon plume was unlikely to occur even at a 50 gallon per minute pumping rate. At the lower 20 gallon per minute rate the likelihood of this effect occurring is even less.

83. Based on my review of the plume data, the size and shape of the Linde hydrocarbon plume is virtually unchanged after three years of the pump and treat system operating. This supports GeoTran's original conclusion that the pumping would not alter the petroleum plume.

84. Even if hydrocarbons from the Linde Property were to be captured by the Treatment System, this would be detected in the monitoring program and appropriate treatment of the plume would be possible.

85. The concern raised by Tetra Tech regarding the hydrocarbon plume is therefore not sufficient to support shutting down the Treatment System, especially given the benefits of the Treatment System described above.

Signed under the penalties of perjury on this 20th day of September 2013.

James D. Okun, LSP

EXHIBIT A

O'Reilly, Talbot & Okun
[A S S O C I A T E S]

James D. Okun, LSP

PRINCIPAL

AREAS OF EXPERTISE

- Risk-Based Decision Support
- Massachusetts Contingency Plan (MCP) Compliance
- Polychlorinated Biphenyl Assessment and Compliance Expertise

PROFILE

Jim Okun has practiced in the environmental field for over 30 years with a technical background in environmental chemistry, risk assessment and toxicology. His experience includes work at the U.S. Environmental Protection Agency Region 1 (New England) in the CERCLA, RCRA, TSCA and FIFRA regulatory programs. A particular interest of Jim's is polychlorinated biphenyls (PCBs), a topic on which he has presented at scientific conferences and published.

PROJECT EXPERIENCE

Hingham Shipyard

Hingham, Massachusetts, *2008 and ongoing*

LSP for the assessment, risk characterization and remediation of this tetrachloroethene contaminated site being redeveloped for commercial and residential use. Implemented source elimination, and vapor intrusion mitigation technologies to reduce risk and permit a permanent solution.

Shutesbury Fire Station

Shutesbury, Massachusetts, 2009 and ongoing

A previously undiscovered underground gasoline storage tank contaminated a large area of soil and groundwater at the Shutesbury fire station. Impacted groundwater discharged to an abutting wetland and seasonal stream that drained to the Quabbin Reservoir. As LSP Jim oversaw a 3,000 ton contaminated soil excavation and is planning additional response action.

Millbury MA, Perchlorate in Water Supply

Millbury, Massachusetts, *ongoing*

LSP for a perchlorate release location that impacted a public water supply. The release originated from perchlorate based blasting materials used to remove bedrock. Managed the investigation and remedial planning steps under the MCP. Developed verification guidelines to permit a determination of when cleanup criteria have been achieved.

New Worcester Trial Court

Worcester, Massachusetts, *2007*

Recycled and treated contaminated soil during construction of a new courthouse, thus minimizing the amount of waste going into landfills. Protected building occupants by designing and installing a sub-slab venting system and vapor barrier beneath the structure's footprint. Awarded a Central Massachusetts "Green Award" by the *Worcester Business Journal.*

REGISTRATIONS & AFFILIATIONS

- Licensed Site Professional (LSP), Massachusetts
- Chairman, Connecticut River Watershed Council
- Former Director, Licensed Site Professional Association (LSPA)
- Former Member, Board of Education, Ellington, CT
- Connecticut Low Level Radioactive Waste Advisory Committee, Member

EDUCATION

- M.S., Toxicology, Massachusetts Institute of Technology, *1978*
- B.S., Chemistry, Massachusetts Institute of Technology, *1975*

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EXHIBIT B

Exhibit B
Calculation of Northeast Area Groundwater Cleanup Rate

A. General Characteristics of Contaminant Concentration Changes

Once a contaminant is introduced to groundwater there tends to be a number of physical processes that act on the contaminant to cause its concentration to decrease over time. The simplest of these is dilution, which occurs as the fixed quantity of contaminant dissolves into greater volumes of water. More complex processes include chemical and biological reactions that also reduce chemical concentrations. Most often, several of these processes are acting at the same time and it is frequently not feasible to precisely quantify the contribution that different processes make to the overall rate of contaminant reduction.

However, the rate at which contaminant concentrations decrease in groundwater generally follows an approximately exponential decay curve similar to the one shown below.

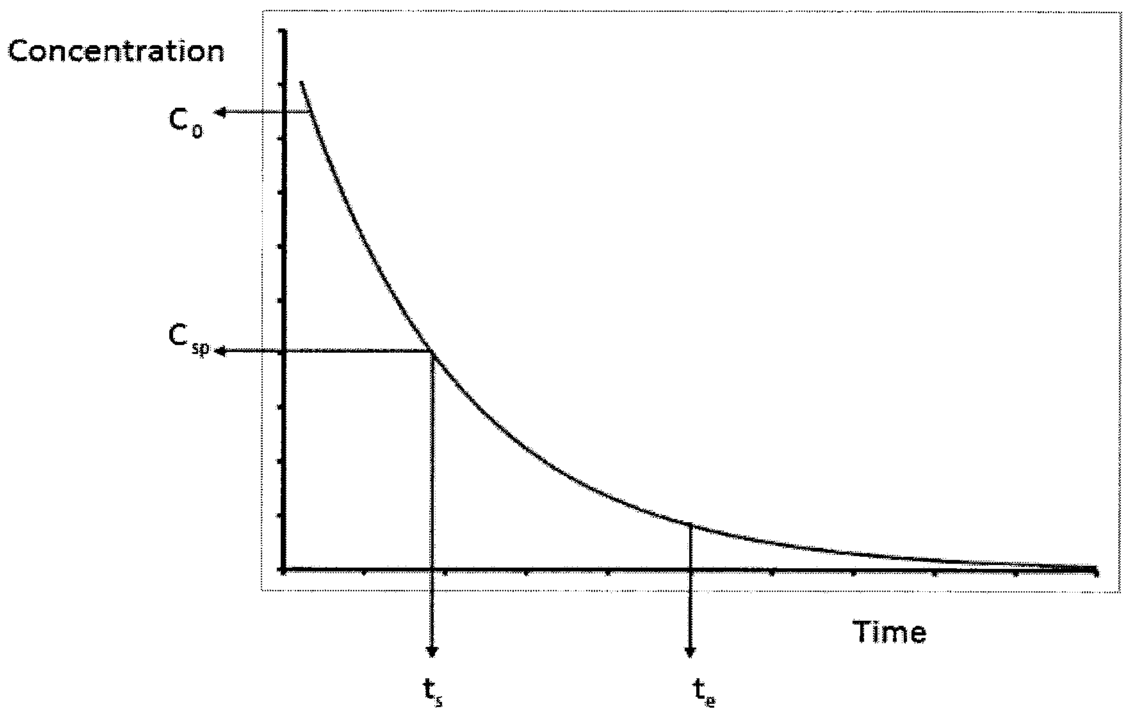

Figure 1 – Idealized Exponential Decay Curve

In practice, real world data is never as smooth as shown in this figure, but the key principle of exponential decay is that concentration decreases over time at a rate that is proportional to the concentration of contaminant remaining. This means the rate of change may be expressed as either a half-life, as is done in the case of radioactive decay, or as a percent decrease per unit time.

Among the reasons that real world groundwater contaminant concentration decay data is not smooth is that it is often not possible to precisely know the quantity or even the specific chemical nature of the contaminants that were released. In addition the inherent uncertainty regarding subsurface soil, bedrock and groundwater conditions combined with uncertain distribution of contaminants make precise calculations of cleanup rates difficult.

Despite these limitations it is often possible to evaluate the relative effectiveness of different cleanup methods provided that data on their relative effectiveness taken from actual field test programs exists. In the case of the Northeast Area groundwater contaminant plume at the W.R. Grace Superfund site in Acton, there are suitable comparative data sets available for analysis.

B. <u>Calculating Rates of Change for Exponential Decay</u>

Exponential decay is a well understood concept in mathematics. The general formula used for calculating decay rate is:

$$C(t) = C_0e^{-rt}$$

where:

$C(t)$ = the contaminant quantity or concentration at the end of the period of interest;

C_0 = the contaminant quantity or concentration at the beginning of the period interest;

e = the mathematical constant

r = the rate of decay; and

t = time duration between the beginning and end of the period of interest.

When any three of the four variables is known, it is possible to calculate the fourth variable from the equation.

C. <u>Developing Representations of Contaminant Mass in the Aquifer</u>

As indicated in section A, it is difficult to precisely quantify the amount of contaminant in the Northeast Area aquifer at any particular time. However, knowledge of the precise quantity is not necessary for the calculation of the rate of change provided that the methods used to calculate the contaminant quantity at the beginning and at the end of the period of interest are the same. This is mathematically true because to solve the exponential decay equation for the rate of change, the important factors are the ratio between C(t) and C_0 and the duration of the period t; all of the particulars associated with the method of contaminant quantification cancel out in the calculation of rate and thus do not affect the answer.

The objective of the following calculation is to compare the rate of contaminant decay during the period without treatment to the period of time with treatment by comparing the rate of decay from the 2001/2002 to 2009 period to the rate of decay for the 2009 to 2012 period. This comparison involves calculating a proportional representation of contaminant quantity for the 2001/2002, 2009 and 2012 data sets. This was done by examining the Tetra Tech Northeast Area plume maps for these time frames and calculating the areas of each of the VDC plume concentration ranges for these given times (see attached plume figures). The area of each range was multiplied by the average VDC concentration within the range and then these products were summed to give a total for that time.

Note that the value calculated using this method does not yield the actual mass of VDC in the aquifer, but a quantity that is proportional to the VDC mass. The following table presents the measurements and factors used to calculate the VDC quantities.

Calculation of VDC Quantity (Proportional)

For 2001 – 2002	Mean Conc.	Area (acres)	ug*acres/l
7 to 30 ug/l	18.5	88.3	1634
30 to 60 ug/l	45	34.6	1557
60 to 100 ug/l	80	17.5	1400
200 to 260 ug/l	230	3.3	759
Total			5350
For 2009			
7 to 30 ug/l	18.5	56.7	1049
31-60 ug/l	45	20.3	914
61-100 ug/l	80	11.3	904
Total			2866
For 2012			
7 to 30 ug/l	18.5	69	1277
31 to 60 ug/l	45	11.8	531
60 to 86 ug/l	73	0.48	35
Total			1843
Note: See figures for identification of concentration bands.			

D. Length of Time Periods

The duration of the period with no treatment (from 2001/2002 until 2009) is estimated to be 7.75 years. The Period with treatment (from 2009 until 2012) is estimated to be 2.5 years. The actual period of treatment is somewhat less than this which will tend to understate the effectiveness of treatment.

E. Calculation of VDC Attenuation Rates

To calculate the rate of VDC concentration decline without treatment the equation from section B was used with the following substitutions:

> C_0 = 5350 ug*acre/l;
> C(t) = 2866 ug*acre/l; and
> t = 7.75 years.

Solving the equation for r fields a decay rate of 8% per year with no treatment.

To calculate the rate of VDC concentration decline with treatment the equation from section B was used with the following substitutions:

> C_0 = 2866 ug*acre/l;
> C(t) = 1843 ug*acre/l; and
> t = 2.5 years.

Solving the equation for r fields a decay rate of 16% per year with treatment.

Thus the relative rate of VDC attenuation is approximately twice as fast with the remedial system running as it is without the remedial system running.

F. Calculation of the Time to Achieve Remedial Goal

The remedial goal for VDC in the aquifer is either the MCL or the MCLG; for VDC this is the same number, 7 ug/l. The same equation from section B used to calculate the relative rate of VDC attenuation can be used to calculate the amount of time it will take to achieve the remedial goal for VDC.

To calculate how long it will take to achieve the remedial goal without treatment the following factors were used:

> C_0 = 86 ug/l (the recent highest groundwater VDC concentration);
> C(t) = 7 ug/l (the remedial goal); and
> r = 8%

Solving the equation for time gives the result of approximately 31 years without treatment.

To calculate the how long it will take to achieve the remedial goal with treatment the following factors were used:

> C_0 = 86 ug/l (the recent highest groundwater VDC concentration);
> C(t) = 7 ug/l (the remedial goal); and
> r = 16%

Solving the equation for time gives the result of approximately 15 years with treatment.

Therefore continued operation of the treatment system will restore the aquifer to a fully usable condition approximately 16 years sooner than would occur if the treatment is discontinued.