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June 12, 2014

Via e-mail: jxgreco@gw.dec.state.ny.us

Mr. Jonathan Greco
NYSDEC – Division of Environmental
Remediation
625 Broadway
Albany, NY 12233-7016

RE: Queens Medallion Leasing
21-03 44th Avenue
Long Island City, New York
NYSDEC Site No. C241144

Dear Mr. Greco:

The Final report submission titled: “Supplemental Remedial Investigation Work Plan, Queens Medallion Leasing, 21-03 44th Avenue, Long Island City, New York, NYSDEC Site No. C241144” prepared for Exclusive Realty Services, LLC is submitted by Leggette, Brashears & Graham, Inc. (LBG) for your file.

If you have any questions please do not hesitate to contact me at (914) 694-5711.

Very truly yours,

LEGGETTE, BRASHEARS & GRAHAM, INC.



Sean Groszkowski
Associate Vice President

SG:dmd

Attachment

cc: Thomas Panzone (NYSDEC)
Dawn Hettrick (NYSDOH)
Scott Furman, Esq. (Sive, Paget & Riesel, PC)
Queens Borough Public Library (Document Repository)
Queens Community Board No. 2 (Document Repository)

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**SUPPLEMENTAL REMEDIAL
INVESTIGATION WORK PLAN
QUEENS MEDALLION LEASING
21-03 44TH AVENUE
LONG ISLAND CITY, NEW YORK
NYSDEC SITE NO. C241144**

Prepared For

Exclusive Realty Services, LLC

June 2014

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**SUPPLEMENTAL REMEDIAL INVESTIGATION WORK PLAN
QUEENS MEDALLION LEASING
21-03 44TH AVENUE
LONG ISLAND CITY, NEW YORK
NYSDEC SITE NO. C241144**

1.0 INTRODUCTION

The following Supplemental Remedial Investigation Work Plan (SRIWP) for the property located at 21-03 44th Avenue in Long Island City, Queens, New York (heretofore referred to as the “Site”) was prepared by Leggette, Brashears & Graham, Inc. (LBG) on behalf of Exclusive Realty Services, LLC (heretofore referred to as “ERS” or the “Volunteer”). Figure 1 shows the general location of the Site.

On January 7, 2014, the application for entry of the Site into the Brownfield Cleanup Program (BCP) was approved by the New York State Department of Environmental Conservation (NYSDEC). The completed Brownfield Cleanup Agreement (BCA) for the Site was executed by ERS on January 16, 2014 and by the NYSDEC on February 10, 2014. Under the NYSDEC BCP, the Site Name is listed as Queens Medallion Leasing and is recorded as Site No. C241144.

The purpose of this SRIWP is to outline the methodology and investigative procedures proposed to confirm the environmental status of the subsurface in the area of historical soil excavation activities. The characterization of the extent and concentration of residual contamination in the former excavation area will be used to evaluate the need (or lack thereof) for additional remedial actions to address residual source material beneath the Site. Additionally, the characterization data will be used to develop the most feasible remediation action(s) to be implemented as a corrective action for the Site.

2.0 SITE BACKGROUND

The Site is located in an urban setting in an area that has historically been used for manufacturing purposes. The Site consists of a two-story building and a small area of land. The Site was historically an industrial facility that performed metal plating approximately 20 to 25 years ago. Presently, the Site has been renovated, and is occupied by Queens Medallion

Leasing. No industrial activity has taken place at the Site since 1996. A site plan is shown on figure 2.

Based on the historical investigations performed at the Site, the contaminants of concern (COC) are chromium and perchloroethylene (PCE), a chlorinated volatile organic compound (CVOC). The COCs, which were detected at concentrations exceeding applicable soil cleanup objectives and groundwater quality standards, were observed to be present beneath the Site as well as upgradient and downgradient of the Site. Prior investigations for the Site were conducted by Vertex Engineering Services, Inc. (Vertex) in 2004, Galdun Frankel Environmental (GFE) in 2005 and LBG in 2007.

Additionally, an NYSDEC Superfund investigation was performed by ARCADIS Malcolm Pirnie, Inc. in relation to the area-wide PCE groundwater contaminant plume. The results of the Superfund investigation were presented in a Remedial Investigation Report (RIR).

Based on the results of historical remedial investigation activities (onsite and surrounding the Site) it has been determined that the Site is a contributor of hexavalent chromium contamination and a potential contributor to the CVOC contamination.

As a result of the Superfund investigation RIR, the NYSDEC is requiring limited supplemental remedial investigation activities to ensure that no residual contaminant source areas are present beneath the Site.

3.0 SUPPLEMENTAL REMEDIAL INVESTIGATION OBJECTIVE

The objectives of the Supplemental Remedial Investigation (SRI) (in combination with the Site characterization data generated from past environmental characterization activities) are:

- to identify contaminant sources;
- to determine the nature and extent of contamination;
- to provide detailed delineation of the environmental media;
- to identify contaminant migration pathways;
- to determine the impact or potential impact of contaminants on public health and the environment; and,
- to collect data required to:

- evaluate appropriate remedial alternatives for the Site that will effectively prevent, mitigate and remedy environmental damage or human exposure to contaminants;
- perform a comparative analysis between potential remedial alternatives; and,
- select a preferred remedial action for the Site.

4.0 SUPPLEMENTAL REMEDIAL INVESTIGATION SCOPE OF WORK

In order to address whether a potentially unidentified source area is present beneath the Site, an area-specific SRI will be performed at the Site. The SRI will be comprised of a limited subsurface investigation, during which two (2) soil characterization borings will be attempted at the Site: one (1) soil boring on the northern portion of the interior of the Site in the location of the former subsurface structure VSS-9; and, one (1) soil boring in the exterior alley to the east of the building (within or as close as practicable to the exterior concrete pit located at the southeastern extent of the alley). The proposed soil boring will be installed using the Geoprobe® drilling method. Of note, field access limitations may prevent the inclusion/completion of the exterior soil boring in the specified location. The location of the proposed soil borings are presented on figure 3.

During the drilling, continuous soil samples will be collected at 5-foot intervals from grade to approximately 25 ft bg (or the top of the bedrock surface). For the exterior soil boring, continuous soil samples will be collected at 5-foot intervals from approximately 12 ft bg (the soil underlying the bottom of the concrete pit) to approximately 25 ft bg (or the top of the bedrock surface). The soil samples will be evaluated in the field and recorded on geologic logs by the onsite LBG hydrogeologist. The geologic log will also document the depth at which the groundwater interface is identified. Each sample will be screened for the presence of volatile organic compounds (VOCs) using a photoionization detector (PID). Soil samples will be collected from the interior soil boring at three (3) intervals: 1) one sample from the unsaturated soil horizon; 2) one sample from the groundwater interface; and 3) one from the top of bedrock. Due to the greater initial sampling depth of the exterior soil boring (if performed successfully) relative to the groundwater table, soil samples will be collected

from the exterior soil boring from only two (2) intervals: 1) one sample from the groundwater interface; and 2) one from the top of bedrock. Additional soil samples will be collected if necessary based on field observations (e.g., in the event gross contamination is identified). All soil samples will be collected in laboratory supplied sample jars and stored in a cooler on ice. Samples will be shipped under chain of custody to a New York State approved laboratory for analysis of VOCs, semivolatile organic compounds (SVOCs), Target Analyte List (TAL) metals, hexavalent chromium, pesticides and polychlorinated biphenyls (PCBs). The analytical laboratory results for the soil sample will be compared to the Restricted Use Soil Cleanup Objectives (RUSCO) in accordance with the Standards, Criteria and Guidance (SCGs) as outlined in 6 NYCRR Part 375-6.8(b) for the selected land use of Restricted Commercial. Additionally, soil quality results will be compared to unrestricted SCOs for the purpose of evaluating site management requirements.

Following the collection of the soil samples from the soil boring, the soil boring will be backfilled. In the event that the soil extracted from the boring does not exhibit elevated levels of VOCs (via the field PID screening) or visual evidence of impact, the cuttings will be used for backfilling the boring. In the event that elevated VOCs or visual evidence of impact is observed, the following procedure will be followed:

- all soil will be drummed onsite in a New York State (NYS) Department of Transportation (DOT) approved 55-gallon drum;
- the completed soil boring will be backfilled with clean sand to approximately 6 inches below grade; and
- the drummed soil will be sampled and submitted to a New York certified laboratory for waste characterization analysis;
- following waste characterization, the soil cuttings will be shipped offsite to a certified disposal facility permitted for the waste.

Following the soil sampling and backfilling, the surface of the boring will be restored to its original condition as documented prior to the completion of the soil boring.

5.0 REMEDIAL INVESTIGATION PROGRAM

5.1 General Remedial Investigation Information

5.1.1 Project Personnel Structuring

LBGES/LBG (LBG Engineering Services, P.C./Leggette, Brashears & Graham, Inc.) will act as the environmental consultant (representative for Volunteer) during the implementation of the supplemental remedial investigation and remedial action activities at the Site. As such, LBG will be responsible for: coordination of field activities with all related subcontractors; soil sampling; groundwater sampling; air monitoring sampling; waste sampling; hydrogeologic activities, excavation and dewatering plans; health and safety oversight; communications with regulatory officials; and, documentation and reporting for the BCP activities. In addition to in-house staff, LBGES/LBG will be utilizing several subcontractors for the completion of the field activities.

5.1.1.1 Remedial Engineer

The Remedial Engineer for this project will be Mr. William Beckman who is a registered professional engineer licensed by the State of New York. Mr. Beckman is the President of LBGES and has been with the firm since 1978. As Remedial Engineer, Mr. Beckman will work with LBGES/LBG personnel and collaborate directly with the Project Manager. The Remedial Engineer will have primary direct responsibility for implementation of the remedial program for the Site (NYSDEC BCA Site No. C241144).

The Remedial Engineer, and/or LBGES/LBG representatives under his supervision, will coordinate the work of other contractors and subcontractors involved in all aspects of remedial construction, including soil excavation, stockpiling, characterization, removal and disposal, air monitoring, emergency spill response services, import of backfill material, and management of waste transport and disposal. The Remedial Engineer, and/or LBGES/LBG representatives under his supervision, will be responsible for all appropriate communication with NYSDEC and New York State Department of Health (NYSDOH).

5.1.1.2 Project Manager

The Project Manager for this project will be Mr. Sean Groszkowski, CPG who has been with LBGES/LBG since 2000 and has been an Associate Vice President with the company since 2014. Mr. Groszkowski has worked on many contaminated site remediation projects in New York for both public and private entities with a specialization in the NYSDEC BCP. Mr. Groszkowski has extensive experience completing long-term hazardous soil remediation projects in collaboration with State regulatory agencies. As such, he is very familiar with Federal and State regulations governing hazardous waste remediation projects.

As Project Manager Mr. Groszkowski would be the primary contact for the project and would be responsible for coordinating and conducting all tasks necessary to complete the required scope of work. Mr. Groszkowski would work with all associated subcontractors and will collaborate directly with the Remedial Engineer.

5.1.1.3 Project Field Supervisor

Mr. Brian Hawe and/or qualified LBGES/LBG representatives under his supervision will serve as Project Field Supervisor for this project. Mr. Hawe, a Senior Hydrogeologist, has been with LBGES/LBG since 2005. His hydrogeologic experience includes but is not limited to: hazardous waste remediation projects; soil excavation oversight; collection of soil, groundwater, soil vapor and indoor air samples; drilling supervision and formation sampling; well design; installation of groundwater/non-aqueous phase liquid (NAPL) monitor and recovery wells; underground storage tank (UST) closures, development and test pumping of recovery wells, supervision of hazardous soils/liquids removal; and air monitoring.

The Project Field Supervisor will be responsible for implementation and oversight of all field activities performed as part of the BCP. This will include the supervision and coordination of all onsite supplemental remedial investigation and subsequent remedial action activities. The Project Field Supervisor will be responsible for conducting daily tailgate meetings with all contractors involved in the remedial project that day. Additionally, the Project Field Supervisor will be responsible for documenting the daily activities associated with the implementation of the Remedial Action Work Plan (RAWP) on Daily Field Sheets. The Daily Field Sheets will outline remedial activities performed for each day and will be submitted

to the NYSDEC and NYSDOH Project Managers (via e-mail) at the end of each day following the reporting period.

The Project Field Supervisor will work alongside the Health and Safety Officer (HSO) during the implementation of the RAWP. The Project Field Supervisor will report directly to the Project Manager and Remedial Engineer.

5.1.1.4 Health and Safety Officer

Mr. David Morelli has been with LBGES/LBG since 2002 and has been a Senior Hydrogeologist with the company since 2008. Mr. Morelli's hydrogeologic experience includes but is not limited to: project management for soil and groundwater remediation sites; community air monitoring activities; collection of soil, groundwater, soil vapor and indoor air samples; well design; drilling supervision and installation of groundwater/NAPL monitor and recovery wells; UST closures; development and test pumping of recovery wells; and air monitoring.

As HSO, Mr. Morelli and/or designated LBGES/LBG representatives under his supervision would be responsible for implementation, enforcement and monitoring of the Health and Safety Plan (HASP). This responsibility will primarily consist of field oversight to ensure work activities/conditions are completed/maintained in compliance with the HASP. This includes but is not limited to: the performance of the pre-project Health and Safety meeting; the performance of the daily Health and Safety tailgate meeting (during implementation of the RAWP); oversight of field work and halting activities in the event of an observed Health and Safety condition. As HSO, he will also be responsible for the pre-decontamination indoctrination and periodic training of all personnel entering and/or working at the Site with regard to the HASP. The HSO will also be responsible for alerting the Project Manager, the Remedial Engineer and the NYSDEC Project Manager of any Health and Safety issues that arise in association with the onsite remedial activities.

The HSO will work alongside the Project Field Supervisor during the implementation of the RAWP. The HSO will report directly to the Project Manager and Remedial Engineer.

5.1.2 Field Activity Policy and Procedures

5.1.2.1 Work Hours

The hours for operation of remedial construction will conform to the New York City Department of Buildings (NYCDOB) construction code requirements or according to specific variances issued by that agency. The anticipated work hours for activities outlined in this SRIWP will be from approximately 7:00 a.m. until 3:00 p.m.

The NYSDEC will be notified by the Volunteer of any variances issued by the NYCDOB. NYSDEC reserves the right to deny alternate remedial construction hours.

5.1.2.2 Site Safety and Security

All remedial action activities will be performed in accordance with the HASP. A copy of the HASP (outlined in Section 5.3.1, below) is presented in Appendix A. During all remedial activities, access onsite within work areas will be limited. All persons entering the Site work areas will be required to sign a log book and will be required to meet all applicable health and safety requirements. All work areas will be secured during non-working hours. Adequate danger signs, barriers, etc., will be placed to effectively warn the public of hazards as well as to restrict access to dangerous areas. Necessary barricades, walkways, lighting and postings will be provided for the protection of the public prior to the start of remedial action activities. Additionally, the onsite HSO will monitor operations during the remedial activities to ensure that applicable protective measures are in place and functioning.

Additionally, safe access will be provided for employees, including installation of walkways, stairs, ladders, etc.

5.1.2.3 Traffic Control

The basic objective of traffic control is to permit the contractor to work within the public right of way efficiently and effectively while maintaining a safe, uniform flow of traffic. The construction work and the public traveling through the Site access points in vehicles, bicycles or as pedestrians must be given equal consideration when developing a traffic control plan.

5.1.2.4 Worker Training and Monitoring

All personnel working on the Site as part of the remedial activities will have at a minimum a 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) certification. This certification will be validated with annual 8-hour refresher courses. Additionally, all personnel will be subject to their specific company medical monitoring program (i.e., annual physical).

All personnel performing work at the Site as well as those certifying any aspect of the project will have the appropriate required certification(s).

5.1.2.5 Agency Approvals

All permits or government approvals required for remedial activities will be obtained as needed.

5.1.2.6 NYSDEC BCP Signage

A project sign will be erected at the main entrance to the Site prior to the start of any remedial activities. The sign will indicate that the project is being performed under the NYSDEC BCP. The sign will meet the detailed specifications as outlined in Division of Environmental Remediation (DER-10) and as provided by the NYSDEC Project Manager. A sample of the NYSDEC BCP project sign is included in Appendix B.

5.1.2.7 Emergency Contact Information

A Project Contact List, containing names, addresses and telephone numbers of key personnel involved in this project is included in Appendix C. This document defines the specific project contacts for use by NYSDEC and NYSDOH in the case of a day or night emergency.

5.2 Field Sampling Procedures

5.2.1 Subsurface Soil Sampling Procedures

Anticipated subsurface soil sampling activities associated with the SRI will be performed via Geoprobe® drilling. Subsurface soil samples will be submitted for laboratory

analysis for VOCs, SVOCs, TAL metal, hexavalent chromium, pesticides and PCBs. Soil sample analytical results will be compared to Applicable or Relevant and Appropriate Regulations (ARARs) and to 6 NYCRR Part 375 RUSCOs to adequately evaluate environmental quality.

Surface and subsurface soil/fill sample intervals may be adjusted in the field based on the actual depths to the strata changes and to allow for sampling of any native soil separately from the overlying or fill material or soils. The actual locations of any of the boreholes and/or sample intervals may be changed in the field based on actual field conditions encountered.

The portion of the collected sample not required for chemical analysis will be placed back into the hole. Clean sand will be used to fill any excess void space within the completed boring(s), if necessary, following which the concrete slab/asphalt will be restored.

All sample locations will be field tied to three permanent features and surveyed with a Global Positioning System (GPS) unit or other appropriate surveying equipment to obtain horizontal and vertical control for each sampling location.

Field sampling personnel will screen and document field soil vapor headspace in a sealable plastic bag using a PID calibrated to a 100 ppm (parts per million) isobutylene standard. The collection of soil samples will be biased toward known disposal areas or areas with grossly contaminated soil/fill. Sample depths may be field altered based on visual and olfactory observations and field screening instrument readings.

The Geoprobe® direct-push method field procedures that will be followed while performing the subsurface soil collection activities are described below:

- i. At each sample location, a new acetate/plastic liner will be inserted into the direct-push soil sampler.
- ii. The sampler will be fitted with a cutting tip/drive shoe and pushed/driven into the ground mechanically with powered equipment mounted on a track unit (approximately 4 feet by 6 feet and 10 feet high) or truck (pick-up truck or van) beyond the depth of the deepest designated sample depth. The sampler may be manually driven if the direct-push unit cannot access the sample location (i.e., presence of large trees, roots, and steep slopes) or may cause significant damage

- to the area or ground surface. If the deepest sampling depth exceeds the length of the soil sampler, then a second lined sampler will be advanced down the same hole subsequent to retrieval of the first sampler.
- iii. The sampler will then be removed and the liner containing the soil core will be removed. The liner will be cut and the soil core will be measured, logged and recorded on a geologic log. At each borehole location, the following information will be logged: soil stratigraphy; depth to refusal where encountered; and the depths to the native soil/clay interface and fill/native soil interface, if possible and where present.
 - iv. If necessary to obtain sufficient sample volume, additional soil cores may be collected next to the first soil core location.
 - v. The soil sample from the selected sample interval(s) will be removed and placed in a clean, dedicated container (e.g., aluminum foil pan or plastic cup) for homogenization. Plastic sampling equipment will not be used for collection of samples that will be analyzed for organic compounds. Pre-cleaned dedicated sampling tools will be used to collect and homogenize the soil sample prior to transferring it into the sample jar(s) provided by the laboratory. When collected, the field duplicate sample, split sample, matrix spike/matrix spike duplicate (MS/MSD) sample, and investigative sample will be taken from the same soil aliquot homogenized in the container.

5.2.2 Groundwater Sampling Methodology

The groundwater quality at the Site has been comprehensively characterized based on the data obtained from the historical environmental investigations. As a result, no groundwater sampling will be performed in association with the SRI.

5.2.3 Soil Vapor and Indoor Air Sampling Methodology

The soil vapor and indoor air quality at the Site has been comprehensively characterized based on the data obtained from the historical environmental investigations. As a result, no soil vapor and/or indoor air quality sampling will be performed in association with the SRI.

5.2.4 Laboratory Analysis and Reporting of Results, Quality Assurance (QA)/Quality Control (QC) and Data Usability

All samples will be submitted and analyzed by a NYSDOH Environmental Laboratory Accreditation Program (ELAP) certified laboratory. Laboratory analysis of soil and groundwater samples will consist of Category A (as defined in the Analytical Services Protocol [ASP]) or Category Spills laboratory data deliverables for all sampling performed at the Site with the exception of confirmatory (post remediation) samples and final delineation samples.

For all confirmatory (post remediation) samples and final delineation samples, Category B laboratory data deliverables as defined in the ASP will be submitted. In addition, for samples analyzed according to Category B laboratory data deliverables, a Data Usability Summary Report (DUSR) will be prepared by a party independent from the laboratory performing the analysis, when required by the NYSDEC.

5.2.5 Recordkeeping

The analytical data generated in association with the SRI (and subsequent remedial activities) will be maintained in the project file. Summary tables and figures presenting all soil quality characterization data (as well as any IDW characterization data) acquired during the SRI will be included in Final Engineers Report. As per the NYSDEC requirement, characterization data will be submitted in EQUIS format.

5.3 Governing Documents

5.3.1 Site-Specific Health and Safety Plan (HASP)

All remedial work performed under this plan will be in full compliance with governmental requirements, including Site and worker safety requirements mandated by the Federal OSHA.

The Volunteer and associated parties preparing the remedial documents submitted to the State, and those performing the construction work, are completely responsible for the preparation of an appropriate HASP and for the implementation of that work according to that plan and applicable laws. As such, LBGES/LBG has prepared a Site-specific HASP to govern all onsite activities completed in association with the environmental remediation activities performed in association with the Site. The Site-specific HASP is presented in Appendix A. The HASP and requirements detailed in the SRIWP will pertain to all supplemental remedial investigation and subsequent remedial action activities performed onsite and offsite.

As outlined in Section 5.1.1.4, the Site HSO will be Mr. David Morelli. A copy of his resume is included in Appendix D.

5.3.2 Soil/Materials Management Plan (SoMP)

This Soil/Materials Management Plan (SoMP) outlines detailed plans for managing all soils/materials that are disturbed at the Site, including excavation, handling, storage, transport and disposal. It also includes all of the controls that will be applied to these efforts to assure effective, nuisance-free performance in compliance with all applicable Federal, State and local laws and regulations. The SoMP will be utilized during all supplemental remedial investigation and subsequent remedial action activities performed onsite, as well as for any future ground invasive work (if necessary) that is performed under the subsequent Site Management Plan (SMP).

5.3.2.1 Soil Screening Methods

During onsite supplemental remedial investigation and subsequent remedial action activities, waste soil material and/or construction and demolition (C&D) debris may be gener-

ated. Soil screening will be performed during invasive work performed during the remedy and development phases prior to issuance of the Notice of Completion (NOC). During all excavation activities, the soil/fill will be inspected for staining and will be field screened for the presence of VOCs with a PID. Based on the soil that is observed to be discolored, tinted, dyed, unnaturally mottled, or has a sheen, or excavated material that is visibly stained or produces elevated PID readings (i.e., above background) will be considered potentially contaminated and will be either containerized or stockpiled on the Site for further assessment. The potentially contaminated material will be stored in labeled drums and/or a lined and covered roll-off container and then sampled for waste characterization. The waste will then be transported offsite to a permitted waste management facility for disposal.

Visual, olfactory and PID soil screening and assessment will be performed by or under the supervision of the Field Project Supervisor and/or HSO and will be reported in the Final Engineering Report (FER).

5.3.2.2 Characterization of Investigation Derived Waste

Based on the widespread distribution of the COCs within the subsurface, the onsite subsurface contamination cannot be attributed to a documented commercial or industrial process. Laboratory analysis will be performed to characterize any investigation derived waste (IDW) generated as part of the supplemental remedial investigation. Analytical results will be utilized to identify and define any characteristics of hazardous waste at the Site.

If contaminants of concern are identified in soil collected from above the groundwater table, the IDW will be treated as a listed waste. However, in that situation LBG on behalf of the volunteer will file for a NYSDEC “Contained-In” decision (as per USEPA 40 CFR Part 260 “Contained-In” policy), thereby exempting the waste material from the Resource Conservation and Recovery Act (RCRA) Subtitle C listed hazardous waste handling/disposal requirements.

In addition to the 6 NYCRR Part 375-6.8(b) analytical parameters, excavated soil and/or other excavated media that will be transported off-Site for disposal will be sampled in accordance with the requirements of the receiving facility, and in compliance with applicable laws and regulations.

5.3.2.3 Offsite Materials Transport and Disposal

Loaded vehicles leaving the Site will comply with all applicable materials transportation requirements (including appropriate covering, manifests, and placards) in accordance with applicable laws and regulations, including use of licensed haulers in accordance with 6 NYCRR Part 364. If deemed beneficial, queuing of trucks will be performed on-Site, when possible in order to minimize off-Site disturbance. Specified trucking routes will be used by waste haulers to take into account the following factors:

1. limiting transport through residential areas and past sensitive sites;
2. use of mapped truck routes;
3. minimizing off-Site queuing of trucks entering the facility;
4. limiting total distance to major highways;
5. promoting safety in access to highways; and,
6. overall safety in transport.

Trucks will not stop or idle in the neighborhood after leaving the project Site.

Transportation of contaminated waste from the Site to the prescribed treatment/disposal facility will utilize: DOT approved steel 55-gallon drums, lined roll-off containers and/or lined dump trucks. Permits, licenses and insurance will be provided as per regulations.

Laboratory waste characterization of IDW generated in association with the SRI will be completed prior to the loading and transport to the disposal facility. Waste characterization will be performed for off-Site disposal in a manner required by the receiving facility and in conformance with its applicable permits. Based on the results of the laboratory analysis, the soil will be classified as either hazardous or non-hazardous.

The disposal/treatment facility to be utilized will be determined based on the contaminant(s) present and the contaminant concentrations as determined by the waste characterization analysis.

The following documentation will be established and reported by the Remedial Engineer for each disposal destination used in association with the remedial program to document that the disposal of regulated materials exported from the Site was in conformance with applicable laws and regulations:

1. A letter from the Remedial Engineer or designee to each disposal facility describing the material to be disposed and requesting written acceptance of the material. This letter will state that material to be disposed is regulated material generated at a NYSDEC BCP environmental remediation Site in Brooklyn, New York. The letter will provide the project identity and the name and phone number of the Remedial Engineer or designee. The letter will include as an attachment a summary of all chemical data for the material being transported.
2. A letter from each disposal facility stating it is in receipt of the correspondence (1, above) and is approved to accept the material. These documents will be included in the FER.

5.3.3 Community Air Monitoring Plan (CAMP)

Environmental air monitoring and visual observation will be conducted during implementation of all remedial activities onsite and offsite. The proposed program consists of two primary forms of environmental monitoring: particulates (dust) and VOCs. The purpose of the community air monitoring is to ensure that the engineering controls (ECs) designed to protect the community from fugitive releases are functioning properly and, should any such releases occur, ensure immediate notice thereof so that appropriate abatement actions may be implemented. A CAMP has been prepared for this Site and is included in Appendix E.

5.3.4 Storm Water Pollution Prevention Plan (SWPPP)

Due to the paved status of the Site and the interior of the building, storm water management is not considered to be an applicable scope item relative to the implementation of the SRIWP at the Site.

5.3.5 Citizen Participation Plan (CPP)

All historical documents related to the environmental activities performed at the Site have been filed with the NYSDEC as well as public document repositories. The document

repositories will be inspected prior to implementation of the SRIWP to ensure/verify that they contain all applicable project documents.

The Fact Sheets will be issued at major project milestones. No changes will be made to Fact Sheets following NYSDEC approval and authorization for mail-out. No other information, such as brochures and flyers, will be included with the Fact Sheet mailing.

The CPP for this project is attached in Appendix F. Document repositories have been established at the following locations and contain all applicable project documents:

Document Repository 1

Queens Borough Public Library

Court Square

2501 Jackson Avenue

Long Island City, NY 11101

Telephone: (718) 937-2790

Hours of Operation:

Mon., Thur. & Fri. - 11 a.m. to 7 p.m.

Tue. & Wed. - 1 p.m. to 7 p.m.

Sat. & Sun. - Closed

Document Repository 2

Queens Community Board No. 2

43-22 50th Street

2nd Floor, Room 2B

Woodside, NY 11377

Telephone: (718)-533-8773

e-mail - qn02@cb.nyc.gov

By Scheduled Appointment

Hours of Operation:

Mon. - Fri. - 9 a.m. to 5 p.m.

Sat. & Sun. - Closed

In addition to the above-listed public document repository locations, all files and/or reports associated with the environmental activities at the Site are maintained and available for review at the NYSDEC Headquarters in Albany, New York. The information for this office is:

NYSDEC - Albany Headquarters Office

Bureau of Environmental Remediation

625 Broadway

Albany, NY 12233-7016

(518) 402-9767 (call in advance for appointment)

Hours: Mon. to Fri. 9 a.m. to 5 p.m.

5.3.6 Established Regulatory Agency Guidance Documents

In addition to all of the above listed Site-specific governing documents applicable to the implementation of the SRIWP, the following SCG documents will be followed where deemed applicable:

New York State Standards

- 29 CFR Part 1910.120 - Hazardous Waste Operations and Emergency Response;
- 6 NYCRR Part 175 - Special Licenses and Permits--Definitions and Uniform Procedures;
- 6 NYCRR Part 371 - Identification and Listing of Hazardous Wastes (November 1998);
- 6 NYCRR Part 372 - Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities (November 1998);
- 6 NYCRR Subpart 374-1 - Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities (November 1998);
- 6 NYCRR Subpart 374-3 - Standards for Universal Waste (November 1998);
- 6 NYCRR Part 375 - Inactive Hazardous Waste Disposal Sites;
- 6 NYCRR Part 376 - Land Disposal Restrictions; and,
- 6 NYCRR Parts 700-706 - Water Quality Standards (June 1998).

New York State Guidance

- NYSDEC - DER-10 Technical Guidance for Site Investigation and Remediation – May 2010;
- NYSDOH - Guidance for Evaluating Soil Vapor Intrusion in the State of New York - October 2006;
- STARS #1 - Petroleum-Contaminated Soil Guidance Policy;
- TAGM 3028 - "Contained In" Criteria for Environmental Media: Soil Action Levels (August 1997);
- TOGS 1.1.1 - Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations; and,
- Air Guide 1 - Guidelines for the Control of Toxic Ambient Air Contaminants.

6.0 DATA EVALUATION AND REPORTING

Following the completion of the SRI, LBG will prepare a comprehensive Remedial Investigation Report (RIR). The RIR will summarize the findings of the past remedial investigation activities performed at the Site. The RIR will also describe methodologies and procedures of all SRI field work, geologic logs for the soil borings, laboratory analytical reports and results presented in tabular and map form.

The comprehensive data evaluation will be used to verify that the vertical and lateral extent of residual subsurface contamination beneath the Site is comprehensively delineated. The results of the SRI will be used specifically to evaluate the environmental status of the subsurface in the former location of VSS-9. This evaluation will be used to verify that no residual contaminant source areas remain beneath the Site. The RIR data evaluation will illustrate that the extent and concentration of residual subsurface contamination at the Site and offsite has been fully characterized.

7.0 REMEDIAL ALTERNATIVES ANALYSIS AND REMEDIAL ACTION PLAN

The results for the Site characterization (as presented in the RIR) will be used to evaluate and select the preferred remedial alternative for addressing the residual contamination beneath the Site. The selection of a remediation technology will be based on the following: compliance with standards, criteria and guidance; overall protectiveness of public health and the environment; short-term and long-term effectiveness; reduction of toxicity, mobility and volume of contaminants; cost effectiveness; and community acceptance.

8.0 CERTIFICATION

I, Sean Groszkowski, certify that I am currently a Qualified Environmental Professional as defined in 6 NYCRR Part 375, and that this SRIWP was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

LEGGETTE, BRASHEARS & GRAHAM, INC.



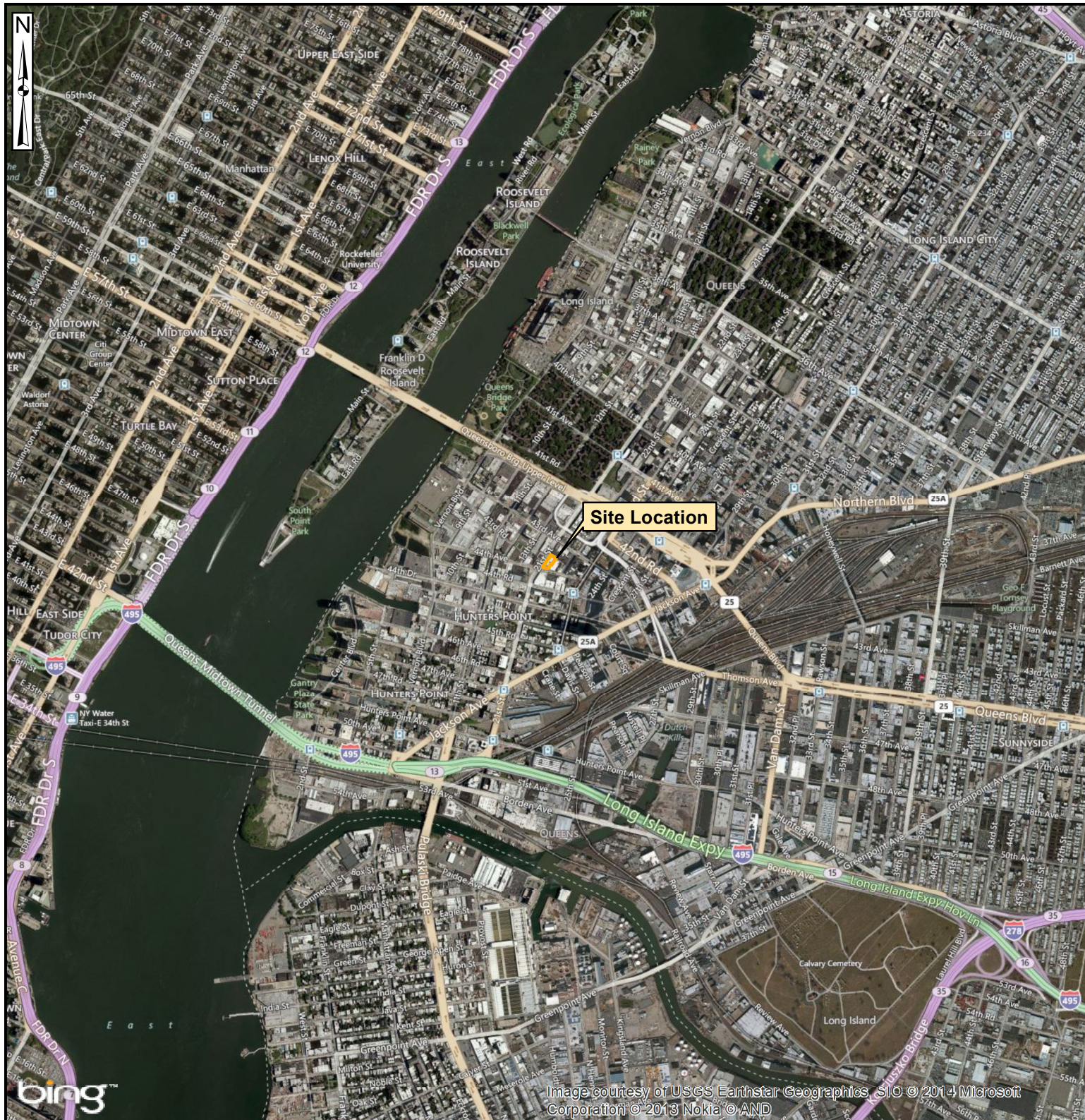
Sean Groszkowski, CPG
Associate Vice President

dmd

June 12, 2014

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FIGURES

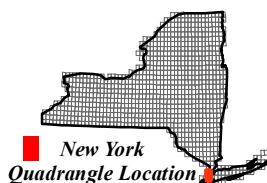


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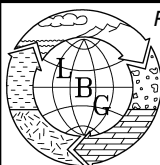
Legend

 Site Boundary



QUEENS MEDALLION
21-03 44TH AVENUE
LONG ISLAND CITY, NEW YORK

SITE LOCATION



Prepared by:
LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Services
4 Westchester Park Drive, Suite 175
White Plains, New York 10604
(914) 694-5711 www.lbgweb.com

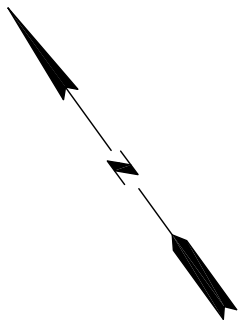
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CHECKED BY: SG

FIGURE: 1



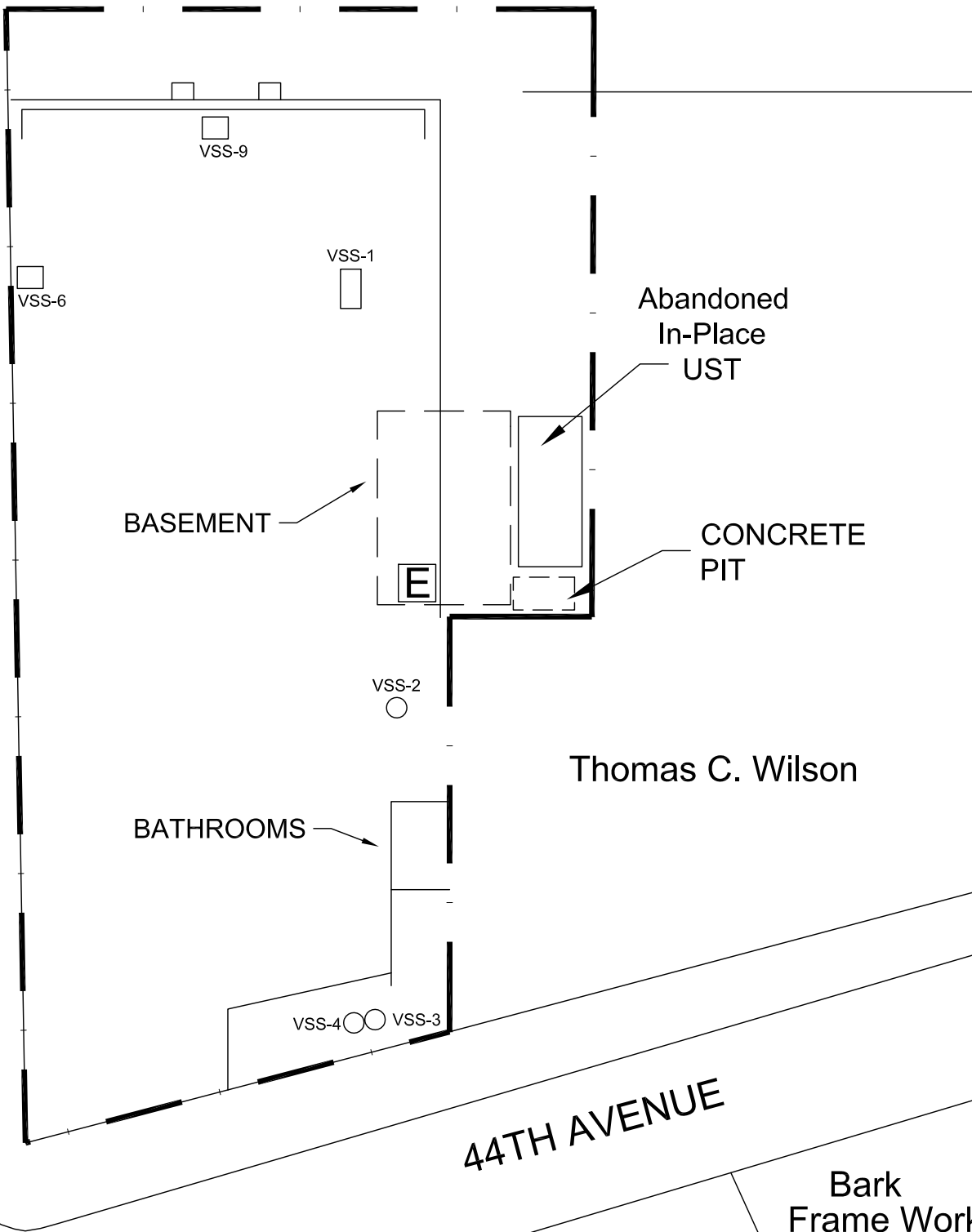
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Envelope

McQuay NY
Air Conditioning
Parts & Services

Limes
Transmission
21st Street
Auto Repair, Inc.

21 ST STREET

Wills Building

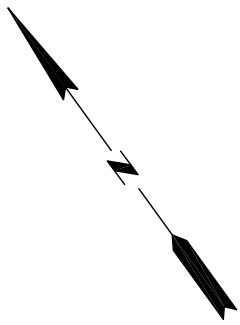


LEGEND

— — — — — PROPERTY BOUNDARY



QUEENS MEDALLION 21-03 44TH AVENUE LONG ISLAND CITY, NEW YORK			
SITE PLAN			
	PREPARED BY: LEGGETTE, BRASHEARS & GRAHAM, INC. Professional Ground-Water and Environmental Services 110 Corporate Park Drive, Suite 112 White Plains, New York (914) 694-5711		
	FILE: white plains\bern	DRAWN BY: SCG	CHECKED BY: SG
DATE: 5/22/13			FIGURE: 2



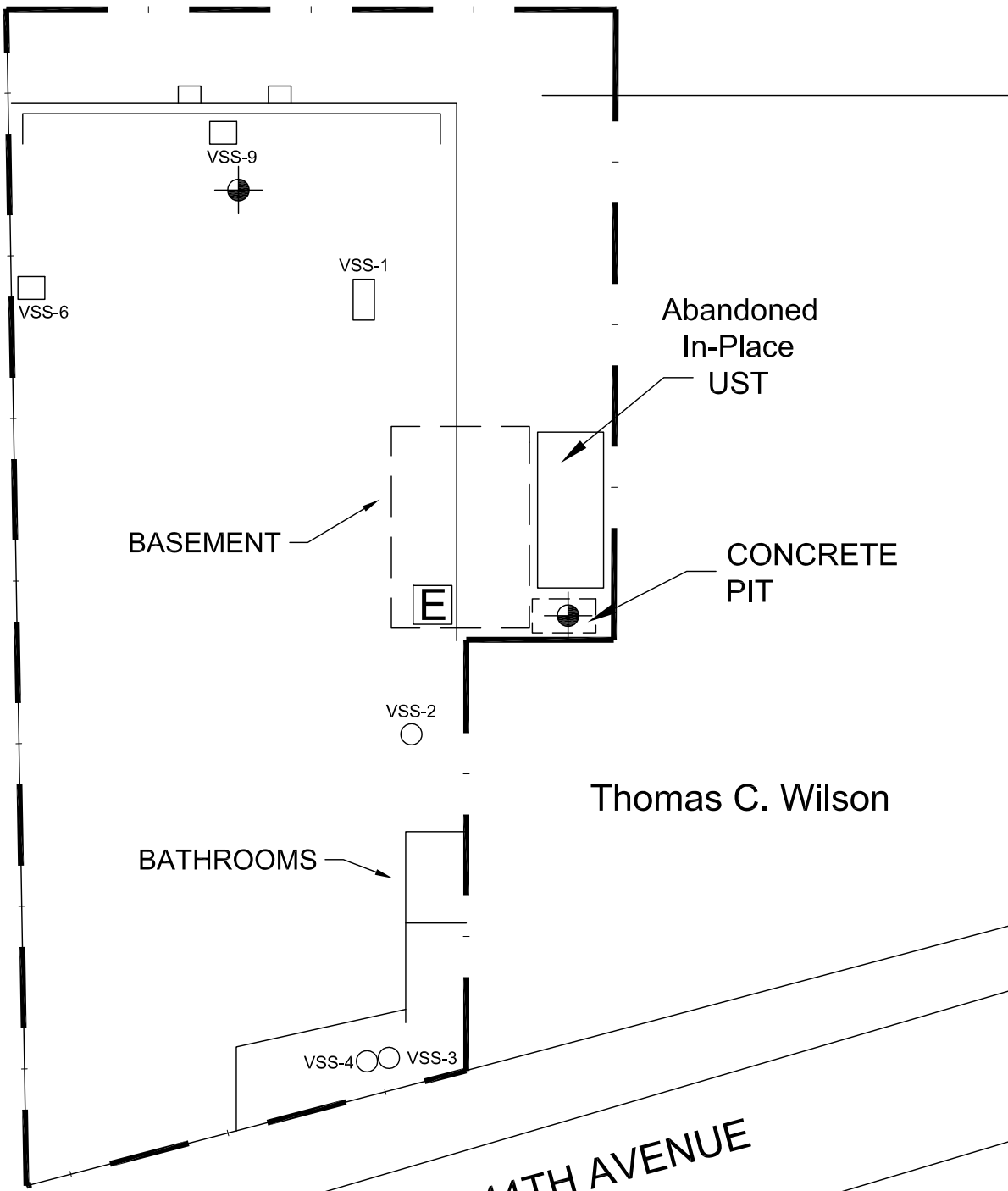
ARGO
Envelope

McQuay NY
Air Conditioning
Parts & Services

Limes
Transmission
21st Street
Auto Repair, Inc.

21 ST STREET

Wills Building



LEGEND

— — — — — PROPERTY BOUNDARY

● PROPOSED GEOPROBE
SOIL BORING LOCATION



QUEENS MEDALLION 21-03 44TH AVENUE LONG ISLAND CITY, NEW YORK			
PROPOSED SRIWP SAMPLE LOCATION MAP			
	PREPARED BY: LEGGETTE, BRASHEARS & GRAHAM, INC. Professional Ground-Water and Environmental Services 110 Corporate Park Drive, Suite 112 White Plains, New York (914) 694-5711		
	FILE: white plains\bern	DRAWN BY: SCG	CHECKED BY: SG
DATE: 5/22/13			FIGURE: 3

APPENDIX A

Health and Safety Plan

**QUEENS MEDALLION LEASING
21-03 44th AVENUE
LONG ISLAND CITY, QUEENS
COUNTY, NEW YORK 11101**

**SITE SPECIFIC HEALTH AND SAFETY PLAN
NYSDEC BCP SITE NO. C241144**

Prepared For

Exclusive Realty Services, LLC

May 2014

LBG ENGINEERING SERVICES, P.C.
Professional Environmental & Civil Engineers
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**QUEENS MEDALLION LEASING
21-03 44th AVENUE
LONG ISLAND CITY, QUEENS
COUNTY, NEW YORK 11101**

**SITE SPECIFIC HEALTH AND SAFETY PLAN
NYSDEC BCP SITE NO. C241144**

Exclusive Realty Services, LLC (ERS) is the volunteer for implementation of a remedial program at a property located at 21-03 44th Avenue in Long Island City, New York, Brownfield Cleanup Program (BCP) Site No. C241144. The remedial activities are to be implemented pursuant to the New York State Department of Environmental Conservation (NYSDEC) BCP. This Health and Safety Plan (HASP) is intended to provide a basic framework for the remedial activities performed at the Site. The procedures provided herein are intended as a guide for all Leggette, Brashears & Graham, Inc. (LBG) and LBG Engineering Services, P.C. (LBGES) personnel as well as all subcontractor employees who will be involved in the performance of the project.

The primary objective of the HASP is to establish work-safety guidelines, requirements and procedures before field activities begin and during the field activities. The following information was prepared specifically for field operations by personnel to enforce and adhere to the established rules as specified in the HASP. The HASP will be provided to all personnel to aid in accomplishing the following objectives:

- monitoring the effectiveness of the HASP as it is conducted in the field by performing field operation audits;
- following up on any necessary corrective actions;
- interacting with regulatory agencies and/or client representatives regarding modifications of health and safety actions; and,
- stopping work should conditions warrant such action.

All personnel will have had health and safety training in accordance with Occupational Safety and Health Administration (OSHA) Interim Final Standard 29 CFR 1910 or as may be amended. A copy of LBG's Corporate Safety Policy and Drug and Alcohol Policy is attached in Appendix A.

1.0 ORGANIZATION AND RESPONSIBILITIES

The organization and responsibilities for implementing safe site-investigation procedures, and specifically for the requirements contained in this manual, are described in this section. The Project Contact Sheet, presenting the contact information for primary project personnel and emergency response agencies that would be utilized in emergency situations at the Site, is presented along with the attached forms. Additionally, the following list outlines project Health and Safety forms that will be utilized as part of the HASP for the Site:

- Site Safety Briefing Form;
- Weekly Safety Report Form;
- Incident Report Form;
- HASP – Plan Acceptance Form;
- Air Monitoring Sheets;
- Exclusion Zone Log Sheet; and,
- Written directions and a map to the Local Hospital.

Copies of the above listed project forms are attached at the end of this document.

1.1 Project Manager

The LBG Project Manager will be responsible for the overall implementation and monitoring of the health and safety program by:

- ensuring appropriate protective equipment is available and properly used by all personnel, in accordance with the HASP;
- ensuring personnel health and safety awareness by providing them with proper training and familiarity with procedures and contingency plans;
- ensuring all personnel are apprised of potential hazards associated with the site conditions and operations;
- supervising and monitoring the safety performance of all personnel to ensure their work practices are conducted in accordance with the HASP;

- correcting any work practices or conditions that would expose personnel to possible injury or hazardous condition;
- communications with the onsite Health and Safety Officer (HSO);
- ensuring sufficient protective equipment is provided and used;
- promptly initiating emergency alerts; and,
- communicating with the client and/or regulatory agency representatives.

1.2 Onsite Health and Safety Officer

The LBG onsite HSO will be onsite during all field activities. The HSO will be accountable for the direct supervision of personnel from the subcontractors and other LBG personnel with regard to:

- health and safety program compliance;
- maintaining a high level of health and safety consciousness among employees at the work site; and,
- reporting accidents within LBG jurisdiction and undertaking corrective action.

1.3 Field Personnel

All field personnel will report directly to the onsite HSO, and will be required to:

- be familiar with, and conform to, provisions of the HASP;
- ensure that they are well informed of potential hazards at the work site and exercise informed consent in their work;
- report any accidents or hazardous conditions to the onsite HSO; and,
- have complete familiarity with their job requirements and the health and safety procedures involved.

1.4 Reporting of Accidents and Unsafe Conditions

If an accident occurs, the HSO and the injured person(s) are to complete an Accident Report for submittal to the project manager, who will forward a copy to the principal-in-charge who should ensure that follow-up action is taken to correct the situation that caused the accident.

1.4.1 Disciplinary Actions for Safety Related Infractions

If an infraction of the HASP is discovered by the Project Manager or the onsite HSO, each case will be dealt with individually. The infraction will be investigated and a disciplinary meeting held with the offender. Disciplinary actions may include a performance deficiency evaluation entered into the employee's personnel file, correction of problem after the disciplinary meeting or removal of the offender from the project. Repeated infractions will not be tolerated and will be dealt with accordingly.

1.4.2 Safety Inspections

Safety inspections will be conducted periodically by the Project Manager. The Project Manager will be familiar with the HASP before performing an onsite visit. While onsite, the Project Manager will evaluate the effectiveness of the plan and offer suggestions for improvement. Although Project Managers are responsible for periodic safety inspections and evaluation of the HASP, the onsite HSO is responsible for daily observation and evaluation of HASP effectiveness.

1.4.3 Safety Meetings

Prior to the start of field activities, a meeting will be held to discuss the potential hazards at the site, with a review of the required protective clothing and procedures observed at this site. As needed, daily meetings will be held to discuss any changes in the hazards.

2.0 HAZARD EVALUATION

The onsite contaminants of concern (COCs) that may be encountered during the implementation of remedial action activities include volatile organic compounds (VOC) and metals. Material Safety Data Sheets (MSDS) for the compounds which have been identified onsite during environmental investigations completed at the Site are included in Appendix B. The exposure limits of chemical constituents which may be encountered are listed in table 1. These constituents would possibly be encountered in groundwater and/or soil and comprise the major concerns for personal health. The protection of personnel and the public from exposure to

these substances by inhalation, oral ingestion, dermal absorption or eye contact is included as a primary purpose of this plan.

The onsite HSO is responsible for determining the level of personal protection equipment (PPE) required. The HSO will perform a preliminary evaluation to confirm PPE requirements once the site has been entered. When work-site conditions warrant, the onsite HSO will modify the level of protection to be utilized. The existence of a situation more hazardous than anticipated will result in the suspension of work until the Project Manager and client representative has been notified and appropriate instructions have been provided to the field team.

During the course of implementing the supplemental remedial investigation activities as well as anticipated future remedial activities, the following will/may be conducted.

During SRI activities on the northern portion of the property, a drill rig and possibly an electric jackhammer will be used to obtain access to the subsurface. All drilling activities will be conducted under Level D PPE unless onsite field observations or air monitoring dictate otherwise. Exposure to VOCs and metals is possible through contact with soil cuttings. Exposure to VOCs is possible by inhaling vapors released to the atmosphere during drilling operations. Gloves shall be worn at all times when coming into contact with soil generated during drilling and respirators shall be worn when air monitoring in the work zone indicates an increase in contaminant concentrations above 5 ppm (parts per million). Caution will be exercised when working around the drill rig due to the multiple moving parts and hazards associated with each. In addition, due to excessive noise generated by the drill rig, hearing protection shall be worn when working in the vicinity of the drill rig. Following the completion of the soil boring, all drill rods/augers and associated equipment will be decontaminated with Alconox and water and rinsed with clean water.

Upon implementation of any remedial activities, a concrete saw will be used in conjunction with an excavator bucket to rip up and stockpile concrete and soil. Care shall be used when working in the vicinity of the excavator and workers should remain in view of the excavator operator to minimize any potential injuries due to the movement/swinging of the machine arm. In addition, when using the jackhammer, all Level D PPE, as well as hearing protection shall be worn to prevent against potential injury. If dust from the concrete removal becomes

an issue, approved dust masks/respirators will be worn and a hose with a misting nozzle can be used to suppress the dust.

The next phase of the anticipated remedial activities includes conducting a sub-slab depressurization system (SSDS)/soil vapor extraction (SVE) pilot test, the installation of SSDS/SVE piping, and the installation of the vacuum extraction and treatment system components. Exposure to VOCs and/or metals is possible through contact with excavated soil cuttings. Exposure to VOCs is possible by inhaling vapors released to the atmosphere during excavation activities. Gloves shall be worn at all times when coming into contact with soil generated during drilling and respirators shall be worn when air monitoring in the work zone indicates an increase in contaminant concentrations above 5 ppm. In addition, should dust generation become a concern during excavation, a hose with a misting nozzle can be used to suppress the dust. Caution will be exercised when working around excavation equipment and hazards associated with each will be continually monitored. In addition, due to excessive noise generated by the excavating equipment, hearing protection shall be worn when working in the vicinity of the work zone. Conducting a pilot test will involve the use of a trailer mounted, portable remediation system and portable generator. Set-up of the remediation system will involve hooking up electric service to a portable generator, which can cause electrical shock. Care should be exercised during the electrical hook-up of the remediation system.

3.0 MONITORING REQUIREMENTS - GROUND INVASIVE ACTIVITIES

A photoionization detector (PID) will be used to continuously monitor ambient air quality during ground invasive activities. Records of these data will be maintained by the onsite HSO. During excavation operations, real-time breathing zone air monitoring will occur in and about the excavations. Work operations which involve handling of potentially hazardous substances will include continuous contaminant monitoring using the PID. In addition, field monitoring will be performed when work is initiated at different portions of the site, when a new operation is initiated and/or when potentially leaking drums or containers are going to be handled. When deemed necessary or desirable by the onsite HSO, area monitoring will be used in potentially hazardous zones. Area monitoring will be performed as plans and conditions dic-

tate, and in accordance with the HASP and with the goal of accident and hazardous condition prevention in mind. Instrument calibration information is included in Appendix C.

For the compounds previously identified to be most prevalent, the lowest 8-hour exposure limit is listed on table 1.

3.1 Vapor Emission Response Plan

If the ambient air concentration of organic vapors exceeds 5 ppm above background at the perimeter of the work area, activities will be halted and monitoring continued. If the organic vapor level decreases below 5 ppm above background, work activities can resume. If the organic vapor levels are greater than 5 ppm over background but less than 25 ppm over background at the perimeter of the work area, activities can resume provided:

- the organic vapor level 200 feet downwind of the work area or half the distance to the nearest residential or commercial structure, whichever is less, is below 5 ppm over background.

An additional vapor suppression method available to be implemented at the Site, in the event that stopping work is not effective in reducing VOC concentrations, consists of covering the excavation with one continuous layer of fire-retardant polysheeting (at least 6-mil thick).

If the organic vapor level is above 25 ppm at the perimeter of the work area, activities will be shutdown. When work shutdown occurs, downwind air monitoring as directed by the Safety Officer will be implemented to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Major Vapor Emission section.

3.2 Major Vapor Emission

If any organic levels greater than 5 ppm over background are identified 200 feet downwind from the work area or half the distance to the nearest residential or commercial property, whichever is less, all work activities will be halted.

If, following the cessation of the work activities and/or the covering of the excavation with polysheeting, or as the result of an emergency, organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial

property from the work area, then the air quality will be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20 Foot Zone).

If efforts to abate the emission source are unsuccessful and if the following levels persist for more than 30 minutes in the 20 Foot Zone, then the Major Vapor Emission Response Plan shall automatically be placed into effect if organic vapor levels are approaching 5 ppm above background. However, the Major Vapor Emission Response Plan shall be immediately placed into effect if organic vapor levels are greater than 10 ppm above background.

3.3 Major Vapor Emission Response Plan

Upon activation, the following activities will be undertaken:

1. All Emergency Response Contacts as listed in the HASP of the Work Plan will be notified.
2. The local police authorities will immediately be contacted by the Safety Officer and advised of the situation.
3. Frequent air monitoring will be conducted at 30 minute intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the Safety Officer.

4.0 LEVELS OF PROTECTION

The level of protection anticipated to perform work on this investigation is Level D, unless otherwise upgraded. Only protective equipment deemed suitable by the onsite HSO for use at the work site will be worn. Any changes in protection levels shall be documented by the onsite HSO. Field personnel should exercise informed judgment on protective equipment requirements at active work sites or at work sites that have been repeatedly entered or occupied without apparent harm. In any case where doubt exists, the safest course of action must be taken. The protective equipment to be used by field personnel is listed below.

4.1 Level D

- hard hat;
- safety glasses, shatter-proof prescription glasses or chemical splash goggles;
- boots/shoes, leather or chemical-resistant, steel toe and shank;
- coveralls; and,
- chemical resistant gloves.

At a minimum, protective headgear, including protective hearing devices, eyewear and footwear will be worn at all times by personnel working around the drilling equipment. When work-site conditions dictate, protective gloves and chemical-resistant boots shall be required for those personnel handling contaminated soils.

Should levels of organic vapor in the ambient air greater than 5 ppm above background levels be detected by the PID in the work area, work will stop and all personnel will leave the work area. The New York State Department of Health (NYSDOH) recommends a level of 5 ppm above background as measured with a PID for VOCs related work. Once the PID readings in the ambient air are back to 0.0 ppm above background, field activities will resume.

4.2 Level C

- hard hat;
- boots, leather, steel toe and shank;
- outer boots, chemical resistant;
- chemical-resistant gloves (solvex);
- Tyvek or Saranex suit; and,
- Air purifying respirator with organic vapor cartridge and dust and mist filter.

Level C protection will be considered for PID consistent readings of 5 to 100 ppm above background in the breathing zone.

Respirators for all personnel will be available with both particulate and organic vapor protection cartridges. The onsite HSO will direct when the protective clothing and respirators will be utilized based on the conditions encountered at the work site.

4.3 Level B

- pressure-demand, self-contained breathing apparatus;
- standby escape pack;
- chemical resistant clothing (Saranex suit);
- outer gloves (Solvex);
- inner gloves (surgical);
- outer boots (chemical resistant);
- inner boots (leather, steel shank and toe); and,
- hard hat.

Level B will be considered for PID readings of 150 ppm above background in the breathing zone. In the event that the work space atmosphere contains in excess of 150 ppm of total ionizable compounds above background, colorimetric tubes or a portable gas chromatograph will be used to determine the levels of individual chemicals. The use of Level B equipment will be based on the specific compounds present and will include discussions with the regulatory authorities and/or the client representative.

Level A conditions will require specialized procedures to be formulated on a case-by-case basis.

5.0 SAFE WORK PRACTICES AND HYGIENE

In addition to the use of protective equipment, other procedures will be followed to minimize risk:

- all consumptive activities including eating, drinking or smoking are prohibited during the drilling, sampling and decontamination activities;
- an adequate source of potable water for emergency use will be available at the drilling sites (two liters per person per day);
- all 55-gallon drums onsite will be moved within the Site using standard drum dolly/carts to avoid personal injury;
- fire extinguishers will be available at the work sites for use on equipment or small fires when appropriate; and,

- an adequately stocked first-aid kit will be maintained at the work site at all times during operational hours.

5.1 Heat Stress

In order to avoid heat stress several preventative measures will be observed:

- Workers will drink a 16-ounce glass of water prior to work (in the morning and after lunch). Water will be contained in a cooler, maintained at a temperature below 60°F. Workers will be encouraged to drink approximately every 20 minutes during days of extreme heat.
- Workers will be encouraged to wear long cotton underwear under the heat-retaining protective clothing required by Level C.
- In extreme hot weather, field activities will be conducted in the early mornings and late afternoons.
- Rest breaks in cool or shaded areas will be enforced as needed.
- Toilet facilities will be made available to site workers, unless transportation is readily available to nearby toilet facilities.
- Good hygiene practices will be encouraged, stressing the importance of allowing the clothing to dry during rest periods. Anyone who notices skin problems should receive medical attention immediately.
- If there are support personnel available outside the work zone, they should observe the workers in the exclusion zone to monitor signs of stress, frequency of breaks, etc.

5.2 Cold Stress and Exposure

In order to avoid cold stress, several preventative measures will be observed:

- Work will not take place when the temperature falls below -20°F. (The wind chill factor should be a major consideration).
- Clothing should be worn in layers, so that personnel can adapt to changing conditions and various levels of physical stress.

- If possible, breaks should be taken in a heated vehicle or building, but care should be taken to remove outer clothing during the break.
- Have on hand extra inner clothing in case perspiration builds up.
- Keep insulated containers of warm liquids available for breaks outside of the exclusion zone.
- Be aware of the signs of frostbite and take immediate remedial measures.
- Take extra precautions around areas subject to ice buildup, such as sanding slippery surfaces.

6.0 WORK ZONE

To prevent unauthorized personnel from entering areas where active operations are being performed, the area enclosing the operation will be monitored.

This zone will be entered in Level D protection. However, individual work sites within the zone may require higher levels of protection based on air monitoring results during the various activities. If this becomes the case, separate work sites will be established based on the level of protection required.

Field personnel are instructed to leave the area if monitoring shows readings above the permissible exposure limits. Before conducting field work in respirators, the Project Manager and client representative will be contacted. A determination will be made by the onsite HSO and Project Manager if work is to continue with respirators. Factors which may influence this decision include the level of observed or suspected hazards, period of time required to complete activity and weather conditions.

If it is necessary to upgrade personal protection then site control measures need to be implemented. This control will help prevent transporting contaminants offsite and minimize exposures to onsite personnel. Site maps will be available which show special work zones.

Three work zones will be delineated. The exclusion zone is where the investigation will take place in the appropriate safety equipment. The contamination reduction zone is where the decontamination of personnel will take place. The support zone is the outer limit zone where equipment is stored and protective clothing is not required.

The buddy system will be observed in the exclusion and contamination reduction zones. Non-essential employees will remain at the clean support zone which will be delineated by a rope or barrier. No one will be permitted beyond that point unless certified and has read and signed the HASP. These zones will be set up with the clean zone being furthest upwind.

6.1 Confined Spaces

Confined spaces are those which, by design or circumstance, present difficulties for entry and exit, or which may serve to reduce ventilation or concentrate vapors. Typical confined spaces consist of excavations, trenches and vaults. Excavations or trenches over 5 feet in depth will be shored or benched according to OSHA regulations. If a vault is to be entered, mechanical ventilation will be initiated and air quality will be monitored. Excavations onsite are not anticipated to be advanced to a depth of 5 feet or greater.

6.2 VOC Project Work Zone Considerations

Typically VOC projects involve installation of wells, monitoring of wells, performance of a pumping test, installation and operation of treatment systems and observation of tank and excavation work. Safety issues with respect to this type of work are attached in Appendix D.

7.0 DECONTAMINATION

An area will be set aside within the work zone for decontamination. The type of decontamination procedures used will be based on the level of protection required. Decontamination of Level D protective wear will consist of brushing heavily soiled boots to remove soils, rinsing gloves and safety glasses (and overboots, if worn) with water, and removing and storing coveralls in plastic bags before leaving the work zone, if heavily soiled or suspected of having been in contact with site contaminants. For detailed information on decontamination equipment and procedures, refer to Appendix E.

8.0 CONTINGENCY PLAN FOR EMERGENCIES

In the event of a safety or health emergency, appropriate corrective measures must immediately be taken to assist those who have been injured or exposed and to protect others

from hazard. The onsite HSO will be notified of the incident immediately. If necessary, first aid will be rendered.

9.0 SAFETY TRAINING

All site workers, including site managers, will provide documentation to the onsite HSO that the field personnel have been trained in the proper use of protective clothing and equipment in accordance with 29 CFR Part 1910, including:

- purpose of wearing respirators;
- how the respirator works;
- limitations;
- fit testing;
- maintenance; and,
- conditions of use.

All LBG personnel, client representatives, regulatory personnel and field personnel shall be made aware of the particular hazardous substances which could be encountered during this project.

10.0 MEDICAL SURVEILLANCE

The HSO will insure that each site worker involved in environmental sampling participates in an ongoing medical surveillance program, which includes baseline and annual follow-up exams.

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TABLE

TABLE 1

Exposure Limits

COMPOUND	EXPOSURE STANDARDS			RECOGNITION QUALITIES		
	TLV/PEL (a) (ppm)	STEL (b) (ppm)	IDLH (c) (ppm)	Odor/Threshold (ppm)	LEL (d) (%)	Ionization Potential (eV)
Gasoline ^{1/}	300	500	1,400	–	1.4	–
Alachlor ^{2/}	–	–	–	No odor	–	–
Benzene ^{1/}	0.1	1	500	12	1.2	9.24
Butane	800	–	–	2,700	1.6	10.63
Chlorobenzene	75 ^{3/}	–	1,000	Almonds	1.3	–
1,1-Dichloroethane	100	Ca ^{5/}	3,000	Chloroform	5.4	11.06
1,2-Dichloroethylene	200	–	1,000	Chloroform	5.6	9.65
EDB (Ethylene dibromide) ^{1/}	0.045	0.13	100	Sweet	–	9.45
EDC (Ethylene dichloride) ^{1/}	1	2	50	Chloroform	6.2	11.05
Ethylbenzene	100	125	800	Aromatic	0.8	8.76
Heptane	85	440	750	150	1.05	9.90
N-Hexane	50	–	1,100	Gasoline/130	1.1	10.18
Hexanes	100	510	–	Mild gasoline	–	–
Methyl ethyl ketone (MEK)	0.2 ^{4/}	–	–	Characteristic odor	–	–
Octane	75	385	1,000	Gasoline/150	1.0	9.82
PCBs (Aroclor) ^{1/}	0.032	0.065	0.325	Hydrocarbon	–	–
TBA (Tert-butyl alcohol)	100	150	1,600	Camphor	2.4	9.70
Tetrachloroethylene ^{1/}	Ca ^{5/}	Ca ^{5/}	150	Chloroform	–	9.32
Tetraethyl Lead	0.075*	–	40*	Sweet	1.8	11.10

COMPOUND	EXPOSURE STANDARDS			RECOGNITION QUALITIES		
	TLV/PEL (a) (ppm)	STEL (b) (ppm)	IDLH (c) (ppm)	Odor/Threshold (ppm)	LEL (d) (%)	Ionization Potential (eV)
Tetramethyl Lead	0.075*	–	40*	Fruity	–	8.50
Toluene	100	150	500	Sweet benzene like/2.9	1.1	8.82
1,1,2-Trichloroethane	Ca ^{5/}	10	100	Chloroform	6.0	11.00
Trichloroethylene	Ca ^{5/}	25	1,000	Chloroform	8.0	9.45
Vinyl Chloride	Ca ^{5/}	Ca ^{5/}	Not determined	Pleasant	3.6	9.99
Xylenes	100	150	900	Aromatic/1.1	0.9	8.56

Notes:

1/ Potential occupational carcinogen

2/ Alachlor manufacturer established internal exposure guideline of 10 ppb for 8-hour TWA

3/ OSHA guideline, NIOSH questions the adequacy of 75 ppm

4/ Ceiling REL, should not be exceeded at any time

5/ NIOSH recommends occupational exposures to carcinogens to be limited to the lowest feasible concentration

– = No published value

* mg/m³

(a) The more stringent of either:

(1) Occupational Safety and Health Administration (OSHA) 1989 Permissible Exposure Limit (PEL),

(2) American Conference Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV), or

(3) National Institute for Occupational Safety and Health (NIOSH) recommended exposure limits (RELs), time-weighted average concentrations for up to a 10-hour work day.

(b) Short Term Exposure Limit - 15 minute exposure.

(c) Immediately dangerous to life and health.

(d) Lower Explosive Limit.

FORMS

PROJECT CONTACT SHEET

Client: Exclusive Realty Services, LLC

Project: Queens Medallion Leasing

Location: 21-03 44th Avenue

Long Island City, Queens, New York 11101

BCA Site # C241144

Task: _____

Client Contacts:

Sive, Paget & Riesel, P.C.

Environmental Counsel Scott Furman, Esq.

Leggette, Brashears & Graham, Inc.

Telephone Contact # (914) 694-5711

Fax # (914) 694-5744

Project Field Supervisor Brian Hawe

Health & Safety Officer David Morelli

Project Manager: Sean Groszkowski

Principal-in-Charge: John Benvegna

Local Hospital: Elmhurst Hospital, 79-01 Broadway

Elmhurst, New York 11373

(718) 334-4000

Local Police Headquarters: 108th Precinct, Long Island City, New York

(718) 784-5411

State Police: State Government Police, New York Marshalls Bureau,

80 Maiden Lane, Floor 17, New York, New York,

(212) 825-5953

Miscellaneous: New York State Department of Environmental Conservation

(NYSDEC) Region 2, 1 Hunters Point Plaza, 47-40 21st Street,

Long Island City, New York

(718) 482-4900

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SITE SAFETY BRIEFING

Site Name: Queens Medallion Leasing
Supplemental Remedial Investigation Work Plan

Date: _____
Site Location: 21-03 44th Avenue, Long Island City, Queens, NY 11101
BCA Site # C241144

SAFETY ISSUES (Circle appropriate information)

Tasks: Site Preparation Activities, Dewatering, Groundwater Monitoring/Dewatering Wells Installation, Hot Spot Excavation, Historic Fill Excavation, Concrete Removal, High Vacuum Extraction, Pressure Washing, Sheet Pile Installation

Protective Clothing/Equipment: Level D, Level C, Level B, Level A
Chemical Hazards: Gasoline, Diesel Fuel, VOCs, SVOCs, PCBs, Heavy Metals

Physical Hazards: Car Traffic, Construction Equipment, Confined Space, Overhead Wires, Slip/Trip/Fall

Control Methods: Cones, Restricted Access, Traffic Control Personnel

Other: _____

Local Hospital: Elmhurst Hospital, 79-01 Broadway
Elmhurst, New York 11373
(718) 334-4000

ATTENDEES

Print Name:	Sign Name:
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Meeting conducted by: _____

WEEKLY SAFETY REPORT FORM

Week Ending: _____ Project Name/Number: _____

Report Date: _____ Project Manager Name: _____

Summary of any violations of procedures occurring that week:

Summary of any job related injuries, illnesses, or near misses that week:

Summary of air monitoring data that week:

(include and sample analyses, action levels exceeded, and actions taken)

Comments:

Name: _____ Company: _____

Signature: _____ Title: _____

INCIDENT REPORT FORM

Date of Report: _____

Injured: _____

Employer: _____

Site: _____ Site Location: _____

Report Prepared By: _____

Signature

Title

ACCIDENT/INCIDENT CATEGORY (check all that applies)

_____ Injury

_____ Illness

_____ Near Miss

_____ Property Damage

_____ Fire

_____ Chemical Exposure

_____ On-site Equipment

_____ Motor Vehicle

_____ Electrical

_____ Mechanical

_____ Spill

_____ Other

DATE AND TIME OF ACCIDENT/INCIDENT:

Narrative report of Accident/Incident:

Identify: 1) actions leading to or contributing to the accident/incident;
2) the accident/incident occurrence; and
3) actions following the accident/incident.

WITNESS TO ACCIDENT/INCIDENT

Name: _____

Company: _____

Address: _____

Address: _____

Phone No.: _____

Phone No.: _____

Name: _____

Company: _____

Address: _____

Address: _____

Phone No.: _____

Phone No.: _____

INJURED/ILL:

Name: _____ SSN: _____

Address: _____ Age: _____

Length of Service: _____ Time on Present Job: _____

Time/Classification: _____

SEVERITY OF INJURY OR ILLNESS:

_____ Disabling	_____ Non-disabling	_____ Fatality
_____ Medical Treatment	_____ First Aid Only	

ESTIMATED NUMBER OF DAYS AWAY FROM JOB: _____**NATURE OF INJURY OR ILLNESS:** __________
_____**CLASSIFICATION OF INJURY:**

_____ Abrasions	_____ Dislocations	_____ Punctures
_____ Bites	_____ Faint/Dizziness	_____ Radiation Burns
_____ Blisters	_____ Fractures	_____ Respiratory Allergy
_____ Bruises	_____ Frostbite	_____ Sprains
_____ Chemical Burns	_____ Heat Burns	_____ Toxic Resp. Exposure
_____ Cold Exposure	_____ Heat Exhaustion	_____ Toxic Ingestion
_____ Concussion	_____ Heat Stroke	_____ Dermal Allergy
_____ Lacerations		

Part of Body Affected: _____

Degree of Disability: _____

Date Medical Care was Received: _____

Where Medical Care was Received: _____

Address (if off-site): _____

(If two or more injuries, record on separate sheets)

PROPERTY DAMAGE:

Description of Damage: _____

Cost of Damage: \$ _____

ACCIDENT/INCIDENT LOCATION: _____

ACCIDENT/INCIDENT ANALYSIS:

*Causative agent most directly related to accident/incident
(Object, substance, material, machinery, equipment, conditions)*

Was weather a factor?: _____

Unsafe mechanical/physical/environmental condition at time of accident/incident (Be specific):

Personal factors (Attitude, knowledge or skill, reaction time, fatigue):

ON-SITE ACCIDENTS/INCIDENTS:

Level of personal protection equipment required in Site Safety Plan:

Modifications: _____

Was injured using required equipment?: _____

If not, how did actual equipment use differ from plan?: _____

ACTION TAKEN TO PREVENT RECURRENCE:

(Be specific. What has or will be done? When will it be done? Who is the responsible party to insure that the correction is made?)

ACCIDENT/INCIDENT REPORT REVIEWED BY:

HSO Name: _____ Signature: _____

OTHERS PARTICIPATING IN INVESTIGATION:

Signature: _____ Title: _____

Signature: _____ Title: _____

Signature: _____ Title: _____

Signature: _____ Title: _____

ACCIDENT/INCIDENT FOLLOW-UP:

Date: _____

Outcome of accident/incident:

Physician's recommendations:

Date Returned to work: _____

Follow-up performed by:

Signature: _____ Title: _____

ATTACH ANY ADDITIONAL INFORMATION TO THIS FORM

AIR MONITORING

General Information

Name(s): _____ Background Level: _____

Date: _____ Weather Conditions: _____

Time: _____

Project/Location: Queens Medallion Leasing
21-03 44th Avenue
Long Island City, Queens, New York 11101
BCA Site # C241144

Equipment Calibration

PID _____ CGI _____

Sample No.	Time	Location	PID Reading (ppm)	Comments	CGI Reading	
					%O ₂	%LEL
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

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Air Monitoring Data

General Information

Client Name(s): Exclusive Realty Services, LLC

Project/Location: Queens Medallion Leasing
21-03 44th Avenue
Long Island City, Queens, New York 11101
BCA Site # C241144

Equipment Used: MINIRAM

Background Level: _____

Date	Weather	Total Time (min)	SA (mg/m ³)	TWA (mg/m ³)

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HASP - PLAN ACCEPTANCE FORM

PROJECT HEALTH & SAFETY PLAN

INSTRUCTIONS: This form is to be completed by each Leggette, Brashears & Graham, Inc. employee to work on the subject project work site and returned to the Office Safety Coordinator prior to site activities.

Client: Exclusive Realty Services, LLC
Project: Queens Medallion Leasing, 21-03 44th Avenue, Long Island City, NY 11101
Date: _____

I represent that I have read and understand the contents of the above Plan and agree to perform my work in accordance with it.

Print Name	Print Name
------------	------------

Signed	Signed
--------	--------

Date	Date
------	------

Print Name	Print Name
------------	------------

Signed	Signed
--------	--------

Date	Date
------	------

Print Name	Print Name
------------	------------

Signed	Signed
--------	--------

Date	Date
------	------

EXCLUSION ZONE LOG SHEET

**QUEENS MEDALLION LEASING
21-03 44th AVENUE
LONG ISLAND CITY, QUEENS COUNTY, NEW YORK 11101
NYSDEC BCP SITE NO. C241144**

Client: Exclusive Realty Services, LLC

Location: 21-03 44th Avenue, Long Island City, New York 11101

Name	Date	Time In	Time Out	Elapsed Time

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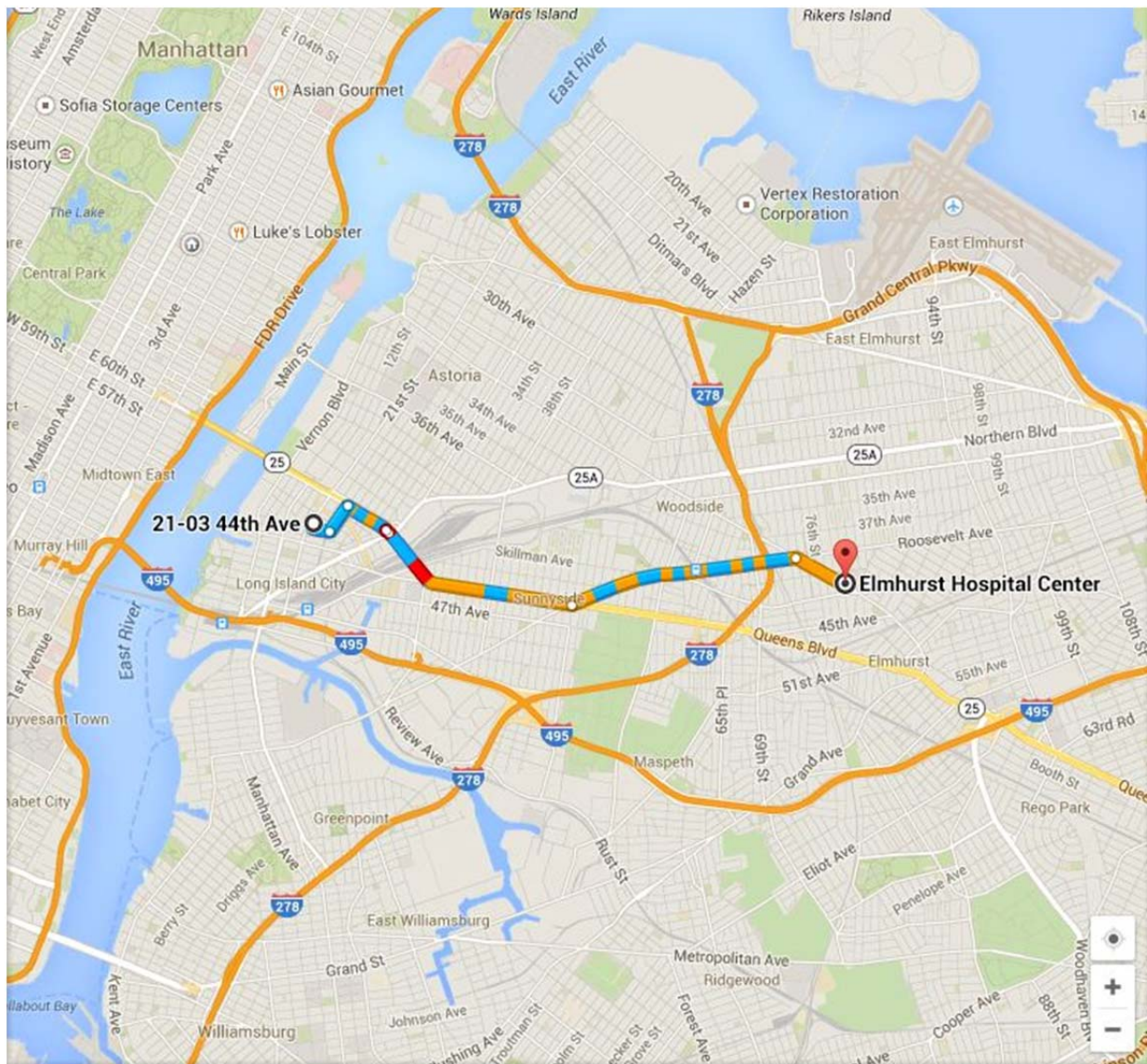
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DIRECTIONS TO LOCAL HOSPITAL:

Elmhurst Hospital
79-01 Broadway
Elmhurst, New York

Total Distance: 4.0 miles
Total Estimated Time: 5 minutes

- Go east on 44th Avenue. Proceed for 0.1 mile.
- Turn left onto 23rd Street. Proceed for 0.2 mile.
- Turn right onto Queens Plaza South. Proceed for 0.3 mile.
- Take a slight left toward Queens Boulevard (148 feet).
- Continue straight onto Queens Boulevard (SR 25). Proceed for 1.2 miles.
- Take a slight left onto Roosevelt Avenue. Proceed for 1.4 miles.
- Take a slight left onto Broadway. Proceed 0.3 mile to Elmhurst Hospital.



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APPENDIX A
LBG Corporate Safety Policy
and Drug and Alcohol Policy

LEGGETTE, BRASHEARS & GRAHAM, INC.
SAFETY POLICY

Job safety is a common-sense part of everyone's life, but requires constant alertness to possible dangers. When we work on industrial sites, LBG employees are expected to observe the safety rules of our Client hosts.

You are the first line of defense for your own personal safety. In the field, appropriate clothing should be worn at all times. Where appropriate, work shoes with hard toes and/or ankle protection should be worn at all times. **Sneakers/tennis shoes should never be worn in the field, regardless of the circumstances.**

LBG provides hard hats that should be worn around any drilling operations and in any other "hard hat zones". Where required, safety glasses, goggles, protective gloves, respirators, and other safety clothing or equipment should be worn and disposed of as specified by the Project Safety Officer.

Periodically, LBG provides special safety seminars which satisfy the OSHA requirements for work on hazardous waste sites. In-house safety training is conducted on an ongoing basis and as dictated by case-by-case needs. There is a Corporate Safety Officer in the Shelton, Connecticut headquarters and a designated Safety Officer in each regional office to whom questions and problems relating to job safety should be referred.

Any project that involves or may involve hazardous or toxic waste or any potentially dangerous condition requires the preparation, filing, use and compliance with a Health and Safety Plan (HASP). LBG has a petroleum related work HASP that can be readily adapted to most petroleum jobs and has numerous site-specific HASPS that comply with state and federal CERCLA requirements that can be used for guidance in developing site-specific HASPS.

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LEGGETTE, BRASHEARS & GRAHAM, INC.
GENERAL DRUG AND ALCOHOL POLICY

In any company, certain common-sense rules of conduct and performance must be established for the employees to follow in order to avoid any misunderstanding and to protect the right of all concerned. Breaches of acceptable conduct which include, but are not limited to, abusive language, insubordination, intoxication, moral turpitude, or substance abuse/possession can lead to disciplinary action or to dismissal.

While performing any service for LBG or LBG's clients, employees, agents, and subcontractors of LBG shall not: (1) be under the influence of alcohol or any controlled substance; (2) use, possess, distribute, or sell illicit or unprescribed controlled drugs, drug paraphernalia, or alcoholic beverages; or (3) misuse legitimate prescription drugs.

LBG may remove from active project status any of its employees any time there is a reasonable basis for suspicion of alcohol/drug use, possession, or impairment involving such employee, and at any time an incident occurs where drug or alcohol use could have been a contributing factor. In such cases, employee may only be considered for return to work after LBG certifies as a result of a for-cause test, conducted immediately following removal, that said employee is in compliance with this policy.

LBG reserves the right to require drug and alcohol testing for its employees, either for its own purposes or at the direction of Clients. Such testing may take place periodically, or for specific projects. The testing will be in compliance with Department of Transportation drug testing regulations.

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APPENDIX B

Onsite Contaminants - Material Safety Data Sheets

Volatile Organic Compounds

SAFETY DATA SHEET

Version 5.5
Revision Date 04/10/2014
Print Date 04/30/2014

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : 1,1,1,2-Tetrachloroethane

Product Number : 46254

Brand : Fluka

REACH No. : A registration number is not available for this substance as the substance or its uses are exempted from registration, the annual tonnage does not require a registration or the registration is envisaged for a later registration deadline.

CAS-No. : 630-20-6

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 4), H302
Acute toxicity, Inhalation (Category 4), H332
Serious eye damage (Category 1), H318
Carcinogenicity (Category 2), H351
Acute aquatic toxicity (Category 3), H402
Chronic aquatic toxicity (Category 3), H412

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H302 + H332

Harmful if swallowed or if inhaled

H318

Causes serious eye damage.

H351

Suspected of causing cancer.

H412

Harmful to aquatic life with long lasting effects.

Precautionary statement(s)

P201

Obtain special instructions before use.

P202	Do not handle until all safety precautions have been read and understood.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ eye protection/ face protection.
P301 + P312	IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310	Immediately call a POISON CENTER or doctor/ physician.
P330	Rinse mouth.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Chemical characterization	: Natural product
Formula	: C ₂ H ₂ Cl ₄
Molecular Weight	: 167.85 g/mol
CAS-No.	: 630-20-6
EC-No.	: 211-135-1

Hazardous components

Component	Classification	Concentration
1,1,1,2-Tetrachloroethane		
	Acute Tox. 4; Eye Dam. 1; Carc. 2; Aquatic Acute 3; Aquatic Chronic 3; H302 + H332, H318, H351, H412	-

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

no data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Carbon oxides, Hydrogen chloride gas

5.3 Advice for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

5.4 Further information

no data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Tightly fitting safety goggles. Faceshield (8-inch minimum). Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: 480 min

Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: 480 min

Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

- | | |
|---|---|
| a) Appearance | Form: liquid, clear
Colour: colourless |
| b) Odour | no data available |
| c) Odour Threshold | no data available |
| d) pH | no data available |
| e) Melting point/freezing point | -70.2 °C (-94.4 °F) |
| f) Initial boiling point and boiling range | 138 °C (280 °F) - lit. |
| g) Flash point | no data available |
| h) Evaporation rate | no data available |
| i) Flammability (solid, gas) | no data available |
| j) Upper/lower flammability or explosive limits | no data available |
| k) Vapour pressure | 18.7 hPa (14.0 mmHg) at 25.0 °C (77.0 °F) |
| l) Vapour density | no data available |

m) Relative density	1.598 g/cm ³ at 25 °C (77 °F)
n) Water solubility	slightly soluble
o) Partition coefficient: n-octanol/water	log Pow: 2.66
p) Auto-ignition temperature	no data available
q) Decomposition temperature	no data available
r) Viscosity	no data available
s) Explosive properties	no data available
t) Oxidizing properties	no data available

9.2 Other safety information

no data available

10. STABILITY AND REACTIVITY

10.1 Reactivity

no data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

no data available

10.4 Conditions to avoid

no data available

10.5 Incompatible materials

Strong oxidizing agents, Strong bases

10.6 Hazardous decomposition products

Other decomposition products - no data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - rat - 670.0 mg/kg

LC50 Inhalation - rat - 4 h - 2100 ppm

Remarks: Diarrhoea

LD50 Dermal - rabbit - 20,000 mg/kg

no data available

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

Eyes - rabbit

Result: Severe eye irritation - 24 h
(Draize Test)

Respiratory or skin sensitisation

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

Limited evidence of carcinogenicity in animal studies

- IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (1,1,1,2-Tetrachloroethane)
- ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

no data available

Specific target organ toxicity - single exposure

no data available

Specific target organ toxicity - repeated exposure

no data available

Aspiration hazard

no data available

Additional Information

RTECS: KI8450000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Nerves. -

12. ECOLOGICAL INFORMATION

12.1 Toxicity

- Toxicity to fish LC50 - *Lepomis macrochirus* (Bluegill) - 16.00 - 24.00 mg/l - 96 h
- Toxicity to daphnia and other aquatic invertebrates EC50 - *Daphnia magna* (Water flea) - 17.00 - 30.00 mg/l - 48 h

12.2 Persistence and degradability

no data available

12.3 Bioaccumulative potential

no data available

12.4 Mobility in soil

no data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Harmful to aquatic life.

no data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 2810 Class: 6.1 Packing group: III
Proper shipping name: Toxic, liquids, organic, n.o.s. (1,1,1,2-Tetrachloroethane)
Reportable Quantity (RQ): 100 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG

UN number: 2810 Class: 6.1 Packing group: III EMS-No: F-A, S-A
Proper shipping name: TOXIC LIQUID, ORGANIC, N.O.S. (1,1,1,2-Tetrachloroethane)
Marine pollutant: No

IATA

UN number: 2810 Class: 6.1 Packing group: III
Proper shipping name: Toxic liquid, organic, n.o.s. (1,1,1,2-Tetrachloroethane)

15. REGULATORY INFORMATION

REACH No. : A registration number is not available for this substance as the substance or its uses are exempted from registration, the annual tonnage does not require a registration or the registration is envisaged for a later registration deadline.

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
1,1,1,2-Tetrachloroethane	630-20-6	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
1,1,1,2-Tetrachloroethane	630-20-6	2007-07-01

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
Eye Dam.	Serious eye damage
H302	Harmful if swallowed.
H302 + H332	Harmful if swallowed or if inhaled
H318	Causes serious eye damage.
H332	Harmful if inhaled.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.5

Revision Date: 04/10/2014

Print Date: 04/30/2014

SAFETY DATA SHEET

Version 5.2
Revision Date 04/28/2014
Print Date 04/30/2014

1. PRODUCT AND COMPANY IDENTIFICATION**1.1 Product identifiers**

Product name : 1,1,2-Trichloroethane

Product Number : 46262

Brand : Fluka

Index-No. : 602-014-00-8

REACH No. : A registration number is not available for this substance as the substance or its uses are exempted from registration, the annual tonnage does not require a registration or the registration is envisaged for a later registration deadline.

CAS-No. : 79-00-5

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION**2.1 Classification of the substance or mixture****GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)**

Acute toxicity, Oral (Category 4), H302
Acute toxicity, Inhalation (Category 3), H331
Acute toxicity, Dermal (Category 4), H312
Carcinogenicity (Category 2), H351
Acute aquatic toxicity (Category 3), H402
Chronic aquatic toxicity (Category 3), H412

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H302 + H312

Harmful if swallowed or in contact with skin

H331

Toxic if inhaled.

H351

Suspected of causing cancer.

H412

Harmful to aquatic life with long lasting effects.

Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P311	Call a POISON CENTER or doctor/ physician.
P322	Specific measures (see supplemental first aid instructions on this label).
P330	Rinse mouth.
P363	Wash contaminated clothing before reuse.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

Repeated exposure may cause skin dryness or cracking.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	: C ₂ H ₃ Cl ₃ C ₂ H ₃ Cl ₃
Molecular Weight	: 133.4 g/mol
CAS-No.	: 79-00-5
EC-No.	: 201-166-9
Index-No.	: 602-014-00-8

Hazardous components

Component	Classification	Concentration
1,1,2-Trichloroethane		
	Acute Tox. 4; Acute Tox. 3; Acute Tox. 4; Carc. 2; Aquatic Acute 3; Aquatic Chronic 3; H302 + H312, H331, H351, H412	90 - 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Move out of dangerous area. Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

- 4.3 Indication of any immediate medical attention and special treatment needed**
no data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Carbon oxides, Hydrogen chloride gas

5.3 Advice for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

5.4 Further information

no data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Wear respiratory protection. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
1,1,2-Trichloroethane	79-00-5	TWA	10 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Central Nervous System impairment Liver damage Confirmed animal carcinogen with unknown relevance to humans Danger of cutaneous absorption		
		TWA	10 ppm 45 mg/m ³	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix C		

		See Appendix A Potential for dermal absorption		
		TWA	10 ppm 45 mg/m ³	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		Skin designation The value in mg/m ³ is approximate.		
		TWA	10 ppm 45 mg/m ³	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000

8.2 Exposure controls

Appropriate engineering controls

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: 480 min

Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.4 mm

Break through time: 60 min

Material tested: Camatril® (KCL 730 / Aldrich Z677442, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

- | | |
|---------------|------------------------------------|
| a) Appearance | Form: liquid
Colour: colourless |
| b) Odour | no data available |

c) Odour Threshold	no data available
d) pH	no data available
e) Melting point/freezing point	-37.0 °C (-34.6 °F)
f) Initial boiling point and boiling range	110 - 115 °C (230 - 239 °F) - lit.
g) Flash point	no data available
h) Evaporation rate	no data available
i) Flammability (solid, gas)	no data available
j) Upper/lower flammability or explosive limits	no data available
k) Vapour pressure	no data available
l) Vapour density	no data available
m) Relative density	1.435 g/cm ³ at 25 °C (77 °F)
n) Water solubility	no data available
o) Partition coefficient: n-octanol/water	no data available
p) Auto-ignition temperature	no data available
q) Decomposition temperature	no data available
r) Viscosity	no data available
s) Explosive properties	no data available
t) Oxidizing properties	no data available

9.2 Other safety information

no data available

10. STABILITY AND REACTIVITY

10.1 Reactivity

no data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

no data available

10.4 Conditions to avoid

no data available

10.5 Incompatible materials

Strong bases, Strong oxidizing agents, Reacts violently with: Sodium/sodium oxides, Potassium, Magnesium, Aluminum

10.6 Hazardous decomposition products

Other decomposition products - no data available

In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - rat - 836.0 mg/kg

Inhalation: no data available

Dermal: no data available

no data available

Skin corrosion/irritation

Skin - rabbit

Result: Severe skin irritation - 24 h

Skin - rabbit

Result: Mild skin irritation - 24 h

Serious eye damage/eye irritation

Eyes - rabbit

Result: Mild eye irritation - 24 h

Respiratory or skin sensitisation

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification. The National Cancer Institute (NCI) has found clear evidence for carcinogenicity.

Limited evidence of carcinogenicity in animal studies

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (1,1,2-Trichloroethane)

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

no data available

Specific target organ toxicity - single exposure

no data available

Specific target organ toxicity - repeated exposure

no data available

Aspiration hazard

no data available

Additional Information

RTECS: KJ3150000

Central nervous system depression, prolonged or repeated exposure can cause:, narcosis, To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish LC50 - Lepomis macrochirus (Bluegill) - 40.00 mg/l - 96 h
 LC50 - Pimephales promelas (fathead minnow) - 81.60 mg/l - 96 h

Toxicity to daphnia and EC50 - Daphnia magna (Water flea) - 43.00 mg/l - 48 h
other aquatic
invertebrates

12.2 Persistence and degradability

no data available

12.3 Bioaccumulative potential

no data available

12.4 Mobility in soil

no data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Harmful to aquatic life with long lasting effects.

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Harmful to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 2810 Class: 6.1 Packing group: III
Proper shipping name: Toxic, liquids, organic, n.o.s. (1,1,2-Trichloroethane)
Reportable Quantity (RQ): 100 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG

UN number: 2810 Class: 6.1 Packing group: III EMS-No: F-A, S-A
Proper shipping name: TOXIC LIQUID, ORGANIC, N.O.S. (1,1,2-Trichloroethane)
Marine pollutant: No

IATA

UN number: 2810 Class: 6.1 Packing group: III
Proper shipping name: Toxic liquid, organic, n.o.s. (1,1,2-Trichloroethane)

15. REGULATORY INFORMATION

REACH No. : A registration number is not available for this substance as the substance or its uses are exempted from registration, the annual tonnage does not require a registration or the registration is envisaged for a later registration deadline.

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
1,1,2-Trichloroethane	79-00-5	2007-07-01

SARA 311/312 Hazards

Acute Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
1,1,2-Trichloroethane	79-00-5	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
1,1,2-Trichloroethane	79-00-5	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
1,1,2-Trichloroethane	79-00-5	2007-07-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.

	CAS-No.	Revision Date
1,1,2-Trichloroethane	79-00-5	2007-09-28

16. OTHER INFORMATION**Full text of H-Statements referred to under sections 2 and 3.**

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
H302	Harmful if swallowed.
H302 + H312	Harmful if swallowed or in contact with skin
H312	Harmful in contact with skin.
H331	Toxic if inhaled.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	1
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.2

Revision Date: 04/28/2014

Print Date: 04/30/2014

Material Safety Data Sheet

Version 5.1

Revision Date 09/05/2013

Print Date 04/30/2014

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : 1,1-Dichloroethane

Product Number : 36967

Brand : Fluka

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555

Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Flammable liquid, Harmful by ingestion., Irritant

Target Organs

Liver, Kidney, Central nervous system

GHS Classification

Flammable liquids (Category 2)

Acute toxicity, Oral (Category 4)

Eye irritation (Category 2A)

Specific target organ toxicity - single exposure (Category 3)

Acute aquatic toxicity (Category 3)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H225

Highly flammable liquid and vapour.

H302

Harmful if swallowed.

H319

Causes serious eye irritation.

H335

May cause respiratory irritation.

H402

Harmful to aquatic life.

Precautionary statement(s)

P210

Keep away from heat/sparks/open flames/hot surfaces. - No smoking.

P261

Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.

P305 + P351 + P338

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

HMIS Classification

Health hazard: 1
Chronic Health Hazard: *
Flammability: 3
Physical hazards: 0

NFPA Rating

Health hazard: 2
Fire: 3
Reactivity Hazard: 0

Potential Health Effects

Inhalation May be harmful if inhaled. May cause respiratory tract irritation.
Skin Harmful if absorbed through skin. May cause skin irritation.
Eyes May cause eye irritation.
Ingestion Harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms : Ethylidene chloride

Formula : C₂H₄Cl₂

Molecular Weight : 98.96 g/mol

Component		Concentration
1,1-Dichloroethane		
CAS-No.	75-34-3	<= 100 %
EC-No.	200-863-5	
Index-No.	602-011-00-1	

4. FIRST AID MEASURES

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability

Flammable in the presence of a source of ignition when the temperature is above the flash point. Keep away from heat/sparks/open flame/hot surface. No smoking.

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas
Hazardous decomposition products formed under fire conditions. - Nature of decomposition products not known.

Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

7. HANDLING AND STORAGE

Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

Use explosion-proof equipment. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value	Control parameters	Basis
1,1-Dichloroethane	75-34-3	TWA	100 ppm	USA. ACGIH Threshold Limit Values (TLV)
Remarks	Eye & Upper Respiratory Tract irritation Liver & kidney damage Not classifiable as a human carcinogen			
		TWA	100 ppm 400 mg/m ³	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	100 ppm 400 mg/m ³	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
	The value in mg/m ³ is approximate.			
		TWA	100 ppm 400 mg/m ³	USA. NIOSH Recommended Exposure Limits
	See Appendix C			

Personal protective equipment

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact
Material: butyl-rubber
Minimum layer thickness: 0.3 mm
Break through time: 60 min
Material tested: Butoject® (KCL 897 / Aldrich Z677647, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Eye protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	liquid
Colour	no data available

Safety data

pH	no data available
Melting point/freezing point	-98.0 °C (-144.4 °F)
Boiling point	55.0 - 58.0 °C (131.0 - 136.4 °F)
Flash point	-10.0 °C (14.0 °F) - closed cup
Ignition temperature	no data available
Auto-ignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	no data available
Density	1.17 g/cm ³
Water solubility	no data available
Partition coefficient: n-octanol/water	no data available
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available

Evapouration rate no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

Vapours may form explosive mixture with air.

Conditions to avoid

Heat, flames and sparks. Extremes of temperature and direct sunlight.

Materials to avoid

Oxidizing agents

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas

Hazardous decomposition products formed under fire conditions. - Nature of decomposition products not known.

Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50

LD50 Oral - rat - 725.0 mg/kg

Inhalation LC50

LC50 Inhalation - rat - 4 h - 13000 ppm

Dermal LD50

no data available

Other information on acute toxicity

no data available

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitisation

Chronic exposure may cause dermatitis.

Germ cell mutagenicity

no data available

Carcinogenicity

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)

May cause respiratory irritation.

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

no data available

Aspiration hazard

no data available

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	Harmful if swallowed.
Skin	Harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure

Liver injury may occur., Kidney injury may occur., narcosis, To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Synergistic effects

no data available

Additional Information

RTECS: KI0175000

12. ECOLOGICAL INFORMATION

Toxicity

no data available

Persistence and degradability

no data available

Bioaccumulative potential

no data available

Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Harmful to aquatic life.

13. DISPOSAL CONSIDERATIONS

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 2362 Class: 3 Packing group: II
Proper shipping name: 1,1-Dichloroethane
Reportable Quantity (RQ): 1000 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG

UN number: 2362 Class: 3 Packing group: II EMS-No: F-E, S-D
Proper shipping name: 1,1-DICHLOROETHANE
Marine pollutant: No

IATA

UN number: 2362 Class: 3 Packing group: II
Proper shipping name: 1,1-Dichloroethane

15. REGULATORY INFORMATION

OSHA Hazards

Flammable liquid, Harmful by ingestion., Irritant

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
1,1-Dichloroethane	75-34-3	2007-07-01

SARA 311/312 Hazards

Fire Hazard, Acute Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
1,1-Dichloroethane	75-34-3	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
1,1-Dichloroethane	75-34-3	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
1,1-Dichloroethane	75-34-3	2007-07-01

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer.	75-34-3	2007-09-28
1,1-Dichloroethane		

16. OTHER INFORMATION

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

MATERIAL SAFETY DATA SHEET

Date Printed: 30.04.2014

Date Updated: 07.01.2010

Version 1.8

Section 1 - Product and Company Information

Product Name	1,1-DICHLOROETHENE SINGLE COMPONENT STANDARD FOR EPA METHODS
Product Number	40027
Brand	SUPELCO
Company	Sigma-Aldrich
Address	3050 Spruce Street SAINT LOUIS MO 63103 US
Technical Phone:	800-325-5832
Fax:	800-325-5052
Emergency Phone:	314-776-6555

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313
ETHYLENE, 1,1-DICHLORO-	75-35-4	Yes
Formula	C2H2Cl2	
Synonyms	Chlorure de vinylidene (French) * 1,1-Dichloroethene (9CI) * 1,1-Dichloroethylene * Ethene, 1,1-dichloro- * NCI-C54262 * RCRA waste number U078 * VDC * Vinylidene chloride * Vinylidene chloride (II) * Vinylidene chloride (ACGIH) * Vinylidene dichloride * Vinylidine chloride * 1,1-DICHLOROETHENE * 1,1-Dichloroethylene	
RTECS Number:	KV9275000	

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Flammable (USA) Extremely Flammable (EU). Toxic. Dangerous for the environment.

Toxic if swallowed. Harmful by inhalation. Irritating to eyes, respiratory system and skin. Limited evidence of a carcinogenic effect. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Target organ(s): Kidneys. Liver. Possible Carcinogen (US).

HMIS RATING

HEALTH: 2*

FLAMMABILITY: 4

REACTIVITY: 2

NFPA RATING

HEALTH: 2

FLAMMABILITY: 4

REACTIVITY: 2

*additional chronic hazards present.

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE

If swallowed, wash out mouth with water provided person is conscious. Call a physician immediately.

INHALATION EXPOSURE

If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.

DERMAL EXPOSURE

In case of skin contact, flush with copious amounts of water for at least 15 minutes. Remove contaminated clothing and shoes. Call a physician.

EYE EXPOSURE

In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

Section 5 - Fire Fighting Measures

FLAMMABLE HAZARDS

Flammable Hazards: Yes
Peroxide Former: Yes

EXPLOSION HAZARDS

Container explosion may occur under fire conditions. Vapor may travel considerable distance to source of ignition and flash back. Forms explosive mixtures in air.

FLASH POINT

- 13,000 °F. - 25,000 °C. Method: closed cup

EXPLOSION LIMITS

Lower: 6,500 % Upper: 15,500 %

AUTOIGNITION TEMP

520,00 °C

FLAMMABILITY

N/A

EXTINGUISHING MEDIA

Suitable: For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray; solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

FIREFIGHTING

Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes. Specific Hazard(s): Vapor may travel considerable distance to source of ignition and flash back. Extremely flammable. Emits

toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

PROCEDURE TO BE FOLLOWED IN CASE OF LEAK OR SPILL

Evacuate area. Shut off all sources of ignition.

PROCEDURE(S) OF PERSONAL PRECAUTION(S)

Wear self-contained breathing apparatus, rubber boots, and heavy rubber gloves.

METHODS FOR CLEANING UP

Cover with dry-lime, sand, or soda ash. Place in covered containers using non-sparking tools and transport outdoors. Ventilate area and wash spill site after material pickup is complete.

ENVIRONMENTAL PRECAUTION(S)

Avoid contaminating sewers and waterways with this material.
Avoid contaminating water supply.

Section 7 - Handling and Storage

HANDLING

User Exposure: Do not breathe vapor. Avoid contact with eyes, skin, and clothing. Avoid prolonged or repeated exposure.

STORAGE

Suitable: Keep container closed. Keep away from heat, sparks, and open flame. May form peroxides on prolonged storage. Date container and periodically test for peroxides.
Store at 2-8°C

SPECIAL REQUIREMENTS

Air and moisture sensitive. Store under inert gas. May develop pressure.

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS

Safety shower and eye bath. Use nonsparking tools. Use only in a chemical fume hood. Mechanical exhaust required.

PERSONAL PROTECTIVE EQUIPMENT

Respiratory: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator.
Hand: Compatible chemical-resistant gloves.
Eye: Chemical safety goggles.

GENERAL HYGIENE MEASURES

Wash contaminated clothing before reuse. Wash thoroughly after handling.

EXPOSURE LIMITS, RTECS

Country	Source	Type	Value
---------	--------	------	-------

USA	ACGIH	TWA	5 PPM
New Zealand OEL			
Remarks: check ACGIH TLV			
USA	NIOSH	LOWEST FEASIBLE CONC.	

Section 9 - Physical/Chemical Properties

Appearance	Physical State: Clear liquid Color: Colorless		
Property	Value	At Temperature or Pressure	
Molecular Weight	96,9400 AMU		
pH	N/A		
BP/BP Range	30,000. - 32,000 °C.		
MP/MP Range	- 122,000 °C.		
Freezing Point	N/A		
Vapor Pressure	500,456000000 mmHg	20,00 °C	
Vapor Density	3,460 g/l		
Saturated Vapor Conc.	N/A		
SG/Density	1,2130 g/cm3		
Bulk Density	N/A		
Odor Threshold	N/A		
Volatile%	N/A		
VOC Content	N/A		
Water Content	N/A		
Solvent Content	N/A		
Evaporation Rate	N/A		
Viscosity	N/A		
Surface Tension	N/A		
Partition Coefficient	N/A		
Decomposition Temp.	N/A		
Flash Point	- 13,000 °F. - 25,000 °C.	Method: closed cup	
Explosion Limits	Lower: 6,500 % Upper: 15,500 %		
Flammability	N/A		
Autoignition Temp	520,00 °C		
Refractive Index	1,4260		
Optical Rotation	N/A		
Miscellaneous Data	N/A		
Solubility	Solubility in Water: 0.2 M in H2O, 20°C		

N/A = not available

Section 10 - Stability and Reactivity

STABILITY

Stable: Stable.

Conditions of Instability: Upon exposure to air, product may slowly degrade, forming peroxides, which can be unstable May decompose on heating

Conditions to Avoid: Air. Heat. Moisture. Direct sunlight

Materials to Avoid: Copper, Oxidizing agents, Aluminum, and its alloys, Peroxides, Strong bases, Oxygen.

HAZARDOUS DECOMPOSITION PRODUCTS

Hazardous Decomposition Products: Carbon monoxide, Carbon dioxide, Hydrogen chloride gas, Phosgene gas, Chlorine.

STABILIZERS PRESENT

This material is stabilized.

HAZARDOUS POLYMERIZATION

Hazardous Polymerization: May occur

Hazardous Polymerization Reactions: Peroxides Air. Oxygen Heat.

Section 11 - Toxicological Information

ROUTE OF EXPOSURE

Skin Contact: May cause skin irritation.

Skin Absorption: May be harmful if absorbed through the skin.

Eye Contact: May cause eye irritation.

Inhalation: Material may be irritating to mucous membranes and upper respiratory tract. Harmful if inhaled.

Ingestion: May be harmful if swallowed.

TARGET ORGAN(S) OR SYSTEM(S)

Central nervous system. Kidneys. Liver.

SIGNS AND SYMPTOMS OF EXPOSURE

Drowsiness. Dizziness. Nausea, headache, and vomiting. Exposure can cause: Confusion. Incoordination. CNS depression. To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

TOXICITY DATA

Oral

Rat

1.500, mg/kg

LD50

Oral

Rat

200,000000 mg/kg

LD50

Inhalation

Rat

6.350, ppm

LC50

Remarks: Behavioral:Coma.

Oral

Mouse

194,000000 mg/kg

LD50

CHRONIC EXPOSURE - CARCINOGEN

Result: This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

Species: Rat

Route of Application: Inhalation

Dose: 55 PPM

Exposure Time: 6H/52W

Frequency: I

Result: Tumorigenic:Equivocal tumorigenic agent by RTECS

criteria. Blood:Lymphomas including Hodgkin's disease.
Liver:Tumors.

Species: Mouse
Route of Application: Inhalation
Dose: 25 PPM
Exposure Time: 4H/52W
Frequency: I
Result: Tumorigenic:Carcinogenic by RTECS criteria.
Blood:Leukemia Kidney, Ureter, Bladder:Kidney tumors.

Species: Mouse
Route of Application: Skin
Dose: 4840 MG/KG
Result: Skin and Appendages: Other: Tumors. Lungs, Thorax, or
Respiration:Tumors. Tumorigenic:Neoplastic by RTECS criteria.

Species: Rat
Route of Application: Inhalation
Dose: 150 PPM
Exposure Time: 4H/52W
Frequency: I
Result: Tumorigenic:Equivocal tumorigenic agent by RTECS
criteria. Skin and Appendages: Other: Tumors. Blood:Leukemia

Species: Mouse
Route of Application: Inhalation
Dose: 55 PPM
Exposure Time: 6H/13W
Frequency: I
Result: Tumorigenic:Equivocal tumorigenic agent by RTECS
criteria. Lungs, Thorax, or Respiration:Tumors. Liver:Tumors.

Species: Mouse
Route of Application: Inhalation
Dose: 55 PPM
Exposure Time: 6H/52W
Frequency: I
Result: Tumorigenic:Equivocal tumorigenic agent by RTECS
criteria. Liver:Tumors.

Species: Rat
Route of Application: Inhalation
Dose: 55 PPM
Exposure Time: 6H/52W
Frequency: I
Result: Tumorigenic:Equivocal tumorigenic agent by RTECS
criteria. Blood:Tumors.

Species: Rat
Route of Application: Inhalation
Dose: 150 PPM
Exposure Time: 4H/52W
Frequency: I
Result: Tumorigenic:Equivocal tumorigenic agent by RTECS
criteria. Gastrointestinal:Tumors. Liver:Tumors.

Species: Rat
Route of Application: Inhalation
Dose: 55 PPM

Exposure Time: 6H/28W
Frequency: I
Result: Tumorigenic:Equivocal tumorigenic agent by RTECS
criteria. Liver:Tumors. Skin and Appendages: Other: Tumors.

IARC CARCINOGEN LIST

Rating: Group 3

ACGIH CARCINOGEN LIST

Rating: A4

CHRONIC EXPOSURE - TERATOGEN

Species: Rat
Dose: 80 PPM/7H
Route of Application: Inhalation
Exposure Time: (6-15D PREG)
Result: Specific Developmental Abnormalities: Musculoskeletal
system.

CHRONIC EXPOSURE - MUTAGEN

Result: Laboratory experiments have shown mutagenic effects.

Species: Rat
Route: Inhalation
Dose: 10 PPM
Mutation test: DNA damage

Species: Mouse
Dose: 160 PPM
Exposure Time: 48H
Cell Type: lymphocyte
Mutation test: specific locus test

Species: Mouse
Route: Inhalation
Dose: 50 PPM
Mutation test: DNA damage

Species: Mouse
Route: Inhalation
Dose: 50 PPM
Mutation test: Unscheduled DNA synthesis

Species: Mouse
Route: Oral
Dose: 200 MG/KG
Mutation test: Unscheduled DNA synthesis

Species: Mouse
Dose: 400 MG/KG
Cell Type: S. cerevisiac
Mutation test: Host-mediated assay

Species: Hamster
Dose: 250 MG/L
Cell Type: lung
Mutation test: Cytogenetic analysis

Species: Hamster
Dose: 75 MG/L
Cell Type: lung
Mutation test: Sister chromatid exchange

CHRONIC EXPOSURE - REPRODUCTIVE HAZARD

Species: Rat
Dose: 200 MG/KG
Route of Application: Oral
Exposure Time: (6-15D PREG)
Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Fertility: Other measures of fertility

Species: Rat
Dose: 55 PPM/6H
Route of Application: Inhalation
Exposure Time: (55D PRE)
Result: Effects on Fertility: Female fertility index (e.g., # females pregnant per # sperm positive females; # females pregnant per # females mated).

Species: Rabbit
Dose: 160 PPM/7H
Route of Application: Inhalation
Exposure Time: (6-15D PREG)
Result: Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants).

Section 12 - Ecological Information

No data available.

ACUTE ECOTOXICITY TESTS

Test Type: LC50 Fish
Species: Daphnia magna
Value: 11,600. - 11,790 mg/l.

Test Type: LC50 Fish
Species: Pimephales promelas (Fathead minnow)
Value: 108,000. - 169,000 mg/l.

Test Type: LC50 Fish
Species: Lepomis macrochirus (Bluegill)
Value: 74,000. - 220,000 mg/l.

Test Type: LC50 Fish
Species: Cyprinodon variegatus (Sheepshead minnow)
Value: 249,000 mg/l

Test Type: LC50 Fish
Species: other fish
Value: 250,000 mg/l

Test Type: LC50 Fish
Species: other fish
Value: 224,000 mg/l

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION

Contact a licensed professional waste disposal service to dispose of this material. Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT

Proper Shipping Name: Vinylidene chloride, inhibited
UN#: 1303
Class: 3
Packing Group: Packing Group I
Hazard Label: Flammable liquid
PIH: Not PIH

IATA

Proper Shipping Name: Vinylidene chloride, stabilized
IATA UN Number: 1303
Hazard Class: 3
Packing Group: I

Section 15 - Regulatory Information

EU DIRECTIVES CLASSIFICATION

Symbol of Danger: F+-Xn
Indication of Danger: Extremely Flammable. Harmful.
R: 12-20-40
Risk Statements: Extremely flammable. Harmful by inhalation.
Limited evidence of a carcinogenic effect.
S: 7-16-29-36/37-46
Safety Statements: Keep container tightly closed. Keep away from sources of ignition - no smoking. Do not empty into drains. Wear suitable protective clothing and gloves. If swallowed, seek medical advice immediately and show this container or label.

US CLASSIFICATION AND LABEL TEXT

Indication of Danger: Flammable (USA) Extremely Flammable (EU).
Toxic. Dangerous for the environment.
Risk Statements: Toxic if swallowed. Harmful by inhalation.
Irritating to eyes, respiratory system and skin. Limited evidence of a carcinogenic effect. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Safety Statements: Keep container tightly closed. Keep away from sources of ignition - no smoking. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Do not empty into drains. Wear suitable protective clothing and gloves. If swallowed, seek medical advice immediately and show this container or label. Avoid release to the environment. Refer to special instructions/safety data sheets.
US Statements: Target organ(s): Kidneys. Liver. Possible Carcinogen (US).

UNITED STATES REGULATORY INFORMATION

SARA LISTED: Yes
DEMINIMIS: 1,000 %
NOTES: This product is subject to SARA section 313 reporting

requirements.

TSCA INVENTORY ITEM: Yes

CANADA REGULATORY INFORMATION

WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.

DSL: Yes

NDSL: No

Section 16 - Other Information

DISCLAIMER

For R&D use only. Not for drug, household or other uses.

WARRANTY

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale. Copyright 2010 Sigma-Aldrich Co. License granted to make unlimited paper copies for internal use only.

Material Safety Data Sheet

Version 4.3

Revision Date 07/04/2013

Print Date 04/30/2014

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : 1,2,4-Trimethylbenzene

Product Number : 45996

Brand : Fluka

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555

Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Combustible Liquid

Target Organs

Central nervous system

GHS Classification

Flammable liquids (Category 3)

Acute toxicity, Inhalation (Category 4)

Acute toxicity, Oral (Category 5)

Skin irritation (Category 2)

Eye irritation (Category 2A)

Specific target organ toxicity - single exposure (Category 3)

Acute aquatic toxicity (Category 2)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Warning

Hazard statement(s)

H226	Flammable liquid and vapour.
H303	May be harmful if swallowed.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H332	Harmful if inhaled.
H335	May cause respiratory irritation.
H401	Toxic to aquatic life.

Precautionary statement(s)

P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if

present and easy to do. Continue rinsing.

HMIS Classification

Health hazard: 1
Chronic Health Hazard: *
Flammability: 2
Physical hazards: 0

NFPA Rating

Health hazard: 2
Fire: 2
Reactivity Hazard: 0

Potential Health Effects

Inhalation May be harmful if inhaled. May cause respiratory tract irritation.
Skin May be harmful if absorbed through skin. May cause skin irritation.
Eyes May cause eye irritation.
Ingestion May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms : Pseudocumene

Formula : C₉H₁₂

Molecular Weight : 120.19 g/mol

Component		Concentration
1,2,4-Trimethylbenzene		
CAS-No.	95-63-6	<=100%
EC-No.	202-436-9	
Index-No.	601-043-00-3	

4. FIRST AID MEASURES

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability

Flammable in the presence of a source of ignition when the temperature is above the flash point. Keep away from heat/sparks/open flame/hot surface. No smoking.

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Carbon oxides

Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES**Personal precautions**

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

7. HANDLING AND STORAGE**Precautions for safe handling**

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION**Components with workplace control parameters**

Components	CAS-No.	Value	Control parameters	Basis
1,2,4-Trimethylbenzene	95-63-6	TWA	25 ppm 125 mg/m ³	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	25 ppm 123 mg/m ³	USA. ACGIH Threshold Limit Values (TLV)
		TWA	25 ppm 125 mg/m ³	USA. NIOSH Recommended Exposure Limits
Remarks	hemimellitene is a mixture of the 1,2,3-isomer with up to 10% of related aromatics such as the 1,2,4-isomer.			

Personal protective equipment**Respiratory protection**

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Splash contact

Material: butyl-rubber

Minimum layer thickness: 0.3 mm

Break through time: 30 min

Material tested: Butoject® (KCL 897 / Aldrich Z677647, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Eye protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	liquid, clear
Colour	light blue colourless

Safety data

pH	no data available
Melting point/freezing point	Melting point/range: -44 °C (-47 °F) - lit.
Boiling point	168 °C (334 °F) - lit.
Flash point	48.0 °C (118.4 °F) - closed cup
Ignition temperature	515 °C (959 °F)
Auto-ignition temperature	515.0 °C (959.0 °F)
Lower explosion limit	0.9 %(V)
Upper explosion limit	6.4 %(V)
Vapour pressure	2.3 hPa (1.7 mmHg) at 20.0 °C (68.0 °F) 6.0 hPa (4.5 mmHg) at 37.7 °C (99.9 °F) 9.3 hPa (7.0 mmHg) at 44.4 °C (111.9 °F)
Density	0.876 g/cm ³ at 20 °C (68 °F)
Water solubility	insoluble
Partition coefficient: n-octanol/water	no data available
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

no data available

Conditions to avoid

Heat, flames and sparks.

Materials to avoid

Strong oxidizing agents

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides

Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION**Acute toxicity****Oral LD50**

LD50 Oral - rat - 5,000 mg/kg

Inhalation LC50

LC50 Inhalation - rat - 4 h - 18,000 mg/m3

Dermal LD50

no data available

Other information on acute toxicity

no data available

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitisation

no data available

Germ cell mutagenicity

Genotoxicity in vitro - in vitro assay - S. typhimurium - with and without metabolic activation - negative

Genotoxicity in vivo - rat - male and female - Intraperitoneal - negative

Carcinogenicity

no data available

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)

May cause respiratory irritation.

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

no data available

Aspiration hazard

no data available

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure

prolonged or repeated exposure can cause:; narcosis, Bronchitis., Symptoms and signs include headache, dizziness, fatigue, muscular weakness, drowsiness and in extreme cases, loss of consciousness., To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Synergistic effects

no data available

Additional Information

RTECS: DC3325000

12. ECOLOGICAL INFORMATION**Toxicity**

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 7.72 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates	Immobilization EC50 - Daphnia magna (Water flea) - 3.6 mg/l - 48 h

Persistence and degradability

no data available

Bioaccumulative potential

no data available

Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS**Product**

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION**DOT (US)**

UN number: 3295 Class: 3 Packing group: III
Proper shipping name: Hydrocarbons, liquid, n.o.s.

Marine pollutant: No
Poison Inhalation Hazard: No

IMDG

UN number: 3295 Class: 3 Packing group: III EMS-No: F-E, S-D
Proper shipping name: HYDROCARBONS, LIQUID, N.O.S.
Marine pollutant: No

IATA

UN number: 3295 Class: 3 Packing group: III
Proper shipping name: Hydrocarbons, liquid, n.o.s.

15. REGULATORY INFORMATION

OSHA Hazards

Combustible Liquid

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
1,2,4-Trimethylbenzene	95-63-6	2007-07-01

SARA 311/312 Hazards

Fire Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
1,2,4-Trimethylbenzene	95-63-6	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
1,2,4-Trimethylbenzene	95-63-6	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
1,2,4-Trimethylbenzene	95-63-6	2007-07-01

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 09/14/2011

Reviewed on 09/13/2011

1 Identification of the substance/mixture and of the company/undertaking**Product identifier****Product name:** Acetone**Stock number:** L10407**CAS Number:**

67-64-1

EC number:

200-662-2

Index number:

606-001-00-8

Relevant identified uses of the substance or mixture and uses advised against.**Sector of Use** SU24 Scientific research and development**Details of the supplier of the safety data sheet****Manufacturer/Supplier:**

Alfa Aesar, A Johnson Matthey Company

Johnson Matthey Catalog Company, Inc

30 Bond Street

Ward Hill, MA 01835-8099

Tel: 800-343-6660

Fax: 800-322-4757

Email: tech@alfa.com

www.alfa.com

Information Department: Health, Safety and Environmental Department**Emergency telephone number:**

During normal hours the Health, Safety and Environmental Department at (800) 343-6660 After normal hours call Carechem 24 at (866) 928-6789

2 Hazards identification**Classification of the substance or mixture**

GHS02 Flame

H225 Highly flammable liquid and vapour



GHS07

H319 Causes serious eye irritation

H336 May cause drowsiness or dizziness

Classification according to Directive 67/548/EEC or Directive 1999/45/EC

Xi; Irritant

R36 Irritating to eyes



F; Highly flammable

R11 Highly flammable

R66-67 Repeated exposure may cause skin dryness or cracking Vapours may cause drowsiness and dizziness

Information concerning particular hazards for human and environment:

At long or repeated contact with skin it may cause dermatitis due to the degreasing effect of the solvent

Causes a narcotic effect

Label elements**Labelling according to EU guidelines:**

The product has been classified and marked in accordance with directives on hazardous materials

Code letter and hazard designation of product:

Xi Irritant

F Highly flammable

Risk phrases:

11 Highly flammable

36 Irritating to eyes

66 Repeated exposure may cause skin dryness or cracking

67 Vapours may cause drowsiness and dizziness

Safety phrases:

9 Keep container in a well-ventilated place

Contd on page 2)

USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 09/14/2011

Reviewed on 09/13/2011

Product name: Acetone

(Contd. of page 1)

16 Keep away from sources of ignition - No smoking
 26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
 46 If swallowed, seek medical advice immediately and show this container or label
Hazard description:
WHMIS classification
 B2 - Flammable liquid
 D2B - Toxic material causing other toxic effects



Classification system
HMIS ratings (scale 0-4)
(Hazardous Materials Identification System)

HEALTH	1
FIRE	3
REACTIVITY	1

Health acute effects) = 1
 Flammability = 3
 Reactivity = 1

Other hazards**Results of PBT and vPvB assessment**

PBT: Not applicable

vPvB: Not applicable

3 Composition/information on ingredients**Chemical characterization:** Substances**CAS# Description:**

67-64-1 Acetone

Identification number(s):

EC number: 200-662-2

Index number: 606-001-00-8

4 First aid measures**Description of first aid measures****After inhalation**

Supply fresh air. If required, provide artificial respiration. Keep patient warm.

Seek immediate medical advice.

After skin contact

Wash with water and soap and rinse thoroughly.

If skin irritation continues, consult a doctor.

Immediately wash with water and soap and rinse thoroughly.

Seek immediate medical advice.

After eye contact

Rinse opened eye for several minutes under running water. Then consult a doctor.

After swallowing

Drink lots of water.

Do not give milk or fatty oils.

Administer activated carbon and sodium sulfate.

Do not initiate vomiting.

Call a doctor immediately.

Information for doctor**Most important symptoms and effects, both acute and delayed**

No further relevant information available.

Danger If swallowed or in case of vomiting, danger of entering the lungs.**Indication of any immediate medical attention and special treatment needed**

No further relevant information available.

5 Firefighting measures**Extinguishing media****Suitable extinguishing agents**

Carbon dioxide, extinguishing powder or water spray. Fight larger fires with water spray or alcohol resistant foam.

For safety reasons unsuitable extinguishing agents Water with full jet.**Special hazards arising from the substance or mixture**

In case of fire, the following can be released:

(Contd. on page 3)

USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 09/14/2011

Reviewed on 09/13/2011

Product name: Acetone

(Contd. of page 2)

Carbon monoxide and carbon dioxide

Advice for firefighters**Protective equipment:**

Wear self-contained respirator

Wear fully protective impervious suit

Additional information Cool endangered receptacles with water spray**6 Accidental release measures****Personal precautions, protective equipment and emergency procedures**

Wear protective equipment Keep unprotected persons away

Ensure adequate ventilation

Keep away from ignition sources

Environmental precautions:

Do not allow to enter sewers/ surface or ground water

Do not allow to penetrate the ground/soil

Methods and material for containment and cleaning up:

Absorb with liquid-binding material sand, diatomite, acid binders, universal binders, sawdust)

Ensure adequate ventilation

Keep away from ignition sources

Reference to other sections

See Section 7 for information on safe handling

See Section 8 for information on personal protection equipment

See Section 13 for disposal information

7 Handling and storage**Handling****Precautions for safe handling**

Use solvent-proof equipment

Keep container tightly sealed

Store in cool, dry place in tightly closed containers

Ensure good ventilation at the workplace

Information about protection against explosions and fires:

Use explosion-proof apparatus / fittings and spark-proof tools

Protect against electrostatic charges

Fumes can combine with air to form an explosive mixture

Conditions for safe storage, including any incompatibilities**Storage****Requirements to be met by storerooms and receptacles:**

Provide solvent resistant, sealed floor

Store in a cool location

Information about storage in one common storage facility: Store away from oxidizing agents**Further information about storage conditions:**

Store receptacle in a well ventilated area

Keep container tightly sealed

Store in cool, dry conditions in well sealed containers

Specific end use(s) No further relevant information available**8 Exposure controls/personal protection****Additional information about design of technical systems:**

Properly operating chemical fume hood designed for hazardous chemicals and having an average face velocity of at least 100 feet per minute

Control parameters**Components with limit values that require monitoring at the workplace:****67-64-1 Acetone (100.0%)**PEL () 2400 mg/m³, 1000 ppmREL () 590 mg/m³, 250 ppmTLV () Short-term value: (1782) NIC-1187 mg/m³, (750) NIC-500 ppmLong-term value: (1188) NIC-475 mg/m³, (500) NIC-200 ppm

BEI

Additional information:

The exposure limits that were valid when the MSDS was created were used

No data

(Contd. on page 4)

USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 09/14/2011

Reviewed on 09/13/2011

Product name: Acetone

(Contd. of page 3)

Exposure controls**Personal protective equipment****General protective and hygienic measures**

The usual precautionary measures for handling chemicals should be followed

Keep away from foodstuffs, beverages and feed

Remove all soiled and contaminated clothing immediately

Wash hands before breaks and at the end of work

Avoid contact with the eyes

Avoid contact with the eyes and skin

Breathing equipment:

Not necessary if room is well-ventilated

In case of brief exposure or low pollution use respiratory filter device In case of intensive or longer exposure use respiratory protective device that is independent of circulating air

Use suitable respirator when high concentrations are present

Recommended filter device for short term use: Filter AX**Protection of hands:**

Rubber gloves

Neoprene gloves

Check protective gloves prior to each use for their proper condition

Impervious gloves

Material of gloves

The selection of suitable gloves not only depends on the material, but also on quality

Quality will vary from manufacturer to manufacturer

Eye protection: Safety glasses**Body protection:**

Solvent resistant protective clothing

Protective work clothing

9 Physical and chemical properties**Information on basic physical and chemical properties****General Information****Appearance:**

Form:	Liquid
Color:	Colorless
Odor:	Characteristic
Odour threshold:	Not determined

pH-value: Not determined

Change in condition

Melting point/Melting range:	-94°C (-137 °F)
Boiling point/Boiling range:	55-56°C (131-133 °F)
Sublimation temperature / start:	Not determined

Flash point: -17°C (-1 °F)

Flammability (solid, gaseous) Not applicable

Ignition temperature: 465°C (869 °F)

Decomposition temperature: Not determined

Auto igniting: Not determined

Explosion limits:

Lower:	2.6 Vol %
Upper:	13 Vol %

Vapor pressure at 20°C (68 °F): 247 hPa (185 mm Hg)

Density at 20°C (68 °F): 0.79 g/cm³ (6.593 lbs/gal)

Relative density Not determined

Vapour density Not determined

Evaporation rate Not determined

Solubility in / Miscibility with

Water:	Fully miscible
Alcohols:	Fully miscible
Chlorinated hydrocarbons:	Partly miscible

Segregation coefficient (n-octanol/water): Not determined

Viscosity:

dynamic at 25°C (77 °F):	32 mPas
kinematic:	Not determined

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USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 09/14/2011

Reviewed on 09/13/2011

Product name: Acetone

(Contd. of page 4)

Other information

No further relevant information available

10 Stability and reactivity**Reactivity****Chemical stability****Thermal decomposition / conditions to be avoided:**

Decomposition will not occur if used and stored according to specifications

Possibility of hazardous reactions

Forms explosive gas mixture with air

Possible formation of peroxides

Reacts with strong oxidizing agents

Reacts with strong acids

Reacts with strong alkali

Hazardous decomposition products: Carbon monoxide and carbon dioxide**11 Toxicological information****Information on toxicological effects****Acute toxicity:****Primary irritant effect:****on the skin:** Irritant to skin and mucous membranes**on the eye:** Irritating effect**Sensitization:** No sensitizing effects known**Other information (about experimental toxicology):**

Mutagenic effects have been observed on tests with laboratory animals

Mutagenic effects have been observed on tests with bacteria

Reproductive effects have been observed on tests with laboratory animals

Additional toxicological information:

To the best of our knowledge the acute and chronic toxicity of this substance is not fully known

EPA-I. Data are inadequate for an assessment of human carcinogenic potential

ACGIH A4: Not classifiable as a human carcinogen. Inadequate data on which to classify the agent in terms of its carcinogenicity in humans and/or animals

The Registry of Toxic Effects of Chemical Substances (RTECS) contains acute and/or other multiple dose toxicity data for components in this product

The Registry of Toxic Effects of Chemical Substances (RTECS) contains reproductive and/or mutation data for components in this product

12 Ecological information**Toxicity****Acquatic toxicity:** No further relevant information available**Persistence and degradability** No further relevant information available**Behavior in environmental systems:****Bioaccumulative potential** No further relevant information available**Mobility in soil** No further relevant information available**Additional ecological information:****General notes:**

Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system

Do not allow material to be released to the environment without proper governmental permits

Results of PBT and vPvB assessment**PBT:** Not applicable**vPvB:** Not applicable**Other adverse effects** No further relevant information available**13 Disposal considerations****Waste treatment methods****Recommendation** Consult state, local or national regulations to ensure proper disposal**Waste disposal key number according to the European Waste Catalogue:**

Contaminated solvent: the waste disposal number depends on the purpose for which the solvent was used, e.g.

07 01 04, 07 02 04, 07 03 04, 07 04 04, 07 05 04, 07 06 04, 07 07 04

Unused solvent:

16 05 03

(Contd. on page 6)

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Material Safety Data Sheet

According to OSHA and ANSI

Printing date 09/14/2011

Reviewed on 09/13/2011

Product name: Acetone

(Contd. of page 5)

Uncleaned packagings:**Recommendation:** Disposal must be made according to official regulations**Recommended cleansing agent:** Water, if necessary with cleansing agents**14 Transport information****UN-Number****DOT, ADR, IMDG, IATA**

UN1090

UN proper shipping name**DOT, IMDG, IATA**

ACETONE

ADR

1090 ACETONE

Transport hazard class(es)**DOT, IMDG, IATA****Class
Label**3 Flammable liquids
3**ADR****Class
Label**3 (F+) Flammable liquids
3**Packing group****DOT, ADR, IMDG, IATA**

II

Environmental hazards:**Marine pollutant:**

No

Special precautions for user

Warning: Flammable liquids

Danger code (Kemler):

33

EMS Number:

F+ E, S-D

**Transport in bulk according to Annex II of
MARPOL73/78 and the IBC Code**

Not applicable

UN 'Model Regulation':

UN1090, ACETONE, 3, II

15 Regulatory information**Safety, health and environmental regulations/legislation specific for the substance or mixture****Product related hazard informations:**

The product has been classified and marked in accordance with directives on hazardous materials

Hazard symbols:

Xi Irritant

F+ Highly flammable

Risk phrases:

11 Highly flammable

36 Irritating to eyes

66 Repeated exposure may cause skin dryness or cracking

67 Vapours may cause drowsiness and dizziness

Safety phrases:

9 Keep container in a well-ventilated place

16 Keep away from sources of ignition - No smoking

26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice

46 If swallowed, seek medical advice immediately and show this container or label

(Contd. on page 7)

USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 09/14/2011

Reviewed on 09/13/2011

Product name: Acetone

(Contd. of page 6)

National regulations

All components of this product are listed in the U S Environmental Protection Agency Toxic Substances Control Act Chemical substance Inventory

All components of this product are listed on the Canadian Domestic Substances List (DSL)

Information about limitation of use:

For use only by technically qualified individuals

This product is subject to the reporting requirements of section 313 of the Emergency Planning and Community Right to Know Act of 1986 and 40CFR372

Chemical safety assessment: A Chemical Safety Assessment has not been carried out

16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

Employers should use this information only as a supplement to other information gathered by them, and should make independent judgement of suitability of this information to ensure proper use and protect the health and safety of employees. This information is furnished without warranty, and any use of the product not in conformance with this Material Safety Data Sheet, or in combination with any other product or process, is the responsibility of the user.

Department issuing MSDS: Health, Safety and Environmental Department

Contact:

Zachariah C Holt
Global EHS Manager

Reference Sources:

CRC Handbook of Chemistry and Physics
CRC Press

Hawley's Condensed Chemical Dictionary
Van Nostrand Reinhold, New York

National Institute for Occupational Safety and Health
Registry of Toxic Effects of Chemical Substances
U S Government Printing Office, Washington D C

Richard J Lewis, Sr
Sax's Dangerous Properties of Industrial Materials
Van Nostrand Reinhold, New York

The Merck Index
Merck & Co, Inc, Rahway N J

L Bretherick
Handbook of Chemical Hazards
Butterworths

L Roth, U Weller
Gefährliche chemische Reaktionen
ecomed Verlag, Landsberg

Abbreviations and acronyms:

ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)

RID: Règlement international concernant le transport des marchandises dangereuses par chemin de fer (Regulations Concerning the International Transport of Dangerous Goods by Rail)

IMDG: International Maritime Code for Dangerous Goods

IATA: International Air Transport Association

ICAO: International Civil Aviation Organization

ETNCS: European Inventory of Existing Commercial Chemical Substances

CAS: Chemical Abstracts Service (division of the American Chemical Society)

HMIS: Hazardous Materials Identification System (USA)

WHMIS: Workplace Hazardous Materials Information System (Canada)

USA

SAFETY DATA SHEET

Version 5.1
Revision Date 02/26/2014
Print Date 04/30/2014

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Benzene

Product Number : 12540
Brand : Fluka
Index-No. : 601-020-00-8
REACH No. : 01-2119447106-44-XXXX
CAS-No. : 71-43-2

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 2), H225
Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319
Germ cell mutagenicity (Category 1B), H340
Carcinogenicity (Category 1A), H350
Aspiration hazard (Category 1), H304
Acute aquatic toxicity (Category 2), H401

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H225	Highly flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H340	May cause genetic defects.
H350	May cause cancer.
H401	Toxic to aquatic life.

Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P210	Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P264	Wash skin thoroughly after handling.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P321	Specific treatment (see supplemental first aid instructions on this label).
P331	Do NOT induce vomiting.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	: C ₆ H ₆
Molecular Weight	: 78.11 g/mol
CAS-No.	: 71-43-2
EC-No.	: 200-753-7
Index-No.	: 601-020-00-8
Registration number	: 01-2119447106-44-XXXX

Hazardous components

Component	Classification	Concentration
Benzene		
	Flam. Liq. 2; Skin Irrit. 2; Eye Irrit. 2A; Muta. 1B; Carc. 1A; STOT RE 1; Asp. Tox. 1; Aquatic Acute 2; H225, H304, H315, H319, H340, H350, H372, H401	90 - 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

no data available

5. FIREFIGHTING MEASURES**5.1 Extinguishing media****Suitable extinguishing media**

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Carbon oxides

Flash back possible over considerable distance., Container explosion may occur under fire conditions.

5.3 Advice for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

5.4 Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES**6.1 Personal precautions, protective equipment and emergency procedures**

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE**7.1 Precautions for safe handling**

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

Use explosion-proof equipment. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Benzene	71-43-2	TWA	0.5 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Leukemia Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed human carcinogen Danger of cutaneous absorption		
		STEL	2.5 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Leukemia Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed human carcinogen Danger of cutaneous absorption		
		TWA	10 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z2
		Z37.40-1969		
		CEIL	25 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z2
		Z37.40-1969		
		Peak	50 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z2
		Z37.40-1969		
		See 1910.1028. See Table Z-2 for the limits applicable in the operations or sectors excluded in 1910.1028 The final benzene standard in 1910.1028 applies to all occupational exposures to benzene except some subsegments of industry where exposures are consistently under the action level (i.e., distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures); for the excepted subsegments, the benzene limits in Table Z-2 apply.		
		TWA	0.1 ppm	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A		
		ST	1 ppm	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Benzene	71-43-2	S-Phenylmercapturic acid	0.03 mg/g	In urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift (As soon as possible after exposure ceases)			
		t,t-Muconic acid	0.5 mg/g	In urine	ACGIH - Biological Exposure Indices (BEI)
		End of shift (As soon as possible after exposure ceases)			

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: 480 min

Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: 480 min

Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

- | | |
|--|---------------------------------------|
| a) Appearance | Form: liquid
Colour: colourless |
| b) Odour | no data available |
| c) Odour Threshold | no data available |
| d) pH | no data available |
| e) Melting point/freezing point | Melting point/range: 5.5 °C (41.9 °F) |
| f) Initial boiling point and boiling range | 80 °C (176 °F) |

g) Flash point	-11.0 °C (12.2 °F) - closed cup
h) Evaporation rate	no data available
i) Flammability (solid, gas)	no data available
j) Upper/lower flammability or explosive limits	Upper explosion limit: 8 %(V) Lower explosion limit: 1.3 %(V)
k) Vapour pressure	221.3 hPa (166.0 mmHg) at 37.7 °C (99.9 °F) 99.5 hPa (74.6 mmHg) at 20.0 °C (68.0 °F)
l) Vapour density	no data available
m) Relative density	0.874 g/mL at 25 °C (77 °F)
n) Water solubility	no data available
o) Partition coefficient: n-octanol/water	no data available
p) Auto-ignition temperature	562.0 °C (1,043.6 °F)
q) Decomposition temperature	no data available
r) Viscosity	no data available
s) Explosive properties	no data available
t) Oxidizing properties	no data available

9.2 Other safety information

no data available

10. STABILITY AND REACTIVITY

10.1 Reactivity

no data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

Vapours may form explosive mixture with air.

10.4 Conditions to avoid

Heat, flames and sparks. Extremes of temperature and direct sunlight.

10.5 Incompatible materials

acids, Bases, Halogens, Strong oxidizing agents, Metallic salts

10.6 Hazardous decomposition products

Other decomposition products - no data available

In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - rat - 2,990 mg/kg

LC50 Inhalation - rat - female - 4 h - 44,700 mg/m³

LD50 Dermal - rabbit - 8,263 mg/kg

no data available

Skin corrosion/irritation

Skin - rabbit

Result: Skin irritation

Serious eye damage/eye irritation

Eyes - rabbit

Result: Eye irritation

Respiratory or skin sensitisation

no data available

Germ cell mutagenicity

Laboratory experiments have shown mutagenic effects.

In vivo tests showed mutagenic effects

Human

lymphocyte

Sister chromatid exchange

mouse

lymphocyte

Mutation in mammalian somatic cells.

mouse

Sister chromatid exchange

Carcinogenicity

Carcinogenicity - Human - male - Inhalation

Tumorigenic: Carcinogenic by RTECS criteria. Leukaemia Blood: Thrombocytopenia.

Carcinogenicity - rat - Oral

Tumorigenic: Carcinogenic by RTECS criteria. Endocrine: Tumors. Leukaemia

This is or contains a component that has been reported to be carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Human carcinogen.

IARC: 1 - Group 1: Carcinogenic to humans (Benzene)

NTP: Known to be human carcinogen (Benzene)

OSHA: OSHA specifically regulated carcinogen (Benzene)

Reproductive toxicity

Reproductive toxicity - mouse - Intraperitoneal

Effects on Fertility: Pre-implantation mortality (e.g., reduction in number of implants per female; total number of implants per corpora lutea). Effects on Embryo or Fetus: Fetal death.

Developmental Toxicity - rat - Inhalation

Effects on Embryo or Fetus: Extra embryonic structures (e.g., placenta, umbilical cord). Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).

Developmental Toxicity - mouse - Inhalation

Effects on Embryo or Fetus: Cytological changes (including somatic cell genetic material). Specific Developmental Abnormalities: Blood and lymphatic system (including spleen and marrow).

Specific target organ toxicity - single exposure

no data available

Specific target organ toxicity - repeated exposure

no data available

Aspiration hazard

May be fatal if swallowed and enters airways.

Additional Information

RTECS: CY1400000

Nausea, Dizziness, Headache, narcosis, Inhalation of high concentrations of benzene may have an initial stimulatory effect on the central nervous system characterized by exhilaration, nervous excitation and/or giddiness, depression, drowsiness, or fatigue. The victim may experience tightness in the chest, breathlessness, and loss of consciousness. Tremors, convulsions, and death due to respiratory paralysis or circulatory collapse can occur in a few minutes to several hours following severe exposures. Aspiration of small amounts of liquid immediately causes pulmonary edema and hemorrhage of pulmonary tissue. Direct skin contact may cause erythema. Repeated or prolonged skin contact may result in drying, scaling dermatitis, or development of secondary skin infections. The chief target organ is the hematopoietic system. Bleeding from the nose, gums, or mucous membranes and the development of purpuric spots, pancytopenia, leukopenia, thrombocytopenia, aplastic anemia, and leukemia may occur as the condition progresses. The bone marrow may appear normal, aplastic or hyperplastic, and may not correlate with peripheral blood-forming tissues. The onset of effects of prolonged benzene exposure may be delayed for many months or years after the actual exposure has ceased., Blood disorders

Stomach - Irregularities - Based on Human Evidence

Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - <i>Oncorhynchus mykiss</i> (rainbow trout) - 5.90 mg/l - 96 h
	LC50 - <i>Pimephales promelas</i> (fathead minnow) - 15.00 - 32.00 mg/l - 96 h
	LC50 - <i>Lepomis macrochirus</i> (Bluegill) - 230.00 mg/l - 96 h
	NOEC - <i>Pimephales promelas</i> (fathead minnow) - 10.2 mg/l - 7 d
	LOEC - <i>Pimephales promelas</i> (fathead minnow) - 17.2 mg/l - 7 d
Toxicity to daphnia and other aquatic invertebrates	EC50 - <i>Daphnia magna</i> (Water flea) - 22.00 mg/l - 48 h
	EC50 - <i>Daphnia magna</i> (Water flea) - 9.20 mg/l - 48 h
Toxicity to algae	EC50 - <i>Pseudokirchneriella subcapitata</i> (green algae) - 29.00 mg/l - 72 h

12.2 Persistence and degradability

Biodegradability Result: - Readily biodegradable.

12.3 Bioaccumulative potential

Bioaccumulation *Leuciscus idus* (Golden orfe) - 3 d
- 0.05 mg/l

Bioconcentration factor (BCF): 10

12.4 Mobility in soil

no data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 1114 Class: 3 Packing group: II
Proper shipping name: Benzene
Reportable Quantity (RQ): 10 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG

UN number: 1114 Class: 3 Packing group: II EMS-No: F-E, S-D
Proper shipping name: BENZENE
Marine pollutant: No

IATA

UN number: 1114 Class: 3 Packing group: II
Proper shipping name: Benzene

15. REGULATORY INFORMATION

REACH No. : 01-2119447106-44-XXXX

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Benzene	71-43-2	2007-07-01

SARA 311/312 Hazards

Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Benzene	71-43-2	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Benzene	71-43-2	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Benzene	71-43-2	2007-07-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.

	CAS-No.	Revision Date
Benzene	71-43-2	2009-02-01

WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

	CAS-No.	Revision Date
Benzene	71-43-2	2009-02-01

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Asp. Tox.	Aspiration hazard
Carc.	Carcinogenicity
Eye Irrit.	Eye irritation

Flam. Liq.	Flammable liquids
H225	Highly flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H340	May cause genetic defects.
H350	May cause cancer.
H372	Causes damage to organs through prolonged or repeated exposure.
H401	Toxic to aquatic life.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	3
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	3
Reactivity Hazard:	0

Further information

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Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.1

Revision Date: 02/26/2014

Print Date: 04/30/2014

SAFETY DATA SHEET

Version 5.1
Revision Date 02/26/2014
Print Date 04/30/2014

1. PRODUCT AND COMPANY IDENTIFICATION**1.1 Product identifiers**

Product name : Carbon disulfide

Product Number : 154709

Brand : Sigma-Aldrich

Index-No. : 006-003-00-3

REACH No. : A registration number is not available for this substance as the substance or its uses are exempted from registration, the annual tonnage does not require a registration or the registration is envisaged for a later registration deadline.

CAS-No. : 75-15-0

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION**2.1 Classification of the substance or mixture****GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)**

Flammable liquids (Category 2), H225

Acute toxicity, Oral (Category 4), H302

Skin irritation (Category 2), H315

Eye irritation (Category 2A), H319

Reproductive toxicity (Category 2), H361

Specific target organ toxicity - repeated exposure, Inhalation (Category 1), H372

Acute aquatic toxicity (Category 3), H402

Chronic aquatic toxicity (Category 3), H412

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H225 : Highly flammable liquid and vapour.

H302 : Harmful if swallowed.

H315 : Causes skin irritation.

H319 : Causes serious eye irritation.

H361	Suspected of damaging fertility or the unborn child.
H372	Causes damage to organs through prolonged or repeated exposure if inhaled.
H412	Harmful to aquatic life with long lasting effects.
Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P210	Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312	IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P321	Specific treatment (see supplemental first aid instructions on this label).
P330	Rinse mouth.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	: CS ₂
Molecular Weight	: 76.14 g/mol
CAS-No.	: 75-15-0
EC-No.	: 200-843-6
Index-No.	: 006-003-00-3

Hazardous components

Component	Classification	Concentration
Carbon disulphide		
	Flam. Liq. 2; Acute Tox. 4; Skin Irrit. 2; Eye Irrit. 2A; Repr. 2; STOT RE 1; Aquatic Acute 3; Aquatic Chronic 3; H225, H302, H315, H319, H361, H372, H412	-

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

no data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Carbon oxides, Sulphur oxides

Carbon oxides, Sulphur oxides

Flash back possible over considerable distance., Container explosion may occur under fire conditions., Vapours may form explosive mixture with air., May explode when heated.

5.3 Advice for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

5.4 Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

Use explosion-proof equipment. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Refrigerate before opening.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Carbon disulphide	75-15-0	TWA	1 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Peripheral Nervous System impairment Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Not classifiable as a human carcinogen Danger of cutaneous absorption		
		TWA	31 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Skin contact does contribute to exposure. Not classifiable as a human carcinogen		
		TWA	4 ppm 12 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		Skin notation		
		STEL	12 ppm 36 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		Skin notation		
		TWA	20 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z2
		Z37.3-1968		
		CEIL	30 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z2
		Z37.3-1968		
		Peak	100 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z2
		Z37.3-1968		
		TWA	1 ppm 3 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential for dermal absorption		
		ST	10 ppm 30 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential for dermal absorption		
		See Table Z-2		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Carbon disulphide	75-15-0	2-Thiothiazolidine-4-carboxylic acid (TTCA)	0.5 mg/g	Urine	ACGIH - Biological Exposure Indices (BEI)

	Remarks	End of shift (As soon as possible after exposure ceases)
--	---------	--

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: 480 min

Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: 480 min

Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

- | | |
|---------------------------------|--|
| a) Appearance | Form: liquid
Colour: colourless |
| b) Odour | Stench. |
| c) Odour Threshold | no data available |
| d) pH | no data available |
| e) Melting point/freezing point | Melting point/range: -112 - -111 °C (-170 - -168 °F) |

f) Initial boiling point and boiling range	46 °C (115 °F)
g) Flash point	-30 °C (-22 °F) - closed cup
h) Evaporation rate	no data available
i) Flammability (solid, gas)	no data available
j) Upper/lower flammability or explosive limits	Upper explosion limit: 50 %(V) Lower explosion limit: 1.3 %(V)
k) Vapour pressure	394.956 hPa (296.241 mmHg) at 20 °C (68 °F) 1,342.711 hPa (1,007.116 mmHg) at 55 °C (131 °F)
l) Vapour density	2.63 - (Air = 1.0)
m) Relative density	1.266 g/mL at 25 °C (77 °F)
n) Water solubility	no data available
o) Partition coefficient: n-octanol/water	log Pow: 2.16
p) Auto-ignition temperature	no data available
q) Decomposition temperature	no data available
r) Viscosity	no data available
s) Explosive properties	no data available
t) Oxidizing properties	no data available

9.2 Other safety information

Relative vapour density 2.63 - (Air = 1.0)

10. STABILITY AND REACTIVITY

10.1 Reactivity

no data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

Vapours may form explosive mixture with air.

10.4 Conditions to avoid

Heat, flames and sparks. Extremes of temperature and direct sunlight.

10.5 Incompatible materials

Alkali metals, Zinc, Amines, Azides, Oxidizing agents

10.6 Hazardous decomposition products

Other decomposition products - no data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - rat - 1,200 mg/kg

LD50 Oral - mouse - 2,780 mg/kg

LD50 Oral - rabbit - 2,550 mg/kg

LD50 Oral - guinea pig - 2,125 mg/kg

LC50 Inhalation - rat - 2 h - 25 mg/l

Dermal: no data available

no data available

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitisation

no data available

Germ cell mutagenicity

Laboratory experiments have shown mutagenic effects.

Human - lymphocyte

Sister chromatid exchange

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

Suspected human reproductive toxicant

May cause reproductive disorders.

Specific target organ toxicity - single exposure

no data available

Specific target organ toxicity - repeated exposure

Inhalation - Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard

no data available

Additional Information

RTECS: FF6650000

May cause convulsions.

Liver - Irregularities - Based on Human Evidence

Liver - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish LC50 - other fish - 162 mg/l - 96 h

Toxicity to algae Growth inhibition EC50 - Chlorella pyrenoidosa - 21 mg/l - 96 h

12.2 Persistence and degradability

no data available

12.3 Bioaccumulative potential

no data available

12.4 Mobility in soil

no data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Harmful to aquatic life.

no data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 1131 Class: 3 (6.1) Packing group: I
Proper shipping name: Carbon disulfide
Reportable Quantity (RQ): 100 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG

UN number: 1131 Class: 3 (6.1) Packing group: I EMS-No: F-E, S-D
Proper shipping name: CARBON DISULPHIDE
Marine pollutant: No

IATA

UN number: 1131 Class: 3 (6.1)
Proper shipping name: Carbon disulphide
IATA Passenger: Not permitted for transport
IATA Cargo: Not permitted for transport

15. REGULATORY INFORMATION

REACH No. : A registration number is not available for this substance as the substance or its uses are exempted from registration, the annual tonnage does not require a registration or the registration is envisaged for a later registration deadline.

SARA 302 Components

The following components are subject to reporting levels established by SARA Title III, Section 302:

	CAS-No.	Revision Date
Carbon disulphide	75-15-0	2007-07-01

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Carbon disulphide	75-15-0	2007-07-01

SARA 311/312 Hazards

Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Carbon disulphide	75-15-0	2007-07-01

Pennsylvania Right To Know Components

Carbon disulphide	CAS-No. 75-15-0	Revision Date 2007-07-01
New Jersey Right To Know Components		
Carbon disulphide	CAS-No. 75-15-0	Revision Date 2007-07-01
California Prop. 65 Components		
WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.	CAS-No. 75-15-0	Revision Date 2008-06-17
Carbon disulphide		

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Eye Irrit.	Eye irritation
Flam. Liq.	Flammable liquids
H225	Highly flammable liquid and vapour.
H302	Harmful if swallowed.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H361	Suspected of damaging fertility or the unborn child.
H372	Causes damage to organs through prolonged or repeated exposure if inhaled.
H402	Harmful to aquatic life.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	3
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	3
Reactivity Hazard:	0

Further information

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Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.1

Revision Date: 02/26/2014

Print Date: 04/30/2014

SAFETY DATA SHEET

Version 3.16
Revision Date 02/21/2014
Print Date 04/30/2014

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Chloroform

Product Number : 02487
Brand : Fluka
Index-No. : 602-006-00-4
REACH No. : 01-2119486657-20-XXXX
CAS-No. : 67-66-3

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 4), H302
Acute toxicity, Inhalation (Category 4), H332
Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319
Carcinogenicity (Category 2), H351
Reproductive toxicity (Category 2), H361
Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336
Specific target organ toxicity - repeated exposure (Category 2), Liver, Kidney, H373
Acute aquatic toxicity (Category 3), H402

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Warning

Hazard statement(s)

H302 + H332	Harmful if swallowed or if inhaled
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H336	May cause drowsiness or dizziness.
H351	Suspected of causing cancer.
H361	Suspected of damaging fertility or the unborn child.

H373	May cause damage to organs (Liver, Kidney) through prolonged or repeated exposure.
H402	Harmful to aquatic life.
Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ eye protection/ face protection.
P301 + P312	IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P321	Specific treatment (see supplemental first aid instructions on this label).
P330	Rinse mouth.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms	: Trichloromethane Methyldiyne trichloride
Formula	: CHCl ₃
Molecular Weight	: 119.38 g/mol
CAS-No.	: 67-66-3
EC-No.	: 200-663-8
Index-No.	: 602-006-00-4
Registration number	: 01-2119486657-20-XXXX

Hazardous components

Component	Classification	Concentration
Chloroform		
	Acute Tox. 4; Skin Irrit. 2; Eye Irrit. 2A; Carc. 2; Repr. 2; STOT SE 3; STOT RE 2; Aquatic Acute 3; H302 + H332, H315, H319, H336, H351, H361, H373, H402	90 - 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

no data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Carbon oxides, Phosgene, Chlorine

Carbon oxides, Hydrogen chloride gas

5.3 Advice for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

5.4 Further information

no data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Chloroform	67-66-3	TWA	10 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Central Nervous System impairment Liver damage Embryo/fetal damage Confirmed animal carcinogen with unknown relevance to humans		
		ST	2 ppm 9.78 mg/m ³	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A		
		C	50 ppm 240 mg/m ³	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		The value in mg/m ³ is approximate. Ceiling limit is to be determined from breathing-zone air samples.		
		TWA	2 ppm 9.78 mg/m ³	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: 480 min

Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: 480 min

Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES**9.1 Information on basic physical and chemical properties**

- | | |
|---|---|
| a) Appearance | Form: liquid, clear
Colour: colourless |
| b) Odour | no data available |
| c) Odour Threshold | no data available |
| d) pH | no data available |
| e) Melting point/freezing point | Melting point/range: -63 °C (-81 °F) |
| f) Initial boiling point and boiling range | 60.5 - 61.5 °C (140.9 - 142.7 °F) |
| g) Flash point | no data available |
| h) Evaporation rate | no data available |
| i) Flammability (solid, gas) | no data available |
| j) Upper/lower flammability or explosive limits | no data available |
| k) Vapour pressure | 213.3 hPa (160.0 mmHg) at 20.0 °C (68.0 °F) |
| l) Vapour density | no data available |
| m) Relative density | 1.492 g/mL at 25 °C (77 °F) |
| n) Water solubility | no data available |
| o) Partition coefficient: n-octanol/water | log Pow: 1.97 |
| p) Auto-ignition temperature | no data available |
| q) Decomposition temperature | no data available |
| r) Viscosity | no data available |
| s) Explosive properties | no data available |
| t) Oxidizing properties | no data available |

9.2 Other safety information

- | | |
|-----------------|--------------------------------|
| Surface tension | 27.1 mN/m at 20.0 °C (68.0 °F) |
|-----------------|--------------------------------|

10. STABILITY AND REACTIVITY

10.1 Reactivity

no data available

10.2 Chemical stability

Stable under recommended storage conditions.

Contains the following stabiliser(s):

2-Methyl-2-butene (0.003 %)

10.3 Possibility of hazardous reactions

no data available

10.4 Conditions to avoid

no data available

10.5 Incompatible materials

Strong oxidizing agents, Strong bases, Magnesium, Sodium/sodium oxides, Lithium

10.6 Hazardous decomposition products

Other decomposition products - no data available

In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - rat - 908 mg/kg

Remarks: Behavioral:Change in motor activity (specific assay). Behavioral:Ataxia. Lungs, Thorax, or Respiration:Respiratory stimulation.

LOEC Inhalation - rat - male - 6 h - 500 ppm

LD50 Dermal - rabbit - > 20,000 mg/kg

no data available

Skin corrosion/irritation

Skin - rabbit

Result: Irritating to skin. - 24 h

Serious eye damage/eye irritation

Eyes - rabbit

Result: Irritating to eyes. - 24 h

Respiratory or skin sensitisation

Did not cause sensitisation on laboratory animals.

Germ cell mutagenicity

Laboratory experiments have shown mutagenic effects.

Carcinogenicity

Carcinogenicity - rat - Oral

Tumorigenic:Carcinogenic by RTECS criteria. Leukaemia

The National Cancer Institute (NCI) has found clear evidence for carcinogenicity. Limited evidence of a carcinogenic effect.

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Chloroform)

NTP: Reasonably anticipated to be a human carcinogen (Chloroform)

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

Suspected of damaging the unborn child. Suspected human reproductive toxicant

no data available

Specific target organ toxicity - single exposure

May cause drowsiness or dizziness.

Specific target organ toxicity - repeated exposure

May cause damage to organs through prolonged or repeated exposure. - Liver, Kidney

Aspiration hazard

no data available

Additional Information

RTECS: FS9100000

Vomiting, Gastrointestinal disturbance, Exposure to and/or consumption of alcohol may increase toxic effects., To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Stomach - Irregularities - Based on Human Evidence

Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Leuciscus idus (Golden orfe) - 162 mg/l - 48 h
	LC100 - Leuciscus idus (Golden orfe) - 220 mg/l - 48 h
	LC50 - other fish - 97 mg/l - 96 h
	LC50 - Danio rerio (zebra fish) - 121 mg/l - 96 h
	NOEC - Oryzias latipes - 122 mg/l - 10 d
	NOEC - Oncorhynchus mykiss (rainbow trout) - 24 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 79.00 mg/l - 24 h
	Immobilization EC50 - Daphnia magna (Water flea) - 51.6 mg/l - 48 h
	NOEC - Daphnia magna (Water flea) - 120 mg/l - 11 d
Toxicity to algae	EC50 - No information available. - 500.00 mg/l - 24 h

12.2 Persistence and degradability

no data available

12.3 Bioaccumulative potential

Bioaccumulation Lepomis macrochirus (Bluegill) - 14 d
 - 0.11 mg/l

Bioconcentration factor (BCF): 6

12.4 Mobility in soil

no data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Harmful to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 1888 Class: 6.1 Packing group: III
Proper shipping name: Chloroform
Reportable Quantity (RQ): 10 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG

UN number: 1888 Class: 6.1 Packing group: III EMS-No: F-A, S-A
Proper shipping name: CHLOROFORM
Marine pollutant: No

IATA

UN number: 1888 Class: 6.1 Packing group: III
Proper shipping name: Chloroform

15. REGULATORY INFORMATION

REACH No. : 01-2119486657-20-XXXX

SARA 302 Components

The following components are subject to reporting levels established by SARA Title III, Section 302:

	CAS-No.	Revision Date
Chloroform	67-66-3	2008-11-03

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Chloroform	67-66-3	2008-11-03

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Chloroform	67-66-3	2008-11-03

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Chloroform	67-66-3	2008-11-03

New Jersey Right To Know Components

	CAS-No.	Revision Date
Chloroform	67-66-3	2008-11-03

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.

	CAS-No.	Revision Date
Chloroform	67-66-3	2011-09-01

WARNING: This product contains a chemical known to the

CAS-No.	Revision Date
---------	---------------

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Carc.	Carcinogenicity
Eye Irrit.	Eye irritation
H302	Harmful if swallowed.
H302 + H332	Harmful if swallowed or if inhaled
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H332	Harmful if inhaled.
H336	May cause drowsiness or dizziness.
H351	Suspected of causing cancer.
H361	Suspected of damaging fertility or the unborn child.
H373	May cause damage to organs through prolonged or repeated exposure.
H402	Harmful to aquatic life.
Repr.	Reproductive toxicity
Skin Irrit.	Skin irritation
STOT RE	Specific target organ toxicity - repeated exposure
STOT SE	Specific target organ toxicity - single exposure

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 3.16

Revision Date: 02/21/2014

Print Date: 04/30/2014

Material Safety Data Sheet

Version 4.0

Revision Date 12/24/2012

Print Date 04/30/2014

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : cis-Dichloroethylene

Product Number : 48597

Brand : Supelco

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555

Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Flammable liquid

Target Organs

Central nervous system, Liver, Kidney

GHS Classification

Flammable liquids (Category 2)

Acute toxicity, Inhalation (Category 4)

Acute aquatic toxicity (Category 3)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H225

Highly flammable liquid and vapour.

H332

Harmful if inhaled.

H402

Harmful to aquatic life.

Precautionary statement(s)

P210

Keep away from heat/sparks/open flames/hot surfaces. - No smoking.

HMIS Classification

Health hazard: 1

Chronic Health Hazard: *

Flammability: 3

Physical hazards: 1

NFPA Rating

Health hazard: 2

Fire: 3

Reactivity Hazard: 0

Potential Health Effects

Inhalation May be harmful if inhaled. May cause respiratory tract irritation.
Skin May be harmful if absorbed through skin. May cause skin irritation.
Eyes May cause eye irritation.
Ingestion May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Formula : C₂H₂Cl₂
Molecular Weight : 96.94 g/mol

Component		Concentration
cis-Dichloroethylene		
CAS-No.	156-59-2	-
EC-No.	205-859-7	
Index-No.	602-026-00-3	

4. FIRST AID MEASURES

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability

Flammable in the presence of a source of ignition when the temperature is above the flash point. Keep away from heat/sparks/open flame/hot surface. No smoking.

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas

Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Use personal protective equipment. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

7. HANDLING AND STORAGE

Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

Use explosion-proof equipment. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Recommended storage temperature: 2 - 8 °C

Handle and store under inert gas. Air and moisture sensitive. Light sensitive.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value	Control parameters	Basis
cis-Dichloroethylene	156-59-2	TWA	200 ppm	USA. ACGIH Threshold Limit Values (TLV)
Remarks	Central Nervous System impairment Eye irritation			

Personal protective equipment

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Eye protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	liquid
Colour	light yellow

Safety data

pH	no data available
----	-------------------

Melting point/freezing point	-80.0 °C (-112.0 °F)
Boiling point	60.0 - 61.0 °C (140.0 - 141.8 °F)
Flash point	6.0 °C (42.8 °F) - closed cup
Ignition temperature	no data available
Auto-ignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	no data available
Density	1.28 g/cm3
Water solubility	no data available
Partition coefficient: n-octanol/water	no data available
Relative vapor density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

Vapours may form explosive mixture with air.

Conditions to avoid

Heat, flames and sparks. Extremes of temperature and direct sunlight.

Materials to avoid

Oxidizing agents

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas

Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50

Inhalation LC50

LC50 Inhalation - rat - 13700 ppm

Remarks: Behavioral:Somnolence (general depressed activity). Liver:Fatty liver degeneration.

Dermal LD50

no data available

Other information on acute toxicity

no data available

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitization

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)

no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

no data available

Aspiration hazard

no data available

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure

narcosis, To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Synergistic effects

no data available

Additional Information

RTECS: KV9420000

12. ECOLOGICAL INFORMATION**Toxicity**

no data available

Persistence and degradability

no data available

Bioaccumulative potential

no data available

Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Harmful to aquatic life.

13. DISPOSAL CONSIDERATIONS**Product**

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION**DOT (US)**

UN number: 1150 Class: 3 Packing group: II

Proper shipping name: 1,2-Dichloroethylene

Marine Pollutant: No

Poison Inhalation Hazard: No

IMDG

UN number: 1150 Class: 3 Packing group: II EMS-No: F-E, S-D

Proper shipping name: 1,2-DICHLOROETHYLENE

Marine Pollutant: No

IATA

UN number: 1150 Class: 3 Packing group: II

Proper shipping name: 1,2-Dichloroethylene

15. REGULATORY INFORMATION**OSHA Hazards**

Flammable liquid

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Fire Hazard

Massachusetts Right To Know Components

cis-Dichloroethylene	CAS-No. 156-59-2	Revision Date 1993-04-24
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Pennsylvania Right To Know Components

cis-Dichloroethylene	CAS-No. 156-59-2	Revision Date 1993-04-24
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New Jersey Right To Know Components

cis-Dichloroethylene	CAS-No. 156-59-2	Revision Date 1993-04-24
----------------------	---------------------	-----------------------------

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Further information

Copyright 2012 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

SAFETY DATA SHEET

Version 5.8
Revision Date 04/20/2014
Print Date 04/30/2014

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Isopropylbenzene

Product Number : 442630
Brand : Supelco
Index-No. : 601-024-00-X
REACH No. : A registration number is not available for this substance as the substance or its uses are exempted from registration, the annual tonnage does not require a registration or the registration is envisaged for a later registration deadline.

CAS-No. : 98-82-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 3), H226
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
Aspiration hazard (Category 1), H304
Acute aquatic toxicity (Category 2), H401
Chronic aquatic toxicity (Category 2), H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H226 Flammable liquid and vapour.
H304 May be fatal if swallowed and enters airways.
H335 May cause respiratory irritation.
H411 Toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P210 Keep away from heat/sparks/open flames/hot surfaces. - No smoking.

P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P312	Call a POISON CENTER or doctor/ physician if you feel unwell.
P331	Do NOT induce vomiting.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

May form explosive peroxides.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	: C ₉ H ₁₂
Molecular Weight	: 120.2 g/mol
CAS-No.	: 98-82-8
EC-No.	: 202-704-5
Index-No.	: 601-024-00-X

Hazardous components

Component	Classification	Concentration
Cumene		
	Flam. Liq. 3; STOT SE 3; Asp. Tox. 1; Aquatic Acute 2; Aquatic Chronic 2; H226, H304, H335, H411	90 - 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

no data available

5. FIREFIGHTING MEASURES**5.1 Extinguishing media****Suitable extinguishing media**

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

no data available

5.3 Advice for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

5.4 Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES**6.1 Personal precautions, protective equipment and emergency procedures**

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE**7.1 Precautions for safe handling**

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION**8.1 Control parameters**

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Cumene	98-82-8	TWA	50 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Central Nervous System impairment Eye, skin, & Upper Respiratory Tract irritation		
		TWA	50 ppm 245 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential for dermal absorption		
		TWA	50 ppm 245 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		Skin designation The value in mg/m3 is approximate.		
		TWA	50 ppm 245 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		Skin notation		

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: 480 min

Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.4 mm

Break through time: 30 min

Material tested: Camatril® (KCL 730 / Aldrich Z677442, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES**9.1 Information on basic physical and chemical properties**

a) Appearance	Form: liquid, clear Colour: colourless
b) Odour	no data available
c) Odour Threshold	no data available
d) pH	no data available
e) Melting point/freezing point	-96.0 °C (-140.8 °F)
f) Initial boiling point and boiling range	152.0 - 153.0 °C (305.6 - 307.4 °F)
g) Flash point	31.0 °C (87.8 °F) - closed cup
h) Evaporation rate	no data available
i) Flammability (solid, gas)	no data available
j) Upper/lower flammability or explosive limits	Upper explosion limit: 6.5 %(V) Lower explosion limit: 0.9 %(V)
k) Vapour pressure	10.7 hPa (8.0 mmHg) at 20.0 °C (68.0 °F)
l) Vapour density	no data available
m) Relative density	0.86 g/cm ³
n) Water solubility	0.06 g/l at 25 °C (77 °F) - slightly soluble
o) Partition coefficient: n-octanol/water	log Pow: 3.55 at 23 °C (73 °F)
p) Auto-ignition temperature	425.0 °C (797.0 °F)
q) Decomposition temperature	no data available
r) Viscosity	no data available
s) Explosive properties	no data available
t) Oxidizing properties	no data available

9.2 Other safety information

Surface tension	27.69 mN/m at 25 °C (77 °F)
-----------------	-----------------------------

10. STABILITY AND REACTIVITY**10.1 Reactivity**

no data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

Vapours may form explosive mixture with air.

10.4 Conditions to avoid

Heat, flames and sparks.

10.5 Incompatible materials

Strong oxidizing agents

10.6 Hazardous decomposition products

Other decomposition products - no data available

In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - rat - male - 2,260 mg/kg

Inhalation: no data available

Dermal: no data available

NOAEL Feed - rat - male - > 535.8 mg/kg

Skin corrosion/irritation

Skin - rabbit

Result: No skin irritation

(OECD Test Guideline 404)

Serious eye damage/eye irritation

Eyes - rabbit

Result: No eye irritation

(OECD Test Guideline 405)

Respiratory or skin sensitisation

- guinea pig

Result: Did not cause sensitisation on laboratory animals.

(OECD Test Guideline 406)

Germ cell mutagenicity

in vitro assay

S. typhimurium

Result: negative

Mutagenicity (micronucleus test)

mouse - male and female

Result: negative

Carcinogenicity

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Cumene)

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

no data available

Specific target organ toxicity - single exposure

May cause respiratory irritation.

Specific target organ toxicity - repeated exposure

no data available

Aspiration hazard

May be fatal if swallowed and enters airways.

Additional Information

RTECS: GR8575000

narcosis, Central nervous system depression, Dermatitis, Gastrointestinal disturbance, Damage to the lungs., Liver injury may occur., Kidney injury may occur.

Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish LC50 - Oncorhynchus mykiss (rainbow trout) - 4.8 mg/l - 96 h

Toxicity to daphnia and other aquatic invertebrates EC50 - Daphnia - 2.14 mg/l - 48 h (OECD Test Guideline 202)

Toxicity to algae EC50 - Pseudokirchneriella subcapitata (green algae) - 2.60 mg/l - 72 h

12.2 Persistence and degradability

Biodegradability Result: - According to the results of tests of biodegradability this product is not readily biodegradable.

no data available

12.3 Bioaccumulative potential

no data available

12.4 Mobility in soil

no data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 1918 Class: 3 Packing group: III
Proper shipping name: Isopropylbenzene
Reportable Quantity (RQ): 5000 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG

UN number: 1918 Class: 3 Packing group: III EMS-No: F-E, S-E
Proper shipping name: ISOPROPYLBENZENE
Marine pollutant: No

IATA

UN number: 1918 Class: 3 Packing group: III
Proper shipping name: Isopropylbenzene

15. REGULATORY INFORMATION

REACH No. : A registration number is not available for this substance as the substance or its uses are exempted from registration, the annual tonnage does not require a registration or the registration is envisaged for a later registration deadline.

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Cumene	98-82-8	2007-07-01

SARA 311/312 Hazards

Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Cumene	98-82-8	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Cumene	98-82-8	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Cumene	98-82-8	2007-07-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.

	CAS-No.	Revision Date
Cumene	98-82-8	2010-06-11

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Asp. Tox.	Aspiration hazard
Flam. Liq.	Flammable liquids
H226	Flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H335	May cause respiratory irritation.
H401	Toxic to aquatic life.
H411	Toxic to aquatic life with long lasting effects.
STOT SE	Specific target organ toxicity - single exposure

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	3
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	3
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the

product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.8

Revision Date: 04/20/2014

Print Date: 04/30/2014

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 05/10/2012

Reviewed on 05/09/2012

1 Identification of the substance/mixture and of the company/undertaking**Product identifier****Product name:** Naphthalene**Stock number:** A13188, L64060**CAS Number:**

91-20-3

EC number:

202-049-5

Index number:

601-052-00-2

Relevant identified uses of the substance or mixture and uses advised against.**Sector of Use** SU24 Scientific research and development**Details of the supplier of the safety data sheet****Manufacturer/Supplier:**

Alfa Aesar, A Johnson Matthey Company

Johnson Matthey Catalog Company, Inc

30 Bond Street

Ward Hill, MA 01835-8099

Tel: 800-343-6660

Fax: 800-322-4757

Email: tech@alfa.com

www.alfa.com

Information Department: Health, Safety and Environmental Department**Emergency telephone number:**

During normal hours the Health, Safety and Environmental Department at (800) 343-6660 After normal hours call Carechem 24 at (866) 928-6789

2 Hazards identification**Classification of the substance or mixture**

GHS02 Flame

H228 Flammable solid



GHS08 Health hazard

H351 Suspected of causing cancer



GHS09 Environment

H400 Very toxic to aquatic life

H410 Very toxic to aquatic life with long lasting effects



GHS07

H302 Harmful if swallowed

Classification according to Directive 67/548/EEC or Directive 1999/45/EC

Xn; Harmful

R22-40 Harmful if swallowed Limited evidence of a carcinogenic effect



F+; Highly flammable

R11 Highly flammable



N; Dangerous for the environment

R50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

Information concerning particular hazards for human and environment: Not applicable

(Contd. on page 2)

USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 05/10/2012

Reviewed on 05/09/2012

Product name: Naphthalene

(Contd. of page 1)

Label elements**Labelling according to EU guidelines:****Code letter and hazard designation of product:**

Xn Harmful

F Highly flammable

N Dangerous for the environment

Risk phrases:

11 Highly flammable

22 Harmful if swallowed

40 Limited evidence of a carcinogenic effect

50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

Safety phrases:

36/37 Wear suitable protective clothing and gloves

46 If swallowed, seek medical advice immediately and show this container or label

60 This material and its container must be disposed of as hazardous waste

61 Avoid release to the environment Refer to special instructions/Safety data sheets

Hazard description:**WHMIS classification**

B4 - Flammable solid

D2A - Very toxic material causing other toxic effects

**Classification system****HMIS ratings (scale 0-4)****(Hazardous Materials Identification System)**

HEALTH	1
FIRE	2
REACTIVITY	1

Health (acute effects) = 1

Flammability = 2

Reactivity = 1

Other hazards**Results of PBT and vPvB assessment**

PBT: Not applicable

vPvB: Not applicable

3 Composition/information on ingredients**Chemical characterization: Substances****CAS# Description:**

91-20-3 Naphthalene

Identification number(s):

EC number: 202-049-5

Index number: 601-652-00-2

4 First aid measures**Description of first aid measures****After inhalation**

Supply fresh air If required, provide artificial respiration Keep patient warm

Seek immediate medical advice

After skin contact

Immediately wash with water and soap and rinse thoroughly

Seek immediate medical advice

After eye contact

Rinse opened eye for several minutes under running water Then consult a doctor

After swallowing Seek medical treatment

Information for doctor**Most important symptoms and effects, both acute and delayed**

No further relevant information available

Indication of any immediate medical attention and special treatment needed

No further relevant information available

USA

(Contd. on page 3)

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 05/10/2012

Reviewed on 05/09/2012

Product name: Naphthalene

Contd of page 2)

5 Firefighting measures**Extinguishing media****Suitable extinguishing agents**

Carbon dioxide, extinguishing powder or water spray Fight larger fires with water spray or alcohol resistant foam

Special hazards arising from the substance or mixture

If this product is involved in a fire, the following can be released:

Carbon monoxide and carbon dioxide

Advice for firefighters**Protective equipment:**

Wear self-contained respirator

Wear fully protective impervious suit

6 Accidental release measures**Personal precautions, protective equipment and emergency procedures**

Wear protective equipment Keep unprotected persons away

Ensure adequate ventilation

Keep away from ignition sources

Environmental precautions:

Do not allow material to be released to the environment without proper governmental permits

Methods and material for containment and cleaning up:

Dispose contaminated material as waste according to item 13

Ensure adequate ventilation

Keep away from ignition sources

Reference to other sections

See Section 7 for information on safe handling

See Section 8 for information on personal protection equipment

See Section 13 for disposal information

7 Handling and storage**Handling****Precautions for safe handling**

Keep container tightly sealed

Store in cool, dry place in tightly closed containers

Ensure good ventilation at the workplace

Information about protection against explosions and fires:

Protect against electrostatic charges

Keep ignition sources away

Conditions for safe storage, including any incompatibilities**Storage****Requirements to be met by storerooms and receptacles:** Store in a cool location**Information about storage in one common storage facility:** Store away from oxidizing agents**Further information about storage conditions:**

Keep container tightly sealed

Store in cool, dry conditions in well sealed containers

Specific end use(s) No further relevant information available**8 Exposure controls/personal protection****Additional information about design of technical systems:**

Properly operating chemical fume hood designed for hazardous chemicals and having an average face velocity of at least 100 feet per minute

Control parameters**Components with limit values that require monitoring at the workplace:****91-20-3 Naphthalene (100.0%)**PEL () 50 mg/m³, 10 ppmREL () Short-term value: 75 mg/m³, 15 ppmLong-term value: 50 mg/m³, 10 ppmTLV () Short-term value: 79 mg/m³, 15 ppmLong-term value: 52 mg/m³, 10 ppm

Skin; NIC-A3

Additional information: No data**Exposure controls****Personal protective equipment****General protective and hygienic measures**

The usual precautionary measures for handling chemicals should be followed

Contd on page 4)

USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 05/10/2012

Reviewed on 05/09/2012

Product name: Naphthalene

(Contd. of page 3)

Keep away from foodstuffs, beverages and feed
 Remove all soiled and contaminated clothing immediately
 Wash hands before breaks and at the end of work
 Maintain an ergonomically appropriate working environment
Breathing equipment: Use suitable respirator when high concentrations are present
Protection of hands:
 Impervious gloves
 Check protective gloves prior to each use for their proper condition
 The selection of suitable gloves not only depends on the material, but also on quality
 Quality will vary from manufacturer to manufacturer
Eye protection: Safety glasses
Body protection: Protective work clothing

9 Physical and chemical properties**Information on basic physical and chemical properties****General Information****Appearance:**

Form:	Crystalline
Color:	White
Odor:	Aromatic
Odor threshold:	Not determined

pH-value:	Not applicable
-----------	----------------

Change in condition

Melting point/Melting range:	80-82°C (176-180 °F)
Boiling point/Boiling range:	218°C (424 °F)
Sublimation temperature / start:	Not determined

Flash point:	78°C (172 °F)
--------------	---------------

Flammability (solid, gaseous)	Highly flammable
-------------------------------	------------------

Ignition temperature:	526°C (979 °F)
-----------------------	----------------

Decomposition temperature:	Not determined
----------------------------	----------------

Auto igniting:	Not determined
----------------	----------------

Explosion limits:

Lower:	6.9 Vol %
Upper:	5.9 Vol %

Vapor pressure:	Not applicable
-----------------	----------------

Density at 20°C (68 °F):	0.963 g/cm ³ (8.036 lbs/gal)
--------------------------	---

Relative density	Not determined
------------------	----------------

Vapor density	Not applicable
---------------	----------------

Evaporation rate	Not applicable
------------------	----------------

Solubility in / Miscibility with

Water:	Insoluble
--------	-----------

Segregation coefficient (n-octanol/water):	Not determined
--	----------------

Viscosity:

dynamic:	Not applicable
----------	----------------

kinematic:	Not applicable
------------	----------------

Other information	No further relevant information available
-------------------	---

10 Stability and reactivity**Reactivity****Chemical stability****Thermal decomposition / conditions to be avoided:**

Decomposition will not occur if used and stored according to specifications

Possibility of hazardous reactions No dangerous reactions known**Incompatible materials:** Oxidizing agents**Hazardous decomposition products:** Carbon monoxide and carbon dioxide

USA

(Contd. on page 5)

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 05/10/2012

Reviewed on 05/09/2012

Product name: Naphthalene

(Contd. of page 4)

11 Toxicological information**Information on toxicological effects****Acute toxicity:****LD/LC50 values that are relevant for classification:**

Oral	LD50	490 mg/kg (rat)
------	------	-----------------

Primary irritant effect:**on the skin:** May cause irritation**on the eye:** May cause irritation**Sensitization:** No sensitizing effects known**Additional toxicological information:**

To the best of our knowledge the acute and chronic toxicity of this substance is not fully known

EPA-C. Possible human carcinogen. limited evidence of carcinogenicity in animals in the absence of human data

IARC-2B. Possibly carcinogenic to humans. limited evidence in humans in the absence of sufficient evidence in experimental animals

NTP-R. Reasonably anticipated to be a carcinogen. limited evidence from studies in humans or sufficient evidence from studies in experimental animals

ACGIH A4. Not classifiable as a human carcinogen. Inadequate data on which to classify the agent in terms of its carcinogenicity in humans and/or animals

The Registry of Toxic Effects of Chemical Substances (RTECS) contains acute and/or other multiple dose toxicity data for components in this product

The Registry of Toxic Effects of Chemical Substances (RTECS) contains reproductive and/or mutation data for components in this product

The Registry of Toxic Effects of Chemical Substances (RTECS) contains tumorigenic and/or carcinogenic and/or neoplastic data for components in this product

12 Ecological information**Toxicity****Aquatic toxicity:** No further relevant information available**Persistence and degradability** No further relevant information available**Behavior in environmental systems:****Bioaccumulative potential** No further relevant information available**Mobility in soil** No further relevant information available**Ecotoxicological effects:****Remark:** Very toxic for aquatic organisms**Additional ecological information:****General notes:**

Do not allow product to reach ground water, water course or sewage system, even in small quantities

Danger to drinking water if even extremely small quantities leak into the ground

Also poisonous for fish and plankton in water bodies

Do not allow material to be released to the environment without proper governmental permits

May cause long lasting harmful effects to aquatic life

Very toxic for aquatic organisms

Results of PBT and vPvB assessment**PBT:** Not applicable**vPvB:** Not applicable**Other adverse effects** No further relevant information available**13 Disposal considerations****Waste treatment methods****Recommendation** Consult state, local or national regulations to ensure proper disposal**Uncleaned packagings:****Recommendation:** Disposal must be made according to official regulations**14 Transport information****UN-Number**

DOT, ADR, IMDG, IATA

UN1334

UN proper shipping name

DOT, IMDG, IATA

ADR

NAPHTHALENE, REFINED

1334 NAPHTHALENE, REFINED, ENVIRONMENTALLY
HAZARDOUS

(Contd. on page 6)

USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 05/10/2012

Reviewed on 05/09/2012

Product name: Naphthalene

(Contd. of page 5)

Transport hazard class(es)**DOT****Class**

4.1 Flammable solids, self-reactive substances and solid desensitised explosives

Label

4.1

ADR**Class**

4.1 (F1) Flammable solids, self-reactive substances and solid desensitised explosives

Label

4.1

IMDG, IATA**Class**

4.1 Flammable solids, self-reactive substances and solid desensitised explosives

Label

4.1

Packing group**DOT, ADR, IMDG, IATA**

III

Environmental hazards:

Environmentally hazardous substance, solid; Marine Pollutant

Marine pollutant:

No

Special marking (ADR):

Symbol (fish and tree)

Special precautions for user

Warning: Flammable solids, self-reactive substances and solid desensitised explosives

Danger code (Kemler):

40

Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code

Not applicable

UN 'Model Regulation':

UN1334, NAPHTHALENE, REFINED, ENVIRONMENTALLY HAZARDOUS, 4.1, III

15 Regulatory information**Safety, health and environmental regulations/legislation specific for the substance or mixture****Product related hazard informations:****Hazard symbols:**

Xn Harmful

F Highly flammable

N Dangerous for the environment

Risk phrases:

11 Highly flammable

22 Harmful if swallowed

40 Limited evidence of a carcinogenic effect

50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

Safety phrases:

36/37 Wear suitable protective clothing and gloves

46 If swallowed, seek medical advice immediately and show this container or label

60 This material and its container must be disposed of as hazardous waste

61 Avoid release to the environment Refer to special instructions/Safety data sheets

(Contd. on page 7)

USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 05/10/2012

Reviewed on 05/09/2012

Product name: Naphthalene

(Contd. of page 6)

National regulations

All components of this product are listed in the U S Environmental Protection Agency Toxic Substances Control Act Chemical substance Inventory

This product contains a chemical known to the state of California to cause cancer and/or reproductive toxicity

All components of this product are listed on the Canadian Domestic Substances List (DSL)

Information about limitation of use:

For use only by technically qualified individuals

This product is subject to the reporting requirements of section 313 of the Emergency Planning and Community Right to Know Act of 1986 and 40CFR372

Other regulations, limitations and prohibitive regulations

REACH - Pre-registered substances Substance is listed

Substances of very high concern (SVHC) according to REACH, Article 57

Substance is not listed

Chemical safety assessment: A Chemical Safety Assessment has not been carried out

16 Other information

Employers should use this information only as a supplement to other information gathered by them, and should make independent judgement of suitability of this information to ensure proper use and protect the health and safety of employees. This information is furnished without warranty, and any use of the product not in conformance with this Material Safety Data Sheet, or in combination with any other product or process, is the responsibility of the user.

Department issuing MSDS: Health, Safety and Environmental Department

Contact:

Zachariah C. Holt

Global EHS Manager

Abbreviations and acronyms:

ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)

IMDG: International Maritime Code for Dangerous Goods

DOT: US Department of Transportation

IATA: International Air Transport Association

EINECS: European Inventory of Existing Commercial Chemical Substances

CAS: Chemical Abstracts Service (division of the American Chemical Society)

HMIS: Hazardous Materials Identification System (USA)

WHMIS: Workplace Hazardous Materials Information System (Canada)

LC50: Lethal concentration, 50 percent

LD50: Lethal dose, 50 percent

USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 06/03/2011

Reviewed on 01/30/2007

1 Identification of the substance/mixture and of the company/undertaking**Product identifier****Product name:** n-Propylbenzene**Stock number:** B21468, L65530**CAS Number:**

103-65-1

EINECS Number:

203-132-9

Index number:

601-024-00-X

Relevant identified uses of the substance or mixture and uses advised against.**Sector of Use** SU24 Scientific research and development**Details of the supplier of the safety data sheet****Manufacturer/Supplier:**

Alfa Aesar, A Johnson Matthey Company

Johnson Matthey Catalog Company, Inc

30 Bond Street

Ward Hill, MA 01835-8099

Tel: 800-343-6660

Fax: 800-322-4757

Email: tech@alfa.com

www.alfa.com

Information Department: Health, Safety and Environmental Department**Emergency telephone number:**

During normal hours the Health, Safety and Environmental Department at (800) 343-6660 After normal hours call Carechem 24 at (866) 928-6789

2 Hazards identification**Classification of the substance or mixture**

GHS02 Flame

H226 Flammable liquid and vapour



GHS08 Health hazard

H304 May be fatal if swallowed and enters airways



GHS09 Environment

H411 Toxic to aquatic life with long lasting effects



GHS07

H335 May cause respiratory irritation

H401 Toxic to aquatic life

Classification according to Directive 67/548/EEC or Directive 1999/45/EC

Xn; Harmful

R65: Harmful. may cause lung damage if swallowed



Xi; Irritant

R37: Irritating to respiratory system



N; Dangerous for the environment

R51/53: Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

R10: Flammable

(Contd on page 2)

USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 06/03/2011

Reviewed on 01/30/2007

Product name: n-Propylbenzene

(Contd. of page 1)

Label elements**Labelling according to EU guidelines:****Code letter and hazard designation of product:**

Xn Harmful

N Dangerous for the environment

Risk phrases:

10 Flammable

37 Irritating to respiratory system

51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

65 Harmful: may cause lung damage if swallowed

Safety phrases:

24 Avoid contact with skin

37 Wear suitable gloves

61 Avoid release to the environment Refer to special instructions/Safety data sheets

62 If swallowed, do not induce vomiting. seek medical advice immediately and show this container or label

Hazard description:**WHMIS classification****Classification system****HMIS ratings (scale 0-4)****(Hazardous Materials Identification System)**

HEALTH	1
FIRE	2
REACTIVITY	1

Health (acute effects) = 1

Flammability = 2

Reactivity = 1

Other hazards**Results of PBT and vPvB assessment**

PBT: Not applicable

vPvB: Not applicable

3 Composition/information on ingredients**Chemical characterization: Substances****(CAS#) Description:**

n-Propylbenzene (CAS# 103-65-1) 100%

Identification number(s):

EINECS Number: 203-132-9

Index number: 601-024-00-X

4 First aid measures**Description of first aid measures****After inhalation**

Supply fresh air. If required, provide artificial respiration. Keep patient warm.

Seek immediate medical advice.

After skin contact

Immediately wash with water and soap and rinse thoroughly.

Seek immediate medical advice.

After eye contact

Rinse opened eye for several minutes under running water. Then consult a doctor.

After swallowing Seek immediate medical advice.**5 Firefighting measures****Extinguishing media****Suitable extinguishing agents**

Use carbon dioxide, extinguishing powder or foam. Water may be ineffective but may be used for cooling exposed containers.

Special hazards arising from the substance or mixture

In case of fire, the following can be released:

Carbon monoxide and carbon dioxide.

(Contd. on page 3)

USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 06/03/2011

Reviewed on 01/30/2007

Product name: n-Propylbenzene

(Contd. of page 2)

Advice for firefighters**Protective equipment:**

Wear self-contained respirator

Wear fully protective impervious suit

6 Accidental release measures**Personal precautions, protective equipment and emergency procedures**

Wear protective equipment Keep unprotected persons away

Ensure adequate ventilation

Keep away from ignition sources

Environmental precautions:

Do not allow material to be released to the environment without proper governmental permits

Methods and material for containment and cleaning up:

Absorb with liquid-binding material sand, diatomite, acid binders, universal binders, sawdust)

Dispose contaminated material as waste according to item 13

Ensure adequate ventilation

Keep away from ignition sources

Reference to other sections

See Section 7 for information on safe handling

See Section 8 for information on personal protection equipment

See Section 13 for disposal information

7 Handling and storage**Handling****Precautions for safe handling**

Keep container tightly sealed

Store in cool, dry place in tightly closed containers

Ensure good ventilation at the workplace

Information about protection against explosions and fires:

Keep ignition sources away

Protect against electrostatic charges

Fumes can combine with air to form an explosive mixture

Conditions for safe storage, including any incompatibilities**Storage****Requirements to be met by storerooms and receptacles:** No special requirements**Information about storage in one common storage facility:** Store away from oxidizing agents**Further information about storage conditions:**

Keep container tightly sealed

Store in cool, dry conditions in well sealed containers

8 Exposure controls/personal protection**Additional information about design of technical systems:**

Properly operating chemical fume hood designed for hazardous chemicals and having an average face velocity of at least 100 feet per minute

Control parameters**Components with limit values that require monitoring at the workplace:** Not required**Additional information:** No data**Exposure controls****Personal protective equipment****General protective and hygienic measures**

The usual precautionary measures for handling chemicals should be followed

Keep away from foodstuffs, beverages and feed

Remove all soiled and contaminated clothing immediately

Wash hands before breaks and at the end of work

Breathing equipment: Use suitable respirator when high concentrations are present**Protection of hands:**

Impervious gloves

Check protective gloves prior to each use for their proper condition

Material of gloves

The selection of suitable gloves not only depends on the material, but also on quality

Quality will vary from manufacturer to manufacturer

Eye protection: Safety glasses**Body protection:** Protective work clothing

USA

(Contd. on page 4)

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 06/03/2011

Reviewed on 01/30/2007

Product name: n-Propylbenzene

(Contd. of page 3)

9 Physical and chemical properties**Information on basic physical and chemical properties****General Information****Appearance:**

Form: Liquid
 Odor: Not determined
 Odour threshold: Not determined

pH-value: Not determined

Change in condition

Melting point/Melting range: Not determined
 Boiling point/Boiling range: 158-160°C (316-320 °F)
 Sublimation temperature / start: Not determined

Flash point: 47°C (117 °F)

Flammability (solid, gaseous) Not applicable

Ignition temperature: Not determined

Decomposition temperature: Not determined

Auto igniting: Not determined

Explosion limits:

Lower: Not determined
 Upper: Not determined

Vapor pressure: Not determined

Density at 20°C (68 °F): 0.862 g/cm³ (57.193 lbs/gal)

Relative density Not determined

Vapour density Not determined

Evaporation rate Not determined

Segregation coefficient (n-octanol/water): Not determined

Viscosity:

dynamic: Not determined
 kinematic: Not determined

Other information No further relevant information available

10 Stability and reactivity**Reactivity****Chemical stability****Thermal decomposition / conditions to be avoided:**

Decomposition will not occur if used and stored according to specifications

Possibility of hazardous reactions No dangerous reactions known**Incompatible materials:** Oxidizing agents**Hazardous decomposition products:** Carbon monoxide and carbon dioxide**11 Toxicological information****Information on toxicological effects****Acute toxicity:****LD/LC50 values that are relevant for classification:**

Oral	LD50	5200 mg/kg (mouse)
		6040 mg/kg (rat)
Inhalative	LC50/2H	65000 ppm/2H (rat)
	LCLo	20 gm/m3 (mouse)

Primary irritant effect:**on the skin:** Irritant to skin and mucous membranes**on the eye:** Irritating effect**Sensitization:** No sensitizing effects known**Subacute to chronic toxicity:****Subacute to chronic toxicity:**

The Registry of Toxic Effects of Chemical Substances (RTECS) reports the following effects in laboratory animals:

Behavioral - somnolence (general depressed activity)

Behavioral - general anesthetic

Lungs, Thorax, or Respiration - respiratory depression

Blood - changes in spleen

(Contd. on page 5)

USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 06/03/2011

Reviewed on 01/30/2007

Product name: n-Propylbenzene

(Contd. of page 4)

Additional toxicological information:

To the best of our knowledge the acute and chronic toxicity of this substance is not fully known

No classification data on carcinogenic properties of this material is available from the EPA, IARC, NTP, OSHA or ACGIH

12 Ecological information**Toxicity****Aquatic toxicity:** No further relevant information available**Persistence and degradability** No further relevant information available**Behavior in environmental systems:****Bioaccumulative potential** No further relevant information available**Mobility in soil** No further relevant information available**Ecotoxicological effects:****Remark:** Toxic for aquatic organisms**Additional ecological information:****General notes:**

Do not allow product to reach ground water, water course or sewage system

Danger to drinking water if even small quantities leak into the ground

Also poisonous for fish and plankton in water bodies

Do not allow material to be released to the environment without proper governmental permits

Toxic for aquatic organisms

Results of PBT and vPvB assessment**PBT:** Not applicable**vPvB:** Not applicable**Other adverse effects** No further relevant information available**13 Disposal considerations****Waste treatment methods****Recommendation** Consult state, local or national regulations to ensure proper disposal**Uncleaned packagings:****Recommendation:** Disposal must be made according to official regulations**14 Transport information****DOT regulations:****Hazard class:**

3

Identification number:

UN1993

Packing group:

III

Proper shipping name (technical name): FLAMMABLE LIQUID, N O S (n-Propylbenzene)**Label**

3

Land transport ADR/RID (cross-border)**ADR/RID class:**

3 F1) Flammable liquids

Danger code (Kemler):

30

UN-Number:

1993

Packaging group:

III

Special marking:

Symbol (fish and tree)

UN proper shipping name:

1993 FLAMMABLE LIQUID, N O S (n-Propylbenzene)

Maritime transport IMDG:**IMDG Class:**

3

(Contd. on page 6)

USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 06/03/2011

Reviewed on 01/30/2007

Product name: n-Propylbenzene

(Contd. of page 5)

UN Number:	1993
Label	3
Packaging group:	III
Marine pollutant:	No
Proper shipping name:	FLAMMABLE LIQUID, N O S (n-Propylbenzene)

Air transport ICAO-TI and IATA-DGR:

ICAO/IATA Class:	3
UN/ID Number:	1993
Label	3
Packaging group:	III
Proper shipping name:	FLAMMABLE LIQUID, N O S (n-Propylbenzene)

UN 'Model Regulation': UN1993, FLAMMABLE LIQUID, N O S , 3, III**Environmental hazards:** Environmentally hazardous substance, liquid; Marine Pollutant**Special precautions for user** Warning: Flammable liquids**Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code** Not applicable**15 Regulatory information****Safety, health and environmental regulations/legislation specific for the substance or mixture****Product related hazard informations:****Hazard symbols:**

Xn Harmful

N Dangerous for the environment

Risk phrases:

10 Flammable

37 Irritating to respiratory system

51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

65 Harmful, may cause lung damage if swallowed

Safety phrases:

24 Avoid contact with skin

37 Wear suitable gloves

61 Avoid release to the environment Refer to special instructions/Safety data sheets

62 If swallowed, do not induce vomiting, seek medical advice immediately and show this container or label

National regulations

All components of this product are listed in the U S Environmental Protection Agency Toxic Substances Control Act Chemical substance Inventory

All components of this product are listed on the Canadian Domestic Substances List (DSL)

Information about limitation of use: For use only by technically qualified individuals**Chemical safety assessment:** A Chemical Safety Assessment has not been carried out**16 Other information**

Employers should use this information only as a supplement to other information gathered by them, and should make independent judgement of suitability of this information to ensure proper use and protect the health and safety of employees. This information is furnished without warranty, and any use of the product not in conformance with this Material Safety Data Sheet, or in combination with any other product or process, is the responsibility of the user.

Department issuing MSDS: Health, Safety and Environmental Department**Contact:**

Zachariah C Holt

Global EHS Manager

Abbreviations and acronyms:

ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)

RID: Règlement international concernant le transport des marchandises dangereuses par chemin de fer (Regulations Concerning the International Transport of Dangerous Goods by Rail)

IMDG: International Maritime Code for Dangerous Goods

DOT: US Department of Transportation

IATA: International Air Transport Association

IATA-DGR: Dangerous Goods Regulations by the 'International Air Transport Association' (IATA)

(Contd. on page 7)

USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 06/03/2011

Reviewed on 01/30/2007

Product name: n-Propylbenzene

(Contd. of page 6)

ICAO: International Civil Aviation Organization
ICAO-TI: Technical Instructions by the 'International Civil Aviation Organization' (ICAO)
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
HMIS: Hazardous Materials Identification System (USA)
WHMIS: Workplace Hazardous Materials Information System (Canada)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent

USA

SAFETY DATA SHEET

Version 3.7
Revision Date 04/02/2014
Print Date 04/30/2014

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : sec-Butylbenzene

Product Number : 19620

Brand : Fluka

REACH No. : A registration number is not available for this substance as the substance or its uses are exempted from registration, the annual tonnage does not require a registration or the registration is envisaged for a later registration deadline.

CAS-No. : 135-98-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 3), H226
Skin irritation (Category 2), H315
Acute aquatic toxicity (Category 2), H401
Chronic aquatic toxicity (Category 2), H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Warning

Hazard statement(s)

H226

Flammable liquid and vapour.

H315

Causes skin irritation.

H411

Toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P210

Keep away from heat/sparks/open flames/hot surfaces. - No smoking.

P233

Keep container tightly closed.

P240

Ground/bond container and receiving equipment.

P241

Use explosion-proof electrical/ ventilating/ lighting/ equipment.

P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P264	Wash skin thoroughly after handling.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P321	Specific treatment (see supplemental first aid instructions on this label).
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P391	Collect spillage.
P403 + P235	Store in a well-ventilated place. Keep cool.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms	: 2-Phenylbutane
Formula	: C ₁₀ H ₁₄
Molecular Weight	: 134.22 g/mol
CAS-No.	: 135-98-8
EC-No.	: 205-227-0

Hazardous components

Component	Classification	Concentration
sec-Butylbenzene		
	Flam. Liq. 3; Skin Irrit. 2; Aquatic Acute 2; Aquatic Chronic 2; H226, H315, H411	-

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

no data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray; solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

5.2 Special hazards arising from the substance or mixture

Carbon oxides

5.3 Advice for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

5.4 Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: 480 min

Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: 480 min

Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

impervious clothing, Flame retardant antistatic protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

- | | |
|--|--|
| a) Appearance | Form: liquid, clear
Colour: colourless |
| b) Odour | no data available |
| c) Odour Threshold | no data available |
| d) pH | no data available |
| e) Melting point/freezing point | Melting point/range: -75.5 °C (-103.9 °F) - lit. |
| f) Initial boiling point and boiling range | 173 - 174 °C (343 - 345 °F) - lit. |
| g) Flash point | 52.0 °C (125.6 °F) - closed cup |
| h) Evaporation rate | no data available |
| i) Flammability (solid, gas) | no data available |
| j) Upper/lower | Lower explosion limit: 0.8 %(V) |

flammability or
explosive limits

- | | | |
|----|--|-----------------------------|
| k) | Vapour pressure | no data available |
| l) | Vapour density | no data available |
| m) | Relative density | 0.863 g/mL at 25 °C (77 °F) |
| n) | Water solubility | no data available |
| o) | Partition coefficient: n-octanol/water | no data available |
| p) | Auto-ignition temperature | 418.0 °C (784.4 °F) |
| q) | Decomposition temperature | no data available |
| r) | Viscosity | no data available |
| s) | Explosive properties | no data available |
| t) | Oxidizing properties | no data available |

9.2 Other safety information

no data available

10. STABILITY AND REACTIVITY

10.1 Reactivity

no data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

no data available

10.4 Conditions to avoid

Heat, flames and sparks.

10.5 Incompatible materials

Strong oxidizing agents

10.6 Hazardous decomposition products

Other decomposition products - no data available

In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

Inhalation: no data available

LD50 Dermal - rabbit - > 13,792 mg/kg

no data available

Skin corrosion/irritation

Skin - rabbit

Result: irritating - 24 h

Serious eye damage/eye irritation

Eyes - rabbit

Result: Mild eye irritation - 24 h

Respiratory or skin sensitisation

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

no data available

Specific target organ toxicity - single exposure

no data available

Specific target organ toxicity - repeated exposure

no data available

Aspiration hazard

no data available

Additional Information

RTECS: CY9100000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION**12.1 Toxicity**

no data available

12.2 Persistence and degradability

no data available

12.3 Bioaccumulative potential

no data available

12.4 Mobility in soil

no data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

Toxic to aquatic life.

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

13. DISPOSAL CONSIDERATIONS**13.1 Waste treatment methods****Product**

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 2709 Class: 3 Packing group: III
Proper shipping name: Butyl benzenes
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG

UN number: 2709 Class: 3 Packing group: III EMS-No: F-E, S-D
Proper shipping name: BUTYLBENZENES
Marine pollutant: No

IATA

UN number: 2709 Class: 3 Packing group: III
Proper shipping name: Butylbenzenes

15. REGULATORY INFORMATION

REACH No. : A registration number is not available for this substance as the substance or its uses are exempted from registration, the annual tonnage does not require a registration or the registration is envisaged for a later registration deadline.

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Fire Hazard, Acute Health Hazard

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
sec-Butylbenzene	135-98-8	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
sec-Butylbenzene	135-98-8	1993-04-24

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Flam. Liq.	Flammable liquids
H226	Flammable liquid and vapour.
H315	Causes skin irritation.
H401	Toxic to aquatic life.
H411	Toxic to aquatic life with long lasting effects.
Skin Irrit.	Skin irritation

HMIS Rating

Health hazard: 2
Chronic Health Hazard:

Flammability: 2
Physical Hazard 0

NFPA Rating

Health hazard: 2
Fire Hazard: 2
Reactivity Hazard: 0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 3.7

Revision Date: 04/02/2014

Print Date: 04/30/2014

Material Safety Data Sheet

Version 4.2

Revision Date 12/13/2012

Print Date 06/07/2013

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Tetrachloroethylene

Product Number : 371696

Brand : Sigma-Aldrich

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555

Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Carcinogen, Corrosive

Target Organs

Heart, Central nervous system, Liver, Kidney

GHS Classification

Acute toxicity, Oral (Category 5)

Eye irritation (Category 2B)

Carcinogenicity (Category 2)

Acute aquatic toxicity (Category 2)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Warning

Hazard statement(s)

H303

May be harmful if swallowed.

H320

Causes eye irritation.

H351

Suspected of causing cancer.

H401

Toxic to aquatic life.

Precautionary statement(s)

P281

Use personal protective equipment as required.

P305 + P351 + P338

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

HMIS Classification

Health hazard:

1

Chronic Health Hazard:

*

Flammability:

0

Physical hazards: 0
NFPA Rating
Health hazard: 1
Fire: 0
Reactivity Hazard: 0

Potential Health Effects

Inhalation May be harmful if inhaled. May cause respiratory tract irritation.
Skin May be harmful if absorbed through skin. May cause skin irritation.
Eyes May cause eye irritation.
Ingestion May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms : Perchloroethylene
PCE

Formula : C₂Cl₄
Molecular Weight : 165.83 g/mol

Component		Concentration
Tetrachloroethylene		
CAS-No.	127-18-4	-
EC-No.	204-825-9	
Index-No.	602-028-00-4	

4. FIRST AID MEASURES

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability

Not flammable or combustible.

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Use personal protective equipment. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up

Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE**Precautions for safe handling**

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION**Components with workplace control parameters**

Components	CAS-No.	Value	Control parameters	Basis
Tetrachloroethylene	127-18-4	TWA	25 ppm	USA. ACGIH Threshold Limit Values (TLV)
Remarks	Central Nervous System impairment Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed animal carcinogen with unknown relevance to humans			
		STEL	100 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Central Nervous System impairment Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed animal carcinogen with unknown relevance to humans			
		TWA	25 ppm 170 mg/m ³	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	100 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z2
		CEIL	200 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z2
		Peak	300 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z2
	Potential Occupational Carcinogen Minimize workplace exposure concentrations. See Appendix A			

Personal protective equipment**Respiratory protection**

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: 480 min

Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash protection

Material: Nitrile rubber
Minimum layer thickness: 0.2 mm
Break through time: 49 min
Material tested: Dermatril® P (KCL 743 / Aldrich Z677388, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an Industrial Hygienist familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Eye protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	liquid, clear
Colour	colourless

Safety data

pH	no data available
Melting point/freezing point	Melting point/range: -22 °C (-8 °F) - lit.
Boiling point	121 °C (250 °F) - lit.
Flash point	no data available
Ignition temperature	no data available
Auto-ignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	25.3 hPa (19.0 mmHg) at 25.0 °C (77.0 °F) 17.3 hPa (13.0 mmHg) at 20.0 °C (68.0 °F)
Density	1.623 g/cm ³ at 25 °C (77 °F)
Water solubility	no data available
Partition coefficient: n-octanol/water	log Pow: 3.40
Relative vapor density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

no data available

Conditions to avoid

no data available

Materials to avoid

Strong oxidizing agents, Strong bases

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas

Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION**Acute toxicity****Oral LD50**

LD50 Oral - rat - 2,629 mg/kg

Inhalation LC50

LC50 Inhalation - rat - 8 h - 34,200 mg/m³

Dermal LD50

LD50 Dermal - rabbit - 5,000 mg/kg

Other information on acute toxicity

no data available

Skin corrosion/irritation

Skin - rabbit - Severe skin irritation - 24 h

Serious eye damage/eye irritation

Eyes - rabbit - Mild eye irritation - 24 h

Respiratory or skin sensitization

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

Limited evidence of carcinogenicity in animal studies

IARC: 2A - Group 2A: Probably carcinogenic to humans (Tetrachloroethylene)

NTP: Reasonably anticipated to be a human carcinogen (Tetrachloroethylene)

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)

no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

no data available

Aspiration hazard

no data available

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure

narcosis, Liver injury may occur., Kidney injury may occur.

Synergistic effects

no data available

Additional Information

RTECS: KX3850000

12. ECOLOGICAL INFORMATION**Toxicity**

Toxicity to fish	LC50 - Cyprinodon variegatus (sheepshead minnow) - 9.8 mg/l - 96.0 h
	LC50 - Lepomis macrochirus (Bluegill) - 13 mg/l - 96.0 h
	LC50 - Oncorhynchus mykiss (rainbow trout) - 4.9 mg/l - 96.0 h
	NOEC - Oryzias latipes - 17 mg/l - 10.0 d
	NOEC - Cyprinodon variegatus (sheepshead minnow) - 29 mg/l - 96.0 h

no data available

Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 7.50 mg/l - 48 h
---	--

Persistence and degradability**Bioaccumulative potential**

Bioaccumulation	Lepomis macrochirus (Bluegill) - 21 d
	Bioconcentration factor (BCF): 49

Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS**Product**

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 1897 Class: 6.1 Packing group: III
Proper shipping name: Tetrachloroethylene
Reportable Quantity (RQ): 100 lbs
Marine Pollutant: No
Poison Inhalation Hazard: No

IMDG

UN number: 1897 Class: 6.1 Packing group: III EMS-No: F-A, S-A
Proper shipping name: TETRACHLOROETHYLENE
Marine Pollutant: Marine pollutant

IATA

UN number: 1897 Class: 6.1 Packing group: III
Proper shipping name: Tetrachloroethylene

15. REGULATORY INFORMATION

OSHA Hazards

Carcinogen, Corrosive

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Tetrachloroethylene	127-18-4	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Tetrachloroethylene	127-18-4	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Tetrachloroethylene	127-18-4	2007-07-01

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer. Tetrachloroethylene	127-18-4	2007-09-28

16. OTHER INFORMATION

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 05/30/2012

Reviewed on 05/29/2012

1 Identification of the substance/mixture and of the company/undertaking**Product identifier****Product name:** Toluene**Stock number:** L10967**CAS Number:**

108-88-3

EC number:

203-625-9

Index number:

601-021-00-3

Relevant identified uses of the substance or mixture and uses advised against.**Sector of Use** SU24 Scientific research and development**Details of the supplier of the safety data sheet****Manufacturer/Supplier:**

Alfa Aesar, A Johnson Matthey Company

Johnson Matthey Catalog Company, Inc

30 Bond Street

Ward Hill, MA 01835-8099

Tel: 800-343-6660

Fax: 800-322-4757

Email: tech@alfa.com

www.alfa.com

Information Department: Health, Safety and Environmental Department**Emergency telephone number:**

During normal hours the Health, Safety and Environmental Department at (800) 343-6660 After normal hours call Carechem 24 at (866) 928-6789

2 Hazards identification**Classification of the substance or mixture**

GHS02 Flame

H225 Highly flammable liquid and vapour



GHS08 Health hazard

H361 Suspected of damaging fertility or the unborn child

H373 May cause damage to organs through prolonged or repeated exposure

H304 May be fatal if swallowed and enters airways



GHS07

H315 Causes skin irritation

H336 May cause drowsiness or dizziness

Classification according to Directive 67/548/EEC or Directive 1999/45/EC

Xn; Harmful

R48/20-63-65. Harmful: danger of serious damage to health by prolonged exposure through inhalation Possible risk of harm to the unborn child Harmful: may cause lung damage if swallowed



Xi; Irritant

R38. Irritating to skin



F; Highly flammable

R11. Highly flammable

R67. Vapours may cause drowsiness and dizziness

Repr Cat 3

Information concerning particular hazards for human and environment:

Causes a narcotic effect

(Contd on page 2)

USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 05/30/2012

Reviewed on 05/29/2012

Product name: Toluene

(Contd. of page 1)

Label elements**Labelling according to EU guidelines:**

The product has been classified and marked in accordance with directives on hazardous materials

Code letter and hazard designation of product:

Xn Harmful

F Highly flammable

Risk phrases:

11 Highly flammable

38 Irritating to skin

48/20 Harmful: danger of serious damage to health by prolonged exposure through inhalation

63 Possible risk of harm to the unborn child

65 Harmful: may cause lung damage if swallowed

67 Vapours may cause drowsiness and dizziness

Safety phrases:

36/37 Wear suitable protective clothing and gloves

46 If swallowed, seek medical advice immediately and show this container or label

62 If swallowed, do not induce vomiting. seek medical advice immediately and show this container or label

Hazard description:**WHMIS classification**

B2 - Flammable liquid

D2A - Very toxic material causing other toxic effects

**Classification system****HMIS ratings (scale 0-4)**

(Hazardous Materials Identification System)

HEALTH	2
FIRE	3
REACTIVITY	1

Health (acute effects) = 2

Flammability = 3

Reactivity = 1

Other hazards**Results of PBT and vPvB assessment**

PBT: Not applicable

vPvB: Not applicable

3 Composition/information on ingredients**Chemical characterization: Substances****CAS# Description:**

108-88-3 Toluene

Identification number(s):

EC number: 203-625-9

Index number: 601-621-00-3

4 First aid measures**Description of first aid measures****General information**

Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident

After inhalation

In case of unconsciousness place patient stably in side position for transportation

Supply fresh air If required, provide artificial respiration Keep patient warm

Seek immediate medical advice

After skin contact

If skin irritation continues, consult a doctor

Immediately wash with water and soap and rinse thoroughly

Seek immediate medical advice

After eye contact

Rinse opened eye for several minutes under running water Then consult a doctor

After swallowing

Drink lots of water

(Contd. on page 3)

USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 05/30/2012

Reviewed on 05/29/2012

Product name: Toluene

(Contd. of page 2)

Administer medicinal carbon
 Administer a solution of sodium carbonate
 Do not give milk or fatty oils
 Do not initiate vomiting
Information for doctor
Most important symptoms and effects, both acute and delayed
 No further relevant information available
Danger If swallowed or in case of vomiting, danger of entering the lungs
Indication of any immediate medical attention and special treatment needed
 No further relevant information available

5 Firefighting measures

Extinguishing media
Suitable extinguishing agents CO₂, sand, extinguishing powder Do not use water
For safety reasons unsuitable extinguishing agents Water
Special hazards arising from the substance or mixture
 If this product is involved in a fire, the following can be released:
 Carbon monoxide and carbon dioxide
Advice for firefighters
Protective equipment:
 Wear self-contained respirator
 Wear fully protective impervious suit
Additional information Cool endangered receptacles with water spray

6 Accidental release measures

Personal precautions, protective equipment and emergency procedures
 Wear protective equipment Keep unprotected persons away
 Ensure adequate ventilation
 Keep away from ignition sources
Environmental precautions:
 Do not allow to enter sewers/ surface or ground water
 Do not allow to penetrate the ground/soil
 Prevent seepage into sewage system, workpits and cellars
Methods and material for containment and cleaning up:
 Absorb with liquid-binding material sand, diatomite, acid binders, universal binders, sawdust)
 Dispose contaminated material as waste according to item 13
 Ensure adequate ventilation
 Keep away from ignition sources
Reference to other sections
 See Section 7 for information on safe handling
 See Section 8 for information on personal protection equipment
 See Section 13 for disposal information

7 Handling and storage

Handling
Precautions for safe handling
 Ensure good interior ventilation, especially at floor level (Fumes are heavier than air)
 Use solvent-proof equipment
 Keep container tightly sealed
 Store in cool, dry place in tightly closed containers
 Ensure good ventilation at the workplace
Information about protection against explosions and fires:
 Use explosion-proof apparatus / fittings and spark-proof tools
 Danger of explosion if fluid enters the sewage system
 Protect against electrostatic charges
 Fumes can combine with air to form an explosive mixture
Conditions for safe storage, including any incompatibilities
Storage
Requirements to be met by storerooms and receptacles:
 Provide solvent resistant, sealed floor
 Store in a cool location
Information about storage in one common storage facility: Store away from oxidizing agents
Further information about storage conditions:
 Store receptacle in a well ventilated area
 Keep container tightly sealed
 Store in cool, dry conditions in well sealed containers

(Contd. on page 4)

USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 05/30/2012

Reviewed on 05/29/2012

Product name: Toluene

(Contd. of page 3)

Specific end use(s) No further relevant information available

8 Exposure controls/personal protection**Additional information about design of technical systems:**

Properly operating chemical fume hood designed for hazardous chemicals and having an average face velocity of at least 100 feet per minute

Control parameters**Components with limit values that require monitoring at the workplace:****108-88-3 Toluene (100.0%)**

PEL ()	Short-term value: C 300; 500* ppm Long-term value: 200 ppm *10-min peak per 8-hr shift
REL ()	Short-term value: 560 mg/m ³ ; 150 ppm Long-term value: 375 mg/m ³ ; 100 ppm
TLV ()	75 mg/m ³ ; 20 ppm BEI

Additional information: No data

Exposure controls**Personal protective equipment****General protective and hygienic measures**

The usual precautionary measures for handling chemicals should be followed

Keep away from foodstuffs, beverages and feed

Remove all soiled and contaminated clothing immediately

Wash hands before breaks and at the end of work

Avoid contact with the skin

Avoid contact with the eyes and skin

Maintain an ergonomically appropriate working environment

Breathing equipment: Use suitable respirator when high concentrations are present

Protection of hands:

Impervious gloves

Check protective gloves prior to each use for their proper condition

The selection of suitable gloves not only depends on the material, but also on quality

Quality will vary from manufacturer to manufacturer

Eye protection: Safety glasses

Body protection: Protective work clothing

9 Physical and chemical properties**Information on basic physical and chemical properties****General Information****Appearance:**

Form:	Liquid
Color:	Colorless
Odor:	Aromatic
Odor threshold:	Not determined

pH-value: Not determined

Change in condition

Melting point/Melting range:	-93°C (-135 °F)
Boiling point/Boiling range:	111°C (232 °F)
Sublimation temperature / start:	Not determined

Flash point: 4°C (39 °F)

Flammability (solid, gaseous) Not applicable

Ignition temperature: 535°C (995 °F)

Decomposition temperature: Not determined

Auto igniting: Not determined

Explosion limits:

Lower:	1.2 Vol %
Upper:	7 Vol %

Vapor pressure at 20°C (68 °F): 29 hPa (22 mm Hg)

Density at 20°C (68 °F): 0.867 g/cm³ (7.235 lbs/gal)

Relative density Not determined

Vapor density Not determined

(Contd. on page 5)

USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 05/30/2012

Reviewed on 05/29/2012

Product name: Toluene

(Contd. of page 4)

Evaporation rate	Not determined
Solubility in / Miscibility with	
Water at 15°C (59 °F):	65 g/l
Alcohols:	Partly miscible
Ketones:	Partly miscible
Chlorinated hydrocarbons:	Partly miscible
Segregation coefficient (n-octanol/water):	Not determined
Viscosity:	
dynamic at 20°C (68 °F):	0.6 mPas
kinematic:	Not determined
Other information	No further relevant information available
Additional information	Fumes are heavier than air

10 Stability and reactivity**Reactivity****Chemical stability****Thermal decomposition / conditions to be avoided:**

Decomposition will not occur if used and stored according to specifications

Possibility of hazardous reactions

Forms explosive gas mixture with air

Reacts with oxidizing agents

Reacts with strong acids

Hazardous decomposition products:

Irritant gases/vapors

Carbon monoxide and carbon dioxide

11 Toxicological information**Information on toxicological effects****Acute toxicity:****LD/LC50 values that are relevant for classification:**

Oral	LD50	636 mg/kg (rat)
		14100 µL/kg (rabbit)
Inhalative	LC50	10000 mg/m3 (mouse)
	LC50/4H	49000 mg/m3/4H (rat)

Primary irritant effect:

on the skin: Irritating effect

on the eye: Irritating effect

Sensitization: No sensitizing effects known**Subacute to chronic toxicity:**

May cause drowsiness or dizziness

May be fatal if swallowed and enters airways

Additional toxicological information:

To the best of our knowledge the acute and chronic toxicity of this substance is not fully known

EPA-I. Data are inadequate for an assessment of human carcinogenic potential

IARC-3. Not classifiable as to carcinogenicity to humans

Possible risk of harm to the unborn child

ACGIH A4. Not classifiable as a human carcinogen. Inadequate data on which to classify the agent in terms of its carcinogenicity in humans and/or animals

The Registry of Toxic Effects of Chemical Substances (RTECS) contains acute and/or other multiple dose toxicity data for components in this product

The Registry of Toxic Effects of Chemical Substances (RTECS) contains reproductive and/or mutation data for components in this product

12 Ecological information**Toxicity****Aquatic toxicity:** No further relevant information available**Persistence and degradability** No further relevant information available**Behavior in environmental systems:****Bioaccumulative potential** No further relevant information available**Mobility in soil** No further relevant information available**Additional ecological information:****General notes:**

Do not allow product to reach ground water, water course or sewage system

(Contd. on page 6)

USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 05/30/2012

Reviewed on 05/29/2012

Product name: Toluene

(Contd. of page 5)

Danger to drinking water if even small quantities leak into the ground

Do not allow material to be released to the environment without proper governmental permits

Results of PBT and vPvB assessment

PBT: Not applicable

vPvB: Not applicable

Other adverse effects No further relevant information available**13 Disposal considerations****Waste treatment methods****Recommendation** Consult state, local or national regulations to ensure proper disposal**Uncleaned packagings:****Recommendation:** Disposal must be made according to official regulations**14 Transport information****UN-Number**

DOT, ADR, IMDG, IATA

UN1294

UN proper shipping name

DOT, IMDG, IATA

TOLUENE

ADR

1294 TOLUENE

Transport hazard class(es)

DOT

**Class**

3 Flammable liquids

Label

3

ADR

**Class**

3 (F1) Flammable liquids

Label

3

IMDG, IATA

**Class**

3 Flammable liquids

Label

3

Packing group

DOT, ADR, IMDG, IATA

II

Environmental hazards:**Marine pollutant:**

No

Special precautions for user

Warning. Flammable liquids

Danger code (Kemler):

33

EMS Number:

F+ E, S-D

Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code

Not applicable

UN 'Model Regulation':

UN1294, TOLUENE, 3, II

USA

(Contd. on page 7)

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 05/30/2012

Reviewed on 05/29/2012

Product name: Toluene

Contd. of page 6)

15 Regulatory information**Safety, health and environmental regulations/legislation specific for the substance or mixture****Product related hazard informations:**

The product has been classified and marked in accordance with directives on hazardous materials

Hazard symbols:

Xn Harmful

F+ Highly flammable

Risk phrases:

11 Highly flammable

38 Irritating to skin

48/20 Harmful: danger of serious damage to health by prolonged exposure through inhalation

63 Possible risk of harm to the unborn child

65 Harmful: may cause lung damage if swallowed

67 Vapours may cause drowsiness and dizziness

Safety phrases:

36/37 Wear suitable protective clothing and gloves

46 If swallowed, seek medical advice immediately and show this container or label

62 If swallowed, do not induce vomiting. seek medical advice immediately and show this container or label

National regulations

All components of this product are listed in the U S Environmental Protection Agency Toxic Substances Control Act Chemical substance Inventory

This product contains a chemical known to the state of California to cause cancer and/or reproductive toxicity

All components of this product are listed on the Canadian Domestic Substances List (DSL)

Information about limitation of use:

Employment restrictions concerning pregnant and lactating women must be observed

For use only by technically qualified individuals

This product is subject to the reporting requirements of section 313 of the Emergency Planning and Community Right to Know Act of 1986 and 40CFR372

Disturbance regulations:

Critical quantity values according to the regulations on accidents should be adhered to

Other regulations, limitations and prohibitive regulations**REACH - Pre-registered substances** Substance is listed**Substances of very high concern (SVHC) according to REACH, Article 57**

Substance is not listed

Chemical safety assessment: A Chemical Safety Assessment has not been carried out**16 Other information**

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

Employers should use this information only as a supplement to other information gathered by them, and should make independent judgement of suitability of this information to ensure proper use and protect the health and safety of employees. This information is furnished without warranty, and any use of the product not in conformance with this Material Safety Data Sheet, or in combination with any other product or process, is the responsibility of the user.

Department issuing MSDS: Health, Safety and Environmental Department**Contact:**

Zachariah C. Holt

Global EHS Manager

Reference Sources:CRC Handbook of Chemistry and Physics
CRC PressHawley's Condensed Chemical Dictionary
Van Nostrand Reinhold, New YorkNational Institute for Occupational Safety and Health
Registry of Toxic Effects of Chemical Substances
U S Government Printing Office, Washington D CRichard J. Lewis, Sr.
Sax's Dangerous Properties of Industrial Materials

Contd. on page 8)

USA

Material Safety Data Sheet

According to OSHA and ANSI

Printing date 05/30/2012

Reviewed on 05/29/2012

Product name: Toluene

(Contd. of page 7)

Van Nostrand Reinhold, New York

The Merck Index

Merck & Co , Inc , Rahway N J

L Bretherick

Handbook of Chemical Hazards

Butterworths

L Roth, U Weller

Gefährliche chemische Reaktionen

ecomed verlag, Landsberg

Abbreviations and acronyms:

ICAO: International Civil Aviation Organization

RID: Règlement international concernant le transport des marchandises dangereuses par chemin de fer (Regulations Concerning the International Transport of Dangerous Goods by Rail)

ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)

IMDG: International Maritime Code for Dangerous Goods

DOT: US Department of Transportation

IATA: International Air Transport Association

EINECS: European Inventory of Existing Commercial Chemical Substances

CAS: Chemical Abstracts Service (division of the American Chemical Society)

HMIS: Hazardous Materials Identification System (USA)

WHMIS: Workplace Hazardous Materials Information System (Canada)

LC50: Lethal concentration, 50 percent

LD50: Lethal dose, 50 percent

USA

Material Safety Data Sheet

Version 4.2

Revision Date 10/30/2012

Print Date 04/30/2014

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Trichloroethylene

Product Number : 251402

Brand : Sigma-Aldrich

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555

Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Carcinogen, Irritant, Mutagen

Target Organs

Liver, Central nervous system, Heart, Lungs

GHS Classification

Acute toxicity, Oral (Category 5)

Skin irritation (Category 2)

Eye irritation (Category 2A)

Germ cell mutagenicity (Category 2)

Carcinogenicity (Category 1B)

Specific target organ toxicity - single exposure (Category 2)

Acute aquatic toxicity (Category 3)

Chronic aquatic toxicity (Category 3)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H303

May be harmful if swallowed.

H315

Causes skin irritation.

H319

Causes serious eye irritation.

H341

Suspected of causing genetic defects.

H350

May cause cancer.

H371

May cause damage to organs.

H412

Harmful to aquatic life with long lasting effects.

Precautionary statement(s)

P201

Obtain special instructions before use.

P260 Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P273 Avoid release to the environment.
P281 Use personal protective equipment as required.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.

HMIS Classification

Health hazard: 2
Chronic Health Hazard: *
Flammability: 0
Physical hazards: 0

NFPA Rating

Health hazard: 2
Fire: 0
Reactivity Hazard: 0

Potential Health Effects

Inhalation May be harmful if inhaled. Causes respiratory tract irritation.
Skin May be harmful if absorbed through skin. Causes skin irritation.
Eyes Causes eye irritation.
Ingestion May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms : TCE
Trichloroethene

Formula : C_2HCl_3
Molecular Weight : 131.39 g/mol

Component		Concentration
Trichloroethylene		
CAS-No.	79-01-6	-
EC-No.	201-167-4	
Index-No.	602-027-00-9	

4. FIRST AID MEASURES

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability

Not flammable or combustible.

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas

6. ACCIDENTAL RELEASE MEASURES**Personal precautions**

Use personal protective equipment. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up

Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE**Precautions for safe handling**

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Light sensitive. Handle and store under inert gas.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION**Components with workplace control parameters**

Components	CAS-No.	Value	Control parameters	Basis
Trichloroethylene	79-01-6	TWA	50 ppm 270 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
Remarks	Skin notation			
		STEL	200 ppm 1,080 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
	Skin notation			
		TWA	100 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z2
	Z37.19-1967			
		CEIL	200 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z2
	Z37.19-1967			
		Peak	300 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z2
	Z37.19-1967			
		TWA	10 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Central Nervous System impairment cognitive decrement Renal toxicity Suspected human carcinogen			
		STEL	25 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Central Nervous System impairment cognitive decrement Renal toxicity Suspected human carcinogen			

Personal protective equipment

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Immersion protection

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: > 480 min

Material tested: Vitoject® (Aldrich Z677698, Size M)

Splash protection

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: > 30 min

Material tested: Vitoject® (Aldrich Z677698, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 873000, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an Industrial Hygienist familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Eye protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form liquid, clear

Colour colourless

Safety data

pH no data available

Melting point/freezing point Melting point/range: -84.8 °C (-120.6 °F) - lit.

Boiling point 86.7 °C (188.1 °F) - lit.

Flash point no data available

Ignition temperature 410 °C (770 °F)

Autoignition 410.0 °C (770.0 °F)

temperature	
Lower explosion limit	8 %(V)
Upper explosion limit	10.5 %(V)
Vapour pressure	81.3 hPa (61.0 mmHg) at 20.0 °C (68.0 °F)
Density	1.463 g/mL at 25 °C (77 °F)
Water solubility	no data available
Partition coefficient: n-octanol/water	log Pow: 2.29
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

no data available

Conditions to avoid

no data available

Materials to avoid

Oxidizing agents, Strong bases, Magnesium

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas

Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50

LD50 Oral - rat - 4,920 mg/kg

Inhalation LC50

LC50 Inhalation - mouse - 4 h - 8450 ppm

Dermal LD50

LD50 Dermal - rabbit - > 20,000 mg/kg

Other information on acute toxicity

no data available

Skin corrosion/irritation

Skin - rabbit - Severe skin irritation - 24 h

Serious eye damage/eye irritation

Eyes - rabbit - Eye irritation - 24 h

Respiratory or skin sensitization

no data available

Germ cell mutagenicity

Laboratory experiments have shown mutagenic effects.

In vitro tests showed mutagenic effects

Carcinogenicity

This product is or contains a component that has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Possible human carcinogen

IARC: 2A - Group 2A: Probably carcinogenic to humans (Trichloroethylene)

NTP: Reasonably anticipated to be a human carcinogen (Trichloroethylene)

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)

May cause damage to organs.

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

no data available

Aspiration hazard

no data available

Potential health effects

Inhalation	May be harmful if inhaled. Causes respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. Causes skin irritation.
Eyes	Causes eye irritation.

Signs and Symptoms of Exposure

burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea, Vomiting, Exposure to and/or consumption of alcohol may increase toxic effects., Gastrointestinal disturbance, Kidney injury may occur., narcosis

Synergistic effects

no data available

Additional Information

RTECS: KX4550000

12. ECOLOGICAL INFORMATION

Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 41 mg/l - 96.0 h LOEC - other fish - 11 mg/l - 10.0 d NOEC - Oryzias latipes - 40 mg/l - 10.0 d
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 18.00 mg/l - 48 h
Toxicity to algae	IC50 - Pseudokirchneriella subcapitata (green algae) - 175.00 mg/l - 96 h

Persistence and degradability

Bioaccumulative potential

Does not bioaccumulate.

Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Harmful to aquatic life with long lasting effects.

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

13. DISPOSAL CONSIDERATIONS

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 1710 Class: 6.1 Packing group: III
Proper shipping name: Trichloroethylene
Reportable Quantity (RQ): 100 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG

UN number: 1710 Class: 6.1 Packing group: III EMS-No: F-A, S-A
Proper shipping name: TRICHLOROETHYLENE
Marine pollutant: No

IATA

UN number: 1710 Class: 6.1 Packing group: III
Proper shipping name: Trichloroethylene

15. REGULATORY INFORMATION

OSHA Hazards

Carcinogen, Irritant, Mutagen

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Trichloroethylene	79-01-6	2007-07-01

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Trichloroethylene	79-01-6	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Trichloroethylene	79-01-6	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Trichloroethylene	79-01-6	2007-07-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.
Trichloroethylene

CAS-No.
79-01-6

Revision Date
2008-10-10

16. OTHER INFORMATION**Further information**

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

SAFETY DATA SHEET

Version 3.7
Revision Date 04/05/2014
Print Date 04/30/2014

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Vinyl chloride

Product Number : 387622
Brand : Aldrich
Index-No. : 602-023-00-7
REACH No. : A registration number is not available for this substance as the substance or its uses are exempted from registration, the annual tonnage does not require a registration or the registration is envisaged for a later registration deadline.

CAS-No. : 75-01-4

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable gases (Category 1), H220
Gases under pressure (Liquefied gas), H280
Carcinogenicity (Category 1A), H350

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H220 : Extremely flammable gas.
H280 : Contains gas under pressure; may explode if heated.
H350 : May cause cancer.

Precautionary statement(s)

P201 : Obtain special instructions before use.
P202 : Do not handle until all safety precautions have been read and understood.
P210 : Keep away from heat/sparks/open flames/hot surfaces. - No smoking.

P281	Use personal protective equipment as required.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P377	Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381	Eliminate all ignition sources if safe to do so.
P405	Store locked up.
P410 + P403	Protect from sunlight. Store in a well-ventilated place.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms : Chloroethylene

Formula : C₂H₃Cl

Molecular Weight : 62.50 g/mol

CAS-No. : 75-01-4

EC-No. : 200-831-0

Index-No. : 602-023-00-7

Hazardous components

Component	Classification	Concentration
Vinyl chloride		
	Flam. Gas 1; Press. Gas ; Carc. 1A; H220, H280, H350	-

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

no data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Carbon oxides, Hydrogen chloride gas

5.3 Advice for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

5.4 Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Clean up promptly by sweeping or vacuum.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid inhalation of vapour or mist.

Use explosion-proof equipment. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.

Contents under pressure. Light sensitive.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Vinyl chloride	75-01-4	TWA	1 ppm	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	1 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Liver damage Lung cancer Confirmed human carcinogen		
		STEL	5 ppm	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	1 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		STEL	5 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		See 1910.1017		
		Potential Occupational Carcinogen See Appendix A		
Hydroquinone	123-31-9	TWA	1 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Eye irritation Eye damage		

		Confirmed animal carcinogen with unknown relevance to humans Sensitizer		
		TWA	2 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	2 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		C	2 mg/m3	USA. NIOSH Recommended Exposure Limits
		15 minute ceiling value		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Hydroquinone	123-31-9	Methemoglobin	1.5 %	In blood	ACGIH - Biological Exposure Indices (BEI)
	Remarks	During or end of shift			

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Splash contact

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: 120 min

Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance	Form: Liquefied gas
b) Odour	no data available
c) Odour Threshold	no data available
d) pH	no data available
e) Melting point/freezing point	Melting point/range: -153.8 °C (-244.8 °F) - lit.
f) Initial boiling point and boiling range	-13.4 °C (7.9 °F) - lit.
g) Flash point	-61.0 °C (-77.8 °F) - closed cup
h) Evaporation rate	no data available
i) Flammability (solid, gas)	no data available
j) Upper/lower flammability or explosive limits	Upper explosion limit: 33 %(V) Lower explosion limit: 3.6 %(V)
k) Vapour pressure	no data available
l) Vapour density	no data available
m) Relative density	0.911 g/cm ³ at 25 °C (77 °F)
n) Water solubility	no data available
o) Partition coefficient: n-octanol/water	no data available
p) Auto-ignition temperature	no data available
q) Decomposition temperature	no data available
r) Viscosity	no data available
s) Explosive properties	no data available
t) Oxidizing properties	no data available

9.2 Other safety information

no data available

10. STABILITY AND REACTIVITY

10.1 Reactivity

no data available

10.2 Chemical stability

Stable under recommended storage conditions.

Contains the following stabiliser(s):

Hydroquinone (≥ 0 - ≤ 0.0001 %)

Phenol (≥ 0 - ≤ 0.01 %)

10.3 Possibility of hazardous reactions

no data available

10.4 Conditions to avoid

Heat, flames and sparks. Extremes of temperature and direct sunlight.

10.5 Incompatible materials

Chemically active metals, Copper

10.6 Hazardous decomposition products

Other decomposition products - no data available

In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

no data available

LC50 Inhalation - rat - 0.3 h - 180000 ppm

Remarks: Behavioral:Tremor. Behavioral:Convulsions or effect on seizure threshold. Respiratory disorder

Dermal: no data available

no data available

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitisation

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

This is or contains a component that has been reported to be carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Human carcinogen.

IARC: 1 - Group 1: Carcinogenic to humans (Vinyl chloride)

NTP: Known to be human carcinogen (Vinyl chloride)

OSHA: OSHA specifically regulated carcinogen (Vinyl chloride)

Reproductive toxicity

no data available

Overexposure may cause reproductive disorder(s) based on tests with laboratory animals.

Specific target organ toxicity - single exposure

no data available

Specific target organ toxicity - repeated exposure

no data available

Aspiration hazard

no data available

Additional Information

RTECS: KU9625000

burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea, Vomiting, To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Central nervous system -

Stomach - Irregularities - Based on Human Evidence (Phenol)

Liver - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

no data available

12.2 Persistence and degradability

no data available

12.3 Bioaccumulative potential

no data available

12.4 Mobility in soil

no data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

no data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 1086 Class: 2.1
Proper shipping name: Vinyl chloride, stabilized
Reportable Quantity (RQ): 1 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG

UN number: 1086 Class: 2.1
Proper shipping name: VINYL CHLORIDE, STABILIZED
Marine pollutant: No

EMS-No: F-D, S-U

IATA

UN number: 1086 Class: 2.1
Proper shipping name: Vinyl chloride, stabilized
IATA Passenger: Not permitted for transport

15. REGULATORY INFORMATION

REACH No. : A registration number is not available for this substance as the substance or its uses are exempted from registration, the annual tonnage does not require a registration or the registration is envisaged for a later registration deadline.

SARA 302 Components

The following components are subject to reporting levels established by SARA Title III, Section 302:

	CAS-No.	Revision Date
Phenol	108-95-2	2007-07-01
Hydroquinone	123-31-9	2007-07-01

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Vinyl chloride	75-01-4	2007-07-01

SARA 311/312 Hazards

Fire Hazard, Sudden Release of Pressure Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Vinyl chloride	75-01-4	2007-07-01
Phenol	108-95-2	2007-07-01
Hydroquinone	123-31-9	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Vinyl chloride	75-01-4	2007-07-01
Phenol	108-95-2	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Vinyl chloride	75-01-4	2007-07-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.

	CAS-No.	Revision Date
Vinyl chloride	75-01-4	2007-09-28

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Carc.	Carcinogenicity
Flam. Gas	Flammable gases
H220	Extremely flammable gas.
H280	Contains gas under pressure; may explode if heated.
H350	May cause cancer.
Press. Gas	Gases under pressure

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	4
Physical Hazard	3

NFPA Rating

Health hazard:	2
Fire Hazard:	4
Reactivity Hazard:	0

Further information

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Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 3.7

Revision Date: 04/05/2014

Print Date: 04/30/2014

Metals

Material Safety Data Sheet

Version 3.3

Revision Date 10/29/2012

Print Date 06/07/2013

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Barium

Product Number : 474711

Brand : Aldrich

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555

Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Water Reactive, Irritant

GHS Classification

Substances, which in contact with water, emit flammable gases (Category 2)

Skin irritation (Category 2)

Eye irritation (Category 2A)

Specific target organ toxicity - single exposure (Category 3)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H261

In contact with water releases flammable gases.

H315

Causes skin irritation.

H319

Causes serious eye irritation.

H335

May cause respiratory irritation.

Precautionary statement(s)

P231 + P232

Handle under inert gas. Protect from moisture.

P261

Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.

P305 + P351 + P338

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P422

Store contents under inert gas.

HMIS Classification

Health hazard: 2

Flammability: 3

Physical hazards: 1

NFPA Rating

Health hazard: 2
Fire: 0
Reactivity Hazard: 1
Special hazard.: W

Potential Health Effects

Inhalation May be harmful if inhaled. Causes respiratory tract irritation.
Skin May be harmful if absorbed through skin. Causes skin irritation.
Eyes Causes eye irritation.
Ingestion May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Formula : Ba
Molecular Weight : 137.33 g/mol

Component		Concentration
Barium		
CAS-No.	7440-39-3	-
EC-No.	231-149-1	

4. FIRST AID MEASURES

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Suitable extinguishing media

Dry powder Carbon dioxide (CO₂)

Extinguishing media which shall not be used for safety reasons

Water

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Barium oxide

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Use personal protective equipment. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

Methods and materials for containment and cleaning up

Sweep up and shovel. Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13). Do not flush with water. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE

Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols.

Provide appropriate exhaust ventilation at places where dust is formed. Keep away from sources of ignition - No smoking.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place.

Never allow product to get in contact with water during storage.

Store under inert gas.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value	Control parameters	Basis
Barium	7440-39-3	TWA	0.5 mg/m ³	USA. ACGIH Threshold Limit Values (TLV)
Remarks	Eye, skin, & Gastrointestinal irritation Muscular stimulation Not classifiable as a human carcinogen			

Personal protective equipment

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Eye protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

impervious clothing, Flame retardant protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form Pieces

Colour grey

Safety data

pH no data available

Melting point/freezing point Melting point/range: 725 °C (1,337 °F) - lit.

Boiling point 1,640 °C (2,984 °F) - lit.

Flash point not applicable

Ignition temperature no data available

Autoignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	no data available
Density	3.6 g/cm ³ at 25 °C (77 °F)
Water solubility	no data available
Partition coefficient: n-octanol/water	no data available
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

Reacts violently with water.

Conditions to avoid

Exposure to moisture.

Materials to avoid

Oxidizing agents, Water, acids, Oxygen, Chlorinated solvents, Carbon dioxide (CO₂), Halogens, Halogenated hydrocarbon, Alcohols, Sulphur compounds, Hydrogen sulfide gas

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Barium oxide
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD₅₀

no data available

Inhalation LC₅₀

no data available

Dermal LD₅₀

no data available

Other information on acute toxicity

no data available

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitization

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC:	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
ACGIH:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)

Inhalation - May cause respiratory irritation.

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

no data available

Aspiration hazard

no data available

Potential health effects

Inhalation	May be harmful if inhaled. Causes respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. Causes skin irritation.
Eyes	Causes eye irritation.

Signs and Symptoms of Exposure

Stomach/intestinal disorders, Nausea, Vomiting, Drowsiness, Dizziness, Gastrointestinal disturbance, Weakness, Tremors, Seizures.

Synergistic effects

no data available

Additional Information

RTECS: CQ8370000

12. ECOLOGICAL INFORMATION

Toxicity

Toxicity to fish	mortality NOEC - Cyprinodon variegatus (sheepshead minnow) - 500 mg/l - 96 h
	LC50 - Cyprinodon variegatus (sheepshead minnow) - > 500 mg/l - 96 h

Persistence and degradability

no data available

Bioaccumulative potential

no data available

Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

no data available

13. DISPOSAL CONSIDERATIONS**Product**

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION**DOT (US)**

UN number: 1400 Class: 4.3 Packing group: II
Proper shipping name: Barium
Reportable Quantity (RQ): 1000 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG

UN number: 1400 Class: 4.3 Packing group: II EMS-No: F-G, S-O
Proper shipping name: BARIUM
Marine pollutant: No

IATA

UN number: 1400 Class: 4.3 Packing group: II
Proper shipping name: Barium

15. REGULATORY INFORMATION**OSHA Hazards**

Water Reactive, Irritant

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Barium	7440-39-3	2007-07-01

SARA 311/312 Hazards

Reactivity Hazard, Acute Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Barium	7440-39-3	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Barium	7440-39-3	2007-07-01

New Jersey Right To Know Components

Barium

CAS-No.
7440-39-3

Revision Date
2007-07-01

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Further information

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Material Safety Data Sheet

Version 4.5

Revision Date 04/19/2013

Print Date 06/07/2013

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Chromium

Product Number : 374849

Brand : Aldrich

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555

Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Target Organ Effect

Target Organs

Liver, Kidney

GHS Classification

Acute aquatic toxicity (Category 1)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Warning

Hazard statement(s)

H400

Very toxic to aquatic life.

Precautionary statement(s)

P273

Avoid release to the environment.

HMIS Classification

Health hazard: 0

Chronic Health Hazard: *

Flammability: 0

Physical hazards: 0

NFPA Rating

Health hazard: 0

Fire: 0

Reactivity Hazard: 0

Potential Health Effects

Inhalation

May be harmful if inhaled. May cause respiratory tract irritation.

Skin
Eyes
Ingestion

May be harmful if absorbed through skin. May cause skin irritation.
May cause eye irritation.
May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Formula : Cr
Molecular Weight : 52.00 g/mol

Component		Concentration
Chromium		
CAS-No.	7440-47-3	-
EC-No.	231-157-5	

4. FIRST AID MEASURES

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability

Not flammable or combustible.

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Chromium oxides

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE

Precautions for safe handling

Provide appropriate exhaust ventilation at places where dust is formed.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value	Control parameters	Basis
Chromium	7440-47-3	TWA	0.5 mg/m ³	USA. NIOSH Recommended Exposure Limits
Remarks	See Appendix C			
		TWA	0.5 mg/m ³	USA. ACGIH Threshold Limit Values (TLV)
	Upper Respiratory Tract & skin irritation Not classifiable as a human carcinogen			
		TWA	1 mg/m ³	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	1 mg/m ³	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000

Personal protective equipment

Respiratory protection

Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatrill® (KCL 740 / Aldrich Z677272, Size M)

Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatrill® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Eye protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	chips
Colour	light grey

Safety data

pH	no data available
Melting point/freezing point	Melting point/range: 1,857 °C (3,375 °F) - lit.
Boiling point	2,672 °C (4,842 °F) - lit.
Flash point	not applicable
Ignition temperature	no data available
Auto-ignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	no data available
Density	7.14 g/mL at 25 °C (77 °F)
Water solubility	insoluble
Partition coefficient: n-octanol/water	no data available
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evapouration rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

no data available

Conditions to avoid

no data available

Materials to avoid

Strong acids, Strong oxidizing agents

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Chromium oxides
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50

no data available

Inhalation LC50

no data available

Dermal LD50

no data available

Other information on acute toxicity

no data available

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitisation

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

Carcinogenicity - rabbit - Implant

Tumorigenic: Equivocal tumorigenic agent by RTECS criteria. Musculoskeletal: Tumors.

Carcinogenicity - rat - Implant

Tumorigenic: Equivocal tumorigenic agent by RTECS criteria. Blood: Lymphomas including Hodgkin's disease.

Tumorigenic: Tumors at site of application.

Carcinogenicity - rat - Intravenous

Tumorigenic: Equivocal tumorigenic agent by RTECS criteria. Gastrointestinal: Tumors. Blood: Lymphomas including Hodgkin's disease.

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (Chromium)

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)

no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

no data available

Aspiration hazard

no data available

Potential health effects

Inhalation

May be harmful if inhaled. May cause respiratory tract irritation.

Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Synergistic effects

no data available

Additional Information

RTECS: GB4200000

12. ECOLOGICAL INFORMATION

Toxicity

Toxicity to fish	mortality NOEC - Pimephales promelas (fathead minnow) - 12 mg/l - 7 d mortality LOEC - Pimephales promelas (fathead minnow) - 2.4 mg/l - 7 d LC50 - Cyprinus carpio (Carp) - 14.3 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 0.07 mg/l - 48 h

Persistence and degradability

no data available

Bioaccumulative potential

Bioaccumulation	Oncorhynchus mykiss (rainbow trout) - 30 d Bioconcentration factor (BCF): 1.03 - 1.22
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Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Very toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

Product

Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3077	Class: 9	Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Chromium)		
Reportable Quantity (RQ): 5000 lbs		
Marine pollutant:		
Poison Inhalation Hazard: No		

IMDG

UN number: 3077	Class: 9	Packing group: III	EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Chromium)			
Marine pollutant: No			

IATA

UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Chromium)

Further information

EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

OSHA Hazards

Target Organ Effect

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Chromium	7440-47-3	2007-07-01

SARA 311/312 Hazards

Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Chromium	7440-47-3	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Chromium	7440-47-3	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Chromium	7440-47-3	2007-07-01

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Material Safety Data Sheet

Version 4.3

Revision Date 05/17/2012

Print Date 06/07/2013

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Copper

Product Number : 31284

Brand : Aldrich

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555

Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

No known OSHA hazards

Not a dangerous substance or mixture according to the Globally Harmonised System (GHS).

HMIS Classification

Health hazard: 0

Flammability: 0

Physical hazards: 0

NFPA Rating

Health hazard: 0

Fire: 0

Reactivity Hazard: 0

Potential Health Effects

Inhalation May be harmful if inhaled. May cause respiratory tract irritation.

Skin May be harmful if absorbed through skin. May cause skin irritation.

Eyes May cause eye irritation.

Ingestion May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Formula : Cu

Molecular Weight : 63.55 g/mol

Component		Concentration
Copper		
CAS-No.	7440-50-8	-
EC-No.	231-159-6	

4. FIRST AID MEASURES

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration.

In case of skin contact

Wash off with soap and plenty of water.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water.

5. FIREFIGHTING MEASURES**Conditions of flammability**

Not flammable or combustible.

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Nature of decomposition products not known.

6. ACCIDENTAL RELEASE MEASURES**Personal precautions**

Avoid dust formation. Avoid breathing vapors, mist or gas.

Environmental precautions

No special environmental precautions required.

Methods and materials for containment and cleaning up

Sweep up and shovel. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE**Precautions for safe handling**

Provide appropriate exhaust ventilation at places where dust is formed.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place.

Store under inert gas. Air sensitive.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION**Components with workplace control parameters**

Components	CAS-No.	Value	Control parameters	Basis
Copper	7440-50-8	TWA	1 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
Remarks	Irritation Gastrointestinal metal fume fever			
		TWA	1 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	1 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	1 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	0.2 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Irritation Gastrointestinal metal fume fever			

		TWA	0.1 mg/m ³	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.1 mg/m ³	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000

Personal protective equipment

Respiratory protection

Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Immersion protection

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: > 480 min

Material tested: Dermatril® (Aldrich Z677272, Size M)

Splash protection

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: > 30 min

Material tested: Dermatril® (Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 873000, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an Industrial Hygienist familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Eye protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

General industrial hygiene practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	Wire
Colour	light red

Safety data

pH	no data available
Melting point/freezing point	Melting point/range: 1,083.4 °C (1,982.1 °F)
Boiling point	2,567 °C (4,653 °F)
Flash point	no data available
Ignition temperature	no data available

Autoignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	no data available
Density	no data available
Water solubility	no data available
Partition coefficient: n-octanol/water	no data available
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

no data available

Conditions to avoid

no data available

Materials to avoid

Strong acids, Strong oxidizing agents, Acid chlorides, Halogens

Hazardous decomposition products

Other decomposition products - no data available

Hazardous decomposition products formed under fire conditions. - Nature of decomposition products not known.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50

no data available

Inhalation LC50

no data available

Dermal LD50

no data available

Other information on acute toxicity

no data available

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitization

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)

no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

no data available

Aspiration hazard

no data available

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure

Symptoms of systemic copper poisoning may include: capillary damage, headache, cold sweat, weak pulse, and kidney and liver damage, central nervous system excitation followed by depression, jaundice, convulsions, paralysis, and coma. Death may occur from shock or renal failure. Chronic copper poisoning is typified by hepatic cirrhosis, brain damage and demyelination, kidney defects, and copper deposition in the cornea as exemplified by humans with Wilson's disease. It has also been reported that copper poisoning has lead to hemolytic anemia and accelerates arteriosclerosis.

Synergistic effects

no data available

Additional Information

RTECS: GL5325000

12. ECOLOGICAL INFORMATION

Toxicity

no data available

Persistence and degradability

no data available

Bioaccumulative potential

no data available

Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

no data available

13. DISPOSAL CONSIDERATIONS

Product

Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

Not dangerous goods

IMDG

Not dangerous goods

IATA

Not dangerous goods

15. REGULATORY INFORMATION

OSHA Hazards

No known OSHA hazards

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Copper	7440-50-8	2007-07-01

SARA 311/312 Hazards

No SARA Hazards

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Copper	7440-50-8	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Copper	7440-50-8	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Copper	7440-50-8	2007-07-01

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Further information

Copyright 2012 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Material Safety Data Sheet

Version 4.3

Revision Date 10/29/2012

Print Date 06/07/2013

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Lead

Product Number : 391352

Brand : Aldrich

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555

Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Carcinogen, Target Organ Effect, Harmful by ingestion., Teratogen

Target Organs

Nerves., Blood, Kidney, Female reproductive system., Male reproductive system.

GHS Classification

Acute toxicity, Oral (Category 4)

Carcinogenicity (Category 2)

Reproductive toxicity (Category 2)

Specific target organ toxicity - repeated exposure (Category 2)

Acute aquatic toxicity (Category 1)

Chronic aquatic toxicity (Category 1)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Warning

Hazard statement(s)

H302

Harmful if swallowed.

H351

Suspected of causing cancer.

H361

Suspected of damaging fertility or the unborn child.

H373

May cause damage to organs through prolonged or repeated exposure.

H410

Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P273

Avoid release to the environment.

P281

Use personal protective equipment as required.

P501

Dispose of contents/ container to an approved waste disposal plant.

HMIS Classification

Health hazard: 1
Chronic Health Hazard: *
Flammability: 0
Physical hazards: 0

NFPA Rating

Health hazard: 1
Fire: 0
Reactivity Hazard: 0

Potential Health Effects

Inhalation May be harmful if inhaled. May cause respiratory tract irritation.
Skin Harmful if absorbed through skin. May cause skin irritation.
Eyes May cause eye irritation.
Ingestion Harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Formula : Pb
Molecular Weight : 207.2 g/mol

Component		Concentration
Lead group entry Annex I		
CAS-No.	7439-92-1	-
EC-No.	231-100-4	

4. FIRST AID MEASURES

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability

Not flammable or combustible.

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Lead oxides

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Use personal protective equipment. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE**Precautions for safe handling**

Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place.

Keep in a dry place.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION**Components with workplace control parameters**

Components	CAS-No.	Value	Control parameters	Basis
Remarks	See 1910.1025			
Lead group entry Annex I	7439-92-1	TWA	0.05 mg/m ³	USA. ACGIH Threshold Limit Values (TLV)
	Confirmed animal carcinogen with unknown relevance to humans			
		TWA	0.05 mg/m ³	USA. ACGIH Threshold Limit Values (TLV)
	Central Nervous System impairment Hematologic effects Peripheral Nervous System impairment Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed animal carcinogen with unknown relevance to humans			
		TWA	0.05 mg/m ³	USA. NIOSH Recommended Exposure Limits
	See Appendix C			

Personal protective equipment**Respiratory protection**

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Immersion protection

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: > 480 min

Material tested: Dermatrill® (Aldrich Z677272, Size M)

Splash protection

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: > 30 min

Material tested: Dermatrill® (Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 873000, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an Industrial Hygienist familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Eye protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES**Appearance**

Form	powder
Colour	no data available

Safety data

pH	no data available
Melting point/freezing point	Melting point/range: 327.4 °C (621.3 °F) - lit.
Boiling point	1,740 °C (3,164 °F) - lit.
Flash point	not applicable
Ignition temperature	no data available
Autoignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	no data available
Density	no data available
Water solubility	no data available
Partition coefficient: n-octanol/water	no data available
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY**Chemical stability**

Stable under recommended storage conditions.

Possibility of hazardous reactions

no data available

Conditions to avoid

no data available

Materials to avoid

Strong acids

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Lead oxides

Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION**Acute toxicity****Oral LD50**

no data available

Inhalation LC50

no data available

Dermal LD50

no data available

Other information on acute toxicity

no data available

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitization

no data available

Germ cell mutagenicity

Genotoxicity in vivo - rat - Inhalation

Cytogenetic analysis

Carcinogenicity

Limited evidence of carcinogenicity in animal studies

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Lead group entry Annex I)

NTP: Reasonably anticipated to be a human carcinogen (Lead group entry Annex I)

Reasonably anticipated to be a human carcinogenThe reference note has been added by TD based on the background information of the NTP. (Lead group entry Annex I)

OSHA: 1910.1025 (Lead group entry Annex I)

Reproductive toxicity

Reproductive toxicity - rat - Inhalation

Effects on Newborn: Biochemical and metabolic.

Reproductive toxicity - rat - Oral

Effects on Newborn: Behavioral.

Reproductive toxicity - mouse - Oral

Effects on Fertility: Female fertility index (e.g., # females pregnant per # sperm positive females; # females pregnant per # females mated). Effects on Fertility: Pre-implantation mortality (e.g., reduction in number of implants per female; total number of implants per corpora lutea).

Teratogenicity

Developmental Toxicity - rat - Inhalation

Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Specific Developmental Abnormalities: Blood and lymphatic system (including spleen and marrow).

Developmental Toxicity - rat - Oral

Specific Developmental Abnormalities: Blood and lymphatic system (including spleen and marrow). Effects on Newborn: Growth statistics (e.g., reduced weight gain).

Developmental Toxicity - rat - Oral

Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Embryo or Fetus: Fetal death.

Developmental Toxicity - mouse - Oral

Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Embryo or Fetus: Fetal death.

Suspected human reproductive toxicant

Specific target organ toxicity - single exposure (Globally Harmonized System)

no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

May cause damage to organs through prolonged or repeated exposure.

Aspiration hazard

no data available

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	Harmful if swallowed.
Skin	Harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure

anemia

Synergistic effects

no data available

Additional Information

RTECS: OF7525000

12. ECOLOGICAL INFORMATION

Toxicity

Toxicity to fish	mortality LOEC - Oncorhynchus mykiss (rainbow trout) - 1.19 mg/l - 96.0 h LC50 - Micropterus dolomieu - 2.2 mg/l - 96.0 h mortality NOEC - Salvelinus fontinalis - 1.7 mg/l - 10.0 d
Toxicity to daphnia and other aquatic invertebrates	mortality LOEC - Daphnia - 0.17 mg/l - 24 h mortality NOEC - Daphnia - 0.099 mg/l - 24 h
Toxicity to algae	mortality EC50 - Skeletonema costatum - 7.94 mg/l - 10 d

Persistence and degradability

no data available

Bioaccumulative potential

Bioaccumulation	Oncorhynchus kisutch - 2 Weeks Bioconcentration factor (BCF): 12
-----------------	---

Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION**DOT (US)**

UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Lead group entry Annex I)
Reportable Quantity (RQ): 10 lbs
Marine pollutant:
Poison Inhalation Hazard: No

IMDG

UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Lead group entry Annex I)
Marine pollutant: No

IATA

UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Lead group entry Annex I)

Further information

EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION**OSHA Hazards**

Carcinogen, Target Organ Effect, Harmful by ingestion., Teratogen

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Lead group entry Annex I	7439-92-1	1994-04-01

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Lead group entry Annex I	7439-92-1	1994-04-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Lead group entry Annex I	7439-92-1	1994-04-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Lead group entry Annex I	7439-92-1	1994-04-01

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer. Lead group entry Annex I	7439-92-1	1989-07-10

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.
Lead group entry Annex I

CAS-No.
7439-92-1

Revision Date
1989-07-10

16. OTHER INFORMATION**Further information**

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Material Safety Data Sheet

Version 3.7

Revision Date 02/01/2013

Print Date 06/07/2013

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Mercury

Product Number : 83359

Brand : Fluka

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555

Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Target Organ Effect, Toxic by inhalation., Teratogen

Target Organs

Kidney

GHS Classification

Acute toxicity, Inhalation (Category 2)

Reproductive toxicity (Category 1B)

Specific target organ toxicity - repeated exposure (Category 1)

Acute aquatic toxicity (Category 1)

Chronic aquatic toxicity (Category 1)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H330

Fatal if inhaled.

H360

May damage fertility or the unborn child.

H372

Causes damage to organs through prolonged or repeated exposure.

H410

Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P201

Obtain special instructions before use.

P260

Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.

P273

Avoid release to the environment.

P284

Wear respiratory protection.

P310

Immediately call a POISON CENTER or doctor/ physician.

P501

Dispose of contents/ container to an approved waste disposal plant.

HMIS Classification

Health hazard: 2
Chronic Health Hazard: *
Flammability: 0
Physical hazards: 0

NFPA Rating

Health hazard: 2
Fire: 0
Reactivity Hazard: 0

Potential Health Effects

Inhalation May be fatal if inhaled. May cause respiratory tract irritation.
Skin May be harmful if absorbed through skin. May cause skin irritation.
Eyes May cause eye irritation.
Ingestion May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Formula : Hg
Molecular Weight : 200.59 g/mol

Component		Concentration
Mercury		
CAS-No.	7439-97-6	-
EC-No.	231-106-7	
Index-No.	080-001-00-0	

4. FIRST AID MEASURES**General advice**

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES**Suitable extinguishing media**

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Mercury/mercury oxides.

6. ACCIDENTAL RELEASE MEASURES**Personal precautions**

Wear respiratory protection. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up

Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE**Precautions for safe handling**

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Normal measures for preventive fire protection.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Store under inert gas.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION**Components with workplace control parameters**

Components	CAS-No.	Value	Control parameters	Basis
Mercury	7439-97-6	C	0.1 mg/m ³	USA. NIOSH Recommended Exposure Limits
Remarks	Potential for dermal absorption			
		CEIL	1.0mg/10m ³	USA. Occupational Exposure Limits (OSHA) - Table Z2
		TWA	0.05 mg/m ³	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
	Skin notation			
		TWA	0.025 mg/m ³	USA. ACGIH Threshold Limit Values (TLV)
	Central Nervous System impairment Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Not classifiable as a human carcinogen Danger of cutaneous absorption			
		TWA	0.05 mg/m ³	USA. NIOSH Recommended Exposure Limits
	Potential for dermal absorption			

Personal protective equipment**Respiratory protection**

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatrill® (KCL 740 / Aldrich Z677272, Size M)

Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Eye protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	liquid
Colour	no data available

Safety data

pH	no data available
Melting point/freezing point	Melting point/range: -38.87 °C (-37.97 °F) - lit.
Boiling point	356.6 °C (673.9 °F) - lit.
Flash point	not applicable
Ignition temperature	no data available
Auto-ignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	< 0.01 hPa (< 0.01 mmHg) at 20 °C (68 °F) 1 hPa (1 mmHg) at 126 °C (259 °F)
Density	no data available
Water solubility	no data available
Partition coefficient: n-octanol/water	no data available
Relative vapour density	6.93 - (Air = 1.0)
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

no data available

Conditions to avoid

no data available

Materials to avoid

Strong oxidizing agents, Ammonia, Azides, Nitrates, Chlorates, Copper

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Mercury/mercury oxides.

Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION**Acute toxicity****Oral LD50**

no data available

Inhalation LC50

no data available

Dermal LD50

no data available

Other information on acute toxicity

no data available

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitisation

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (Mercury)

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity**Teratogenicity**

Presumed human reproductive toxicant

Specific target organ toxicity - single exposure (Globally Harmonized System)

no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard

no data available

Potential health effects

Inhalation	May be fatal if inhaled. May cause respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure

Mercury accumulates in almost all tissues, especially in the: Kidney, Effects due to ingestion may include: Nausea, Vomiting, Diarrhoea, intestinal bleeding

Synergistic effects

no data available

Additional Information

RTECS: OV4550000

12. ECOLOGICAL INFORMATION**Toxicity**

Toxicity to fish LC50 - Labeo rohita - 0.018 mg/l - 96.0 h

Persistence and degradability

no data available

Bioaccumulative potential

Bioaccumulation Carassius auratus (goldfish) - 1,789 d
Bioconcentration factor (BCF): 155,986

Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS**Product**

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION**DOT (US)**

UN number: 2809 Class: 8 Packing group: III
Proper shipping name: A,W Mercury
Reportable Quantity (RQ): 1 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG

UN number: 2809 Class: 8 Packing group: III EMS-No: F-A, S-B
Proper shipping name: MERCURY
Marine pollutant: No

IATA

UN number: 2809 Class: 8 (6.1)

Packing group: III

Proper shipping name: Mercury

15. REGULATORY INFORMATION**OSHA Hazards**

Target Organ Effect, Toxic by inhalation., Teratogen

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

Mercury

CAS-No.
7439-97-6Revision Date
2007-07-01**Pennsylvania Right To Know Components**

Mercury

CAS-No.
7439-97-6Revision Date
2007-07-01**New Jersey Right To Know Components**

Mercury

CAS-No.
7439-97-6Revision Date
2007-07-01**California Prop. 65 Components**

WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

CAS-No.
7439-97-6Revision Date
2007-09-28

Mercury

16. OTHER INFORMATION**Further information**

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Material Safety Data Sheet

Version 5.4

Revision Date 09/27/2012

Print Date 06/07/2013

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Raney®-Nickel

Product Number : 221678

Brand : Aldrich

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555

Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Unstable Reactive, Carcinogen, Target Organ Effect, Skin sensitiser

Target Organs

Lungs

GHS Classification

Pyrophoric liquids (Category 1)

Skin sensitization (Category 1)

Carcinogenicity (Category 2)

Specific target organ toxicity - repeated exposure (Category 1)

Acute aquatic toxicity (Category 3)

Chronic aquatic toxicity (Category 3)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H250 Catches fire spontaneously if exposed to air.

H317 May cause an allergic skin reaction.

H351 Suspected of causing cancer.

H372 Causes damage to organs through prolonged or repeated exposure.

H412 Harmful to aquatic life with long lasting effects.

Precautionary statement(s)

P222 Do not allow contact with air.

P231 Handle under inert gas.

P273 Avoid release to the environment.

P280 Wear protective gloves.

P314 Get medical advice/ attention if you feel unwell.

P422 Store contents under inert gas.

HMIS Classification

Health hazard: 2
Chronic Health Hazard: *
Flammability: 0
Physical hazards: 2

NFPA Rating

Health hazard: 2
Fire: 0
Reactivity Hazard: 2

Potential Health Effects

Inhalation May be harmful if inhaled. May cause respiratory tract irritation.
Skin May be harmful if absorbed through skin. May cause skin irritation.
Eyes May cause eye irritation.
Ingestion May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms : Nickel sponge

Component		Classification	Concentration
Nickel			
CAS-No.	7440-02-0	Skin Sens. 1; Carc. 2; STOT RE 1; Aquatic Chronic 3; H317, H351, H372, H412	90 - 100 %
EC-No.	231-111-4		
Index-No.	028-002-00-7		
Aluminium			
CAS-No.	7429-90-5	Pyr. Sol. 1; Water-react. 2; Aquatic Acute 1; H250, H261, H400	1 - 5 %
EC-No.	231-072-3		
Index-No.	013-001-00-6		

For the full text of the H-Statements and R-Phrases mentioned in this Section, see Section 16

4. FIRST AID MEASURES

General advice

Move out of dangerous area. Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability

Not flammable or combustible.

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Nickel/nickel oxides, Aluminum oxide

Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES**Personal precautions**

Use personal protective equipment. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

7. HANDLING AND STORAGE**Precautions for safe handling**

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Keep away from sources of ignition - No smoking.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Keep wetted with water. Protect from frost, heat and sunlight.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION**Components with workplace control parameters**

Components	CAS-No.	Value	Control parameters	Basis
Nickel	7440-02-0	TWA	1.5 mg/m ³	USA. ACGIH Threshold Limit Values (TLV)
Remarks	Dermatitis Pneumoconiosis Not suspected as a human carcinogen			
		TWA	1 mg/m ³	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	1 mg/m ³	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	0.015 mg/m ³	USA. NIOSH Recommended Exposure Limits
	Potential Occupational Carcinogen See Appendix A			
Aluminium	7429-90-5	TWA	1 mg/m ³	USA. ACGIH Threshold Limit Values (TLV)
Remarks	Lower Respiratory Tract irritation Pneumoconiosis Neurotoxicity Not classifiable as a human carcinogen			
		TWA	15 mg/m ³	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	5 mg/m ³	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	15 mg/m ³	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	5 mg/m ³	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000

		TWA	5 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	10 mg/m3	USA. NIOSH Recommended Exposure Limits

Personal protective equipment

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands. Protective gloves against thermal risks

Eye protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	Slurry Slurry
Colour	grey

Safety data

pH	9 - 11 at 20 °C (68 °F)
Melting point/freezing point	no data available
Boiling point	no data available
Flash point	no data available
Ignition temperature	no data available
Autoignition temperature	87 °C (189 °F) - Catches fire spontaneously if exposed to air.
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	no data available
Density	no data available
Water solubility	insoluble
Partition coefficient: n-octanol/water	no data available
Relative vapour density	no data available

Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

Dry active Raney Catalyst is pyrophoric. If allowed to dry in air, it may smolder to red heat and provide a combustion source for exposed combustible materials.

Conditions to avoid

may begin to self-heat and spontaneously ignite at temperatures above: 40°C Do not allow evaporation to dryness.

Materials to avoid

acids, Oxidizing agents, Sulphur compounds, Hydrogen gas, Oxygen, Methanol, organic solvents, Aluminium, Fluorine, Ammonia

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Nickel/nickel oxides, Aluminum oxide
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50

no data available

Inhalation LC50

no data available

Dermal LD50

no data available

Other information on acute toxicity

no data available

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

Eyes: no data available

Respiratory or skin sensitization

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

IARC: 1 - Group 1: Carcinogenic to humans (Aluminium)

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Nickel)

NTP: Reasonably anticipated to be a human carcinogen (Nickel)

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)

no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

no data available

Aspiration hazard

no data available

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure

sensitising effects, Inhalation may provoke the following symptoms:, irritant effects, Cough, sneezing, Lachrymation

Synergistic effects

no data available

Additional Information

RTECS: Not available

12. ECOLOGICAL INFORMATION

Toxicity

no data available

Persistence and degradability

no data available

Bioaccumulative potential

no data available

Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Harmful to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 1378 Class: 4.2 Packing group: II
Proper shipping name: Metal catalyst, wetted (Nickel, Aluminium)
Reportable Quantity (RQ): 100 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG

UN number: 1378 Class: 4.2 Packing group: II EMS-No: F-H, S-M
Proper shipping name: METAL CATALYST, WETTED (Nickel, Aluminium)
Marine pollutant: No

IATA

UN number: 1378 Class: 4.2 Packing group: II
Proper shipping name: Metal catalyst, wetted (Nickel, Aluminium)
IATA Passenger: Not permitted for transport

15. REGULATORY INFORMATION**OSHA Hazards**

Unstable Reactive, Carcinogen, Target Organ Effect, Skin sensitiser

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Nickel	7440-02-0	2007-07-01
Aluminium	7429-90-5	1994-04-01

SARA 311/312 Hazards

Reactivity Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Nickel	7440-02-0	2007-07-01
Aluminium	7429-90-5	1994-04-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Nickel	7440-02-0	2007-07-01
Water	7732-18-5	
Aluminium	7429-90-5	1994-04-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Nickel	7440-02-0	2007-07-01
Water	7732-18-5	
Aluminium	7429-90-5	1994-04-01

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer.	7440-02-0	2007-09-28
Nickel		

16. OTHER INFORMATION**Text of H-code(s) and R-phrase(s) mentioned in Section 3**

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity

H250	Catches fire spontaneously if exposed to air.
H261	In contact with water releases flammable gases.
H317	May cause an allergic skin reaction.
H351	Suspected of causing cancer.
H372	Causes damage to organs through prolonged or repeated exposure.
H400	Very toxic to aquatic life.
H412	Harmful to aquatic life with long lasting effects.
Pyr. Sol.	Pyrophoric solids
Skin Sens.	Skin sensitization
STOT RE	Specific target organ toxicity - repeated exposure
Water-react.	Substances, which in contact with water, emit flammable gases

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Material Safety Data Sheet

Version 5.1

Revision Date 05/05/2013

Print Date 06/07/2013

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Zinc

Product Number : 96454

Brand : Fluka

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555

Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Water Reactive

GHS Classification

Self-heating substances (Category 1)

Substances, which in contact with water, emit flammable gases (Category 2)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H251

Self-heating: may catch fire.

H261

In contact with water releases flammable gases.

Precautionary statement(s)

P231 + P232

Handle under inert gas. Protect from moisture.

P235 + P410

Keep cool. Protect from sunlight.

P422

Store contents under inert gas.

HMIS Classification

Health hazard: 0

Flammability: 3

Physical hazards: 1

NFPA Rating

Health hazard: 0

Fire: 0

Reactivity Hazard: 1

Special hazard.: W

Potential Health Effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.
Ingestion	May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Formula : Zn
Molecular Weight : 65.39 g/mol

No ingredients are hazardous according to OSHA criteria.

4. FIRST AID MEASURES

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability

May burn in presence of air, or emit a flammable gas in the presence of water or water vapour. Keep away from heat/sparks/open flame/hot surface/air/water. No smoking.

Suitable extinguishing media

Dry powder

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Zinc/zinc oxides

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

Methods and materials for containment and cleaning up

Sweep up and shovel. Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13). Do not flush with water. Keep in suitable, closed containers for disposal. Contain spillage, pick up with an electrically protected vacuum cleaner or by wet-brushing and transfer to a container for disposal according to local regulations (see section 13).

7. HANDLING AND STORAGE

Precautions for safe handling

Provide appropriate exhaust ventilation at places where dust is formed. Keep away from sources of ignition - No smoking.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place.
Never allow product to get in contact with water during storage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Contains no substances with occupational exposure limit values.

Personal protective equipment

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatrill® (KCL 740 / Aldrich Z677272, Size M)

Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatrill® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Eye protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Flame retardant protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form solid

Colour grey

Safety data

pH no data available

Melting point/freezing point Melting point/range: 420 °C (788 °F) - lit.

Boiling point 907 °C (1,665 °F) - lit.

Flash point no data available

Ignition temperature no data available

Auto-ignition temperature The substance or mixture is classified as self heating with the category 1.

Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	no data available
Density	7.133 g/mL at 25 °C (77 °F)
Water solubility	no data available
Partition coefficient: n-octanol/water	no data available
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

Reacts violently with water.

Conditions to avoid

Exposure to moisture.

Materials to avoid

Acids, Strong bases, chlorides, Fluorine, Nitrates, Carbon disulfide

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Zinc/zinc oxides

Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50

no data available

Inhalation LC50

no data available

Dermal LD50

no data available

Other information on acute toxicity

no data available

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitisation

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as

probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)

no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

no data available

Aspiration hazard

no data available

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Synergistic effects

no data available

Additional Information

RTECS: ZG8600000

12. ECOLOGICAL INFORMATION

Toxicity

no data available

Persistence and degradability

no data available

Bioaccumulative potential

no data available

Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

no data available

13. DISPOSAL CONSIDERATIONS

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION**DOT (US)**

UN number: 1436 Class: 4.3 (4.2) Packing group: II
Proper shipping name: Zinc powder
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG

UN number: 1436 Class: 4.3 (4.2) Packing group: II EMS-No: F-G, S-O
Proper shipping name: ZINC POWDER
Marine pollutant: No

IATA

UN number: 1436 Class: 4.3 (4.2) Packing group: II
Proper shipping name: Zinc powder

15. REGULATORY INFORMATION**OSHA Hazards**

Water Reactive

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Reactivity Hazard

Massachusetts Right To Know Components

Zinc

CAS-No.	Revision Date
7440-66-6	1993-04-24

Pennsylvania Right To Know Components

Zinc

CAS-No.	Revision Date
7440-66-6	1993-04-24

New Jersey Right To Know Components

Zinc

CAS-No.	Revision Date
7440-66-6	1993-04-24

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION**Further information**

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

APPENDIX C

Field Instrument Calibration Information

LEGGETTE, BRASHEARS & GRAHAM, INC.
AIR MONITORING EQUIPMENT OPERATION

Instrument Calibration

All applicable instruments will be calibrated daily before use. Readings will be recorded on the Air Monitoring form.

Background Readings

Before any field activities commence, the background levels of the site must be read and noted. Daily background readings must be conducted away from areas of potential contamination to obtain accurate results.

Air Monitoring Frequency

All site readings must be noted on the Air Monitoring form along with the date, time, background level, weather conditions, wind direction and speed, and the location where the background level was recorded.

OVM 580B Calibration

- Turn the OVM on by pressing the ON/OFF switch.
- With the OVM running, press the MODE/STORE switch and then press the -/CRSR switch when the OVM reads if "logging is desired".
- Keep pressing the -/CRSR switch until OVM will display "reset to calibrate".
- Enter the calibration mode by pressing the RESET switch. The OVM will then display "restore backup + = Yes".
- Press the -/INC switch and the OVM will display "zero gas reset when ready".
- Connect zero gas to OVM and press RESET switch. The OVM will display "Model 580B zeroing".
- After the OVM calibrates the zero gas, it will display "span gas reset when ready".
- Connect span gas to OVM and press RESET switch.
- When OVM displays "reset to calibrate", the OVM has calibrated the span gas.
- To exit calibration mode, press MODE/STORE switch.

HNU PI-101 Calibration

- Battery check--The function switch should be turned to BATT. The needle should be in the green region; if not, recharge the battery.
- Zero set--The function switch should be turned to STANDBY. In this position, the lamp is

- OFF and no signal is generated. The zero point should be set with the ZERO set control.
- Gas standard--The standard should be connected to the probe. The function switch should be turned to the range position of the standard and the meter reading should be noted. The SPAN control setting should be adjusted, as required, to read the parts per million (ppm) concentration of the standard. The zero setting should be rechecked.
 - Lamp cleaning--If the span setting from calibration is 0.0 or calibration cannot be achieved, then the lamp must be cleaned.
 - Lamp replacement--If the lamp output is too low or if the lamp has failed, it must be replaced.

MSA Explosimeter Model 2A Calibration Instructions

Before the calibration can be checked, the instrument and its aspirator sampling bulb must be in operating condition, as described in the instrument instruction manual.

- The flow control should be attached to the calibration gas tank.
- The hose should be connected to the flow control and to the instrument inlet fitting.
- The control valve should be opened.
- The meter reading should be recorded after it stabilizes. Note: It is not necessary for the aspirator bulb to be operated for the calibration sample to be obtained. If the instrument does not read within the acceptable range, the detector filament unit should be replaced and the calibration check procedure should be repeated.
- The flow control valve should be closed.
- The hose should be removed from the flow control and from the inlet fitting on the instrument.
- The flow control should be removed from the calibration gas tank.

Thermo Anderson MIE Personal Data RAM Dust Meter Calibration and Operation:

- Turn unit on by pressing the ON/OFF button
- Press 'Enter' to 'Start zero', unit will enter the zeroing mode and LCD will display 'Calibration:OK' when complete
- Press 'Next' to enter measure mode, unit will display 'Start Run', press 'Enter'
- Unit will display instantaneous dust concentration (SA) and time weighted average (TWA) in milligrams per cubic meter (mg/m³)

dmd

May 2, 2014

F:\reports\furman\exclusive realty bcp\2014\sriwp\appendix a - health and safety plan\appendix c - report.2014-05-02.rawp.rpt general hspappc.docx

APPENDIX D

VOC Project Work Zone Considerations

LEGGETTE, BRASHEARS & GRAHAM, INC.
VOLATILE ORGANIC COMPOUNDS
PROJECT WORK ZONE CONSIDERATIONS

1.0 EXCAVATION

The following requirements, which apply to all types of excavation operations, except tunnels and shafts, are taken from the U.S. Department of the Interior, Bureau of Reclamation's Construction Safety Standards. They are not intended to be an exhaustive set of requirements, but rather, a summary of current practices that are being enforced at construction activities by Federal and state government agencies and private industry. The requirements were assembled in cooperation with the Associated General Contractors of America, the American National Standards Institute, labor unions, and other interested in improving safety.

1.1 Preliminary Inspection

Prior to excavation, the site shall be thoroughly inspected to determine conditions that require special safety measures. The location of underground utilities, such as sewer, telephone, gas, water, and electric lines, must be determined and plainly staked. Necessary arrangements must be made with the utility company or owner for the protection, removal, or relocation of the underground utilities. In such circumstances, excavation will be done in a manner that does not endanger the employees engaged in the work or the underground utility. Utilities left in place shall be protected by barricading, shoring, suspension, or other measures, as necessary.

1.2 Protection of the Public

Necessary barricades, walkways, lighting, and posting shall be provided for the protection of the public prior to the start of excavation. Excavation operations on or near state, county, or city streets, accessways, or other locations where there is extensive interface with the public and/or motorized equipment will not start until all of the following actions have been taken:

- The contractor has contacted the authority having jurisdiction and obtained written permission to proceed with protective measures required.

- The contractor, using the authority's instructions and these standards, has developed an extensive and detailed standard operating plan.
- The plan has been discussed with affected employees, and applicable protective measures are in place and functioning.

1.3 Access and Lighting

Safe access will be provided for employees, including installation of walkways, stairs, ladders, etc. When operations are conducted during hours of darkness, adequate lighting will be provided at the excavation, borrow pits, and waste areas.

Where employees are required to enter excavations over 4 feet in depth, stairs, ladders, or ramps must be provided, so as to require no more than 25 feet of lateral travel. When access to excavations exceeds 20 feet vertically, ramps, stairs, or personnel hoists shall be provided. Ladders extending from the bottom of the trench to at least 3 feet above the top must be placed within 25 feet of workers in the trench.

1.4 Personal Protective Equipment

PPE will be provided and used in accordance with the specific requirements set forth in the plan. Drillers and helpers must wear approved safety goggles or safety glasses with side shields, hearing protection, hard hats, and safety shoes.

1.5 Removal of Trees and Brush

Prior to excavation, trees, brush, boulders, and other surface obstacles that present a hazard to employees shall be removed.

1.6 Slide Prevention and Trenching Requirements

All trench excavations over 5 feet in depth must be shored, shielded, or sloped to the angle of repose from the bottom of the trench, but never less than 3/4 horizontal to 1 vertical (i.e., 37 degrees from vertical), or supported by structures designed by a professional engineer. Excavations shall be inspected following rainstorms or other hazardous events. Additional protection against possible slides or cave-ins shall be provided, as necessary. Several

excavations onsite are anticipated to be advanced to approximately 18-22 feet below grade (ft bg). All such excavations exceeding 5 feet in depth will be shored or benched accordingly.

1.7 Angle of Repose

The determination of the angle of repose and design of supporting systems shall be based on a thorough evaluation of all pertinent factors, including depth of cut; possible variation in water content of the material; anticipated changes in the material from exposure to air, sun, water, or freezing; loading imposed by structures, equipment, or overlying or stored material; and vibrations from sources such as traffic, equipment, and blasting. The angle of repose for all excavations, including trenching, should be determined by a professional engineer, but in no event should the slope be less than 3/4 horizontal to 1 vertical (i.e., 37 degrees from vertical) from the bottom of the excavation.

1.8 Support Systems

Materials used for support systems, such as sheeting, piling, cribbing, bracing, shoring, and underpinning, shall be in good serviceable condition, and timbers shall be sound and free of large or loose knots. The design of support systems shall be based on calculations of the forces and their directions, with consideration for surcharges, the angle of internal friction of materials, and other pertinent characteristics of the material to be retained.

When tight sheeting or sheet piling is used; full loading due to the ground-water table shall be assumed unless relieved by weep holes, drains, or other means. Cross braces and trench jacks shall be placed in true horizontal position and secured to prevent sliding, falling, or kickouts. Additional stingers, ties, and bracing shall be provided to allow for any necessary temporary removal of individual supports. Support systems should be planned and designed by a professional engineer competent in the field.

Backfilling and removal of trench support systems shall progress together from the bottom of the trench. Jacks or braces shall be released slowly. In unstable soil, ropes or other safe means will be used to remove the braces from the surface after workers have left the trench.

Special precaution must be taken in sloping or shoring the sides of excavations adjacent to a previously backfilled excavation or fill area. The use of compacted backfill as backforms on slopes that are steeper than the angle of repose of the compacted material in its natural state is prohibited.

1.9 Structural Foundations and Footings

Except in hard rock, excavations below the level of the base of any foundation, footing, or retaining wall will not be permitted unless the wall is underpinned and all necessary precautions are taken to ensure the stability of adjacent walls. If the excavation endangers the stability of adjacent buildings or structures, shoring, bracing, or underpinning designed by a qualified person will be installed. Such supporting systems must be inspected at least daily by qualified persons to ensure that protection is adequate and effectively maintained.

Small diameter footings that workers are required to enter, including bell-bottomed footings over 4 feet deep, must be provided with a steel casing or support system of sufficient strength to support the earth walls and prevent cave-ins. The casing or support system shall be provided for the full depth, except for the bell portion of bell footings.

Fixed or portable ladders must be provided for access. A lifeline, securely attached to a shoulder harness, shall be worn by every employee entering the footing. The lifeline shall be manned from above and shall be separate from any line used to raise or lower materials.

1.10 Vertical Cuts and Slopes

Before a slope or vertical cut is undercut, the residual material must be adequately supported and the undercutting method and support system must be inspected.

When exposed to falling, rolling, or sliding rocks, earth, or other materials, employees working below or on slopes or cuts shall be protected in the following manner:

- By effective scaling performed prior to exposure and at intervals necessary to eliminate the danger.
- By the installation of rock bolting, wire mesh, or equivalent support if the material continues to ravel and fall after scaling.

- By the installation of protective timber or wire mesh barricades at the slope of the cut and at necessary intervals down the slope. Wherever practical, benching sufficient to retain falling material may be used in lieu of barricades.
- By ensuring that personnel do not work above one another where there is danger of falling rock or earth. Personnel performing work on vertical cuts or slopes where balance depends on a supporting system must wear appropriate safety equipment.

1.11 Groundwater

Groundwater is expected to be encountered at approximately 12-13 ft bg. A Dewatering Plan will be required to address the groundwater issue with respect to excavations and/or trenching, considering the deepest excavations are anticipated to be advanced to approximately 18-22 ft bg.

1.12 Surface Water

The accumulation of surface water in excavations must not be permitted and shall be controlled by diversion ditches, dikes, dewatering sumps, or other effective means.

1.13 Trench Excavation

In the event that trenching activities are necessary onsite, any materials excavated will be put into a 'bobcat' or similar front loader bucket and then transferred and stored in a roll-off container prior to offsite disposal.

1.14 Protective Devices

Guardrails, fences, barricades, and warning lights or other illumination systems will be maintained from sunset to sunrise on excavations adjacent to walkways, driveways, and other pedestrian or vehicle thoroughfares. Walkways or bridges that are protected by standard guardrails shall be provided where employees are required or permitted to cross over excavations when necessary.

Wells, calyx holes, pits, shafts, and all similar hazardous excavations must be effectively barricaded or covered and posted. All temporary excavations of this type should be backfilled as soon as possible. When mobile equipment is permitted adjacent to excavations with steep slopes or cuts, substantial stoplogs or barricades shall be installed.

1.15 Equipment Operation

Equipment that is operated on loading or waste areas must be equipped with an automatic backup alarm. Additionally, when employees are on foot or otherwise endangered by equipment in dumping or waste areas, a competent signalman shall be used to direct traffic. The signalman must have no other assignment that interferes with signaling duties. If the equipment or truck cab is not shielded, the operator shall stand clear of the vehicle during loading. Excavating or hoisting equipment shall not be allowed to raise, lower, or swing loads over workers unless effective overhead protection is provided.

1.16 Excavation Operations

When drilling in rock or other dust-producing material, the dust shall be controlled within the OSHA Permissible Exposure Limits (PELs). Except in shaft and tunnel excavation, dust control devices are not required on jackhammers as long as the operators wear approved dust respirators.

2.0 EXCAVATION SAFETY

2.1 Basic Requirements

Employees will not proceed with work on, or in the proximity of, hazardous equipment until they have been properly trained and have received a safety briefing.

Potential hazards (e.g., overhead or underground power, oil, or gas lines in the immediate vicinity of the drilling location) must be removed, avoided by relocating the drill site, or adequately barricaded to eliminate the hazard.

The use of unsafe or defective equipment is not permitted. Equipment must be inspected regularly and, if found to be defective, must be immediately removed from use and either repaired or replaced.

Employees will be familiar with the location of first-aid kits and fire extinguishers. Telephone numbers for emergency assistance must be prominently posted and kept current.

2.2 General Requirements at Excavation Operations

2.2.1 Housekeeping

Good housekeeping conditions shall be observed in and around the work area. Suitable storage places shall be provided for all materials and supplies.

Work surfaces, platforms, stairways, walkways, scaffolding, and accessways will be kept free of obstructions. All debris will be collected and stored in piles or containers for removal and disposal.

2.2.2 Flammable Liquids

All highly flammable liquids used in conjunction with onsite activities will be stored and handled only in approved containers. Portable containers must be the approved red safety containers equipped with flame arresters and self-closing lids. When equipment needs to be filled with gasoline/diesel, the equipment will be placed on two layers of 6-mil fire retardant polysheeting, bermed on all four sides to prevent migration of any spilled fuels, and filled.

Approved hand pumps will be used to dispense gasoline from barrels. Gasoline will not be used for degreasing or to start fires. Also, gasoline containers shall be clearly labeled, and storage areas shall be posted with "No Smoking" signs. Fire extinguishers shall be readily available in all areas that contain flammable liquids.

2.2.3 Public Safety

Work areas will be regulated so that the public will be protected from injury or accident. Adequate danger signs, barriers, etc., will be placed to effectively warn the public of hazards as well as to restrict access to dangerous areas.

2.3 Excavation Equipment

2.3.1 Hand Digging Equipment

In the event any hand digging/excavating is necessary, the equipment used will consist of: shovels, pry bars, a concrete/asphalt chop saw, a 'bobcat' or similar front loader bucket machine and if necessary an electric jackhammer. All shovels, pry-bars and miscellaneous manual digging tools will be constructed of non-conductive materials.

2.3.2 Overhead and Underground Utilities

Special precaution must be taken when using a drill rig or excavating on a site within the vicinity of electrical power lines and other utilities. Electricity can shock, burn, and cause death.

Overhead and underground utilities shall be located, noted, and emphasized on all boring location plans and assignment sheets. As overhead electric lines are not present at the Site, this is not presumed to be an issue. Should overhead utilities be installed in the future, appropriate precautions will be taken when needed.

A check shall be made for sagging power lines before a site is entered. Power lines shall not be lifted to gain entrance. The appropriate utility company shall be contacted and a request shall be made that it lift or raise and cut off power to the lines.

When drilling, the area around the drill rig shall be inspected before the drill rig mast (derrick) is raised at a site in the vicinity of power lines. The minimum distance from any point on the drill rig to the nearest power line shall be determined when the mast is raised or is being raised. The mast shall not be raised and the drill rig should not be operated if this distance is less than 20 feet, because hoist lines and overhead power lines can be moved toward each other by the wind.

The existence of underground utilities, such as electric power, gas, petroleum, telephone, sewer, and water lines, shall always be suspected. These underground electric lines are as dangerous as overhead lines, so a utility locating service shall always be contacted.

There are generally two types of utility locating services. One is a "free" service that is paid for by companies with underground pipes, lines, etc., to protect the public and to prevent costly repairs. However, these services have access only to drawings for primary pipes or

lines, typically on public property or right-of-way easements, but not to drawings showing supply or feeder lines from a primary system to the interior of a property. Therefore, they are not required, and in fact hesitate, to locate interior lines. Sites can be cleared for drilling by such services, but without the drill operator's knowledge of the locations of underground feeder or supply lines.

A second type of locating service is provided by a paid subcontractor who physically sweeps or clears interior locations using locating equipment. Locating costs can be minimized by obtaining all available maps, drawings, and employee interview information before contracting with the locating company. This is especially important at large industrial plants or military bases, which can have an intricate network of underground utilities. It is important that every location be cleared, even those for hand-auger borings.

If a sign warning of underground utilities is located on a site boundary, it shall not be assumed that underground utilities are located on or near the boundary or property line under the sign; they may be a considerable distance from the sign. The utility company shall be contacted to check it out.

The owners of utility lines or the nearest underground utility location service shall always be contacted before drilling or excavation work is started. However, remember that some services provide information on utilities going to, but not within, a site. Metal detectors or other locating equipment may be necessary to determine the presence of shallow (surface) utilities onsite. The utility personnel shall mark or flag the location of the underground lines and determine what specific precautions must be taken to ensure safety.

2.3.3 Site Selection and Working Platforms

In preparing a work site located on adverse topography, precautions must be taken against cave-ins, slides, and loose boulders. Drill platforms shall be stabilized by outriggers or adequate timbering.

Prior to drilling, adequate site clearing and leveling shall be performed to accommodate the drill rig and supplies and to provide a safe working area. Drilling shall not commence when tree limbs, unstable ground, or site obstructions result in unsafe tool-handling conditions.

Suitable storage locations shall be provided that allow for the convenient handling of tools, materials, and supplies without danger that they could fall and injure anyone. Storing or transporting tools, materials, or supplies within or on the drilling mast (derrick) should be avoided. Pipes, drill rods, bits, casings, augers, and similar drilling tools shall be securely stacked in an orderly manner on racks or sills.

Penetration hammers or other types of driving hammers shall be placed at a safe location on the ground or secured when unattended on a platform. Work areas, platforms, walkways, scaffolding, and other accessways shall be kept free of obstructions and substances such as ice, grease, or oil that could create a hazardous surface. All controls, control linkages, and warning and operation lights and lenses also shall be kept free of ice, grease, or oil.

In the vicinity of power transmission or distribution lines, drills shall be adequately grounded and set with at least a 15-foot clearance between any part of the drill or mast and the power lines.

3.0 REMEDIATION SYSTEM EQUIPMENT

LBG operates remediation system equipment at various sites. Remediation equipment includes but is not limited to pump and treat, soil vapor extraction, two-phase vapor extraction, liquid and vapor phase granular activated carbon, thermal destruction and air stripping tower systems. This brief list of safety requirements cover hazards specific to this type of operation.

The components of typical remediation system equipment can include an electric or gasoline powered motor, a carbon absorption bed, and various filters, piping, and controls. The remediation system anticipated at the Exclusive Realty Services, LLC site located at 21-03 44th Avenue, Long Island City, NY is sub-slab depressurization system (SSDS) to achieve soil vapor extraction (SVE) and subsequent treatment and discharge.

Activities associated with the remediation system installation, operation and maintenance include: interior trenching activities, installation of a network of sub-slab extraction pipes, installation of a vacuum extraction and vapor treatment system, connection of the remedial equipment and implementation and operation and maintenance of the remedial system. Activities to be performed following the installation of the system include routine measuring of soil vapor quality from onsite and sampling of influent and effluent soil vapor samples. The

safety requirements which cover hazards specific to these type of activities are listed below. The list assumes that the safety requirements for standard onsite procedures inherent work performed at the facility are already being followed, such as 29 CFR 1910.120 "Hazwoper" planning, training, and other requirements; or drilling, trenching, and shoring safety practices.

3.1 Basic Requirements

3.1.1 General

Employees will not proceed with work on, or in the proximity of, the remediation equipment until they have been properly trained and have attended a safety briefing covering the hazards involved. This may in the form of a "tailgate" safety briefing or a more extensive session, depending upon the extent of the hazards, the employees' safety knowledge, and site-specific exposures.

The use of unsafe or defective equipment is not permitted. Equipment must be inspected regularly and, if found to be defective, immediately removed from use and repaired or replaced.

Employees shall be familiar with the location of first-aid kits and fire extinguishers. Telephone numbers or radio frequencies for emergency assistance must also be prominently posted and kept current.

3.1.2 Housekeeping

Good housekeeping practices shall be observed in and around the work area. Suitable storage shall be provided for all materials and supplies.

Any work surfaces, platforms, stairways, walkways, scaffolding, or accessways shall be kept free of obstructions. Any debris shall be collected and stored in piles or containers for removal and proper disposal.

3.1.3 Flammable Liquids

All highly flammable liquids shall be stored and handled only in approved containers. Portable containers must be of the approved, red safety container type, equipped with flame arresters and self-closing lids.

Approved hand pumps shall be used to dispense gasoline from drums. Gasoline must not be used for degreasing or starting fires. Also, gasoline containers shall be clearly labeled, and any storage areas shall be posted with "No Smoking" signs. Fire extinguishers shall be installed in all areas that contain flammable liquids.

3.1.4 Public Safety

Work areas shall be regulated so that the public will be protected from injury or accident. Adequate danger signs, barriers, etc., shall be placed to effectively warn the public of hazards as well as to restrict access to dangerous areas.

3.2 Specific Requirements

3.2.1 Chemical Hazards

Some of the primary chemical hazards at remediation operations are site contaminants related to volatile organic compounds. Based on anticipated future remedial actions, contaminants will be drawn from extraction wells and treated with a vapor phase carbon adsorption units. Manufacturers' Material Safety Data Sheets shall be available on site for all chemical compounds used.

Personnel can be exposed to site contaminants during sampling and equipment maintenance. Because the groundwater and vapor phase treatment systems will be closed systems, chances of exposure incidents during normal operations are minimal. If chemical exposure occurs, however, it is most likely during sampling or equipment maintenance. Sampling typically includes sampling of site soils or ground water to measure the long-term effectiveness of remediation activities, or sampling process water or vapors to determine the efficiency of treatment technologies in capturing or destroying the contaminants.

A potential for exposure exists during maintenance procedures because of cleaning sediment from knockout pots and from general piping system repairs.

In order to minimize the potential hazards associated with chemical exposure, all site workers shall have a knowledge of particular site hazards and contaminants. Based upon site conditions, proper personal protective equipment shall be worn such as hard hats, chemical protective clothing, safety gloves, goggles/protective glasses, and safety shoes.

Personnel onsite not involved with the remediation activities will be educated about the system and instructed as to what access restrictions are involved with the system.

3.2.2 Physical Hazards

Physical hazards can be managed by general housekeeping in work areas and routine equipment maintenance. Scaffolding may be erected around vapor effluent stack and will be inspected periodically, as part of a routine maintenance procedure.

3.2.3 Pressure

The remediation system recovering groundwater and free-phase product (and subsequent vapor phase stream) from beneath the ground surface and forces it through the system under pressure. As such, all remedial equipment will be shut off when maintenance activities or repairs occur.

3.2.4 Electric Hazards

Because several types of equipment in remediation systems are commonly powered by electricity, electrical hazards exist at these remedial sites. Catalytic oxidizers, liquid ring vacuum pumps, knockout pumps, air stripper holding tanks and pumps, and other elements of the treatment units are frequently powered by electricity. General housekeeping and equipment maintenance are necessary to prevent electrical safety hazards. Worn switches and wiring shall be quickly repaired, use of water shall be controlled, and unnecessary spills prevented. Ground fault interrupters (GFI) shall be used on all circuits carrying power from a nearby indoor source to outdoor equipment or from an outdoor portable generator to equipment. Equipment shall also be properly grounded as a protection against shocks, static electricity, and lightning if an electrical storm occurs.

3.2.5 Lighting

In addition to providing required or recommended illumination intensities of at least 5 foot-candles for nighttime operation, consideration shall be given to the selection and placement of lighting equipment. Proper lighting shall provide minimum glare, eliminate harsh shadows, and provide adequate illumination to perform work efficiently and safely. Light bulbs shall be of the heavy duty, outdoor, nonshattering type.

All lighting circuits, including extension cords, shall be grounded and have GFI protection. Circuits and extension cords shall be inspected periodically.

3.2.6 Catalytic Oxidizer/Treatment System

Thermal hazards exist with catalytic oxidizers, and boundaries shall be set up to prevent contact with heated surfaces. Additionally, proper thermal protection shall be available for personnel working at the catalytic oxidizer. Vapor extractor pumps shall be set to shut off automatically if the catalytic oxidizer shuts off, to prevent accumulation of high concentrations of volatile compounds that could result in an explosion hazard.

3.2.7 Carbon Bed Temperature

A hazard related to carbon absorption units is the heat of reaction, which is high for some materials, such as ketones, treated in high concentrations. Vapor Phase treatment equipment shall be designed to take this into account when carbon absorption is employed and the bed temperature must be monitored. This is considered to be a minimal concern as carbon treatment is proposed for use only as a supplemental treatment option shall the air stripper, catalytic oxidizer system not reduce contaminant levels to the required concentrations.

Typically, but not limited to, two carbon units will be piped in series to treat the recovered vapors. Carbon units will be changed out according to the air permit guidelines.

When carbon units are changed out, the primary unit will be taken off line, the secondary unit will become the primary unit, and a fresh carbon vessel will become the secondary unit.

All field activities will be initiated in Level D, and can be upgraded to Level C depending on conditions in the field.

3.2.8 Vapor Emission Response Plan

If the air concentration of organic vapors exceeds applicable limits above background in the exhaust of the treatment system, the system exhaust will be continuously monitored and necessary actions will be taken to reduce system emissions to 5 ppm--for example, by bleeding air into the system, changing carbon canisters, etc. If the organic vapor levels measured in the treatment system exhaust are between 5 ppm and 50 ppm above background, continue site activities and perform continuous monitoring. If the organic vapor level exceeds 50 ppm above background in the treatment system exhaust, shut down work activities until the system is repaired.

Prior to beginning construction activities, notify fire departments and police as well as the local emergency facility of planned site activities. These organizations shall be briefed on the nature of planned site work and given a schedule of the proposed tasks. Changes or modifications to the planned work or schedule which could affect the need for emergency services shall be communicated to these organizations. LBG shall communicate to the local hospital and fire department what types of materials may be encountered at the site.

Should the level of total hydrocarbons exceed 100 ppm for any single reading, or should the explosimeter indicate in excess of 10 percent of the lower explosive limit on any single reading, work in that area will be shut down and personnel will be evacuated upwind. Work will not resume there until authorized by the Site Safety Officer.

3.2.9 Remediation System Start-Up

Any remediation system will be designed to operate unattended 24 hours per day, 7 days per week. Upon commencement of operation, once the electrical connections are complete, LBG will begin system start-up.

During system operations, LBG will monitor the system on a prescribed schedule. LBG field personnel will use a photoionization detector (PID) to monitor the vapor emissions from the effluent vapor stack as well as periodically collect vapor samples to be submitted to a laboratory for analysis by USEPA method TO-15 in order to ensure compliance with standards. If the laboratory analysis indicates the effluent vapors are above standards, a vapor-phase carbon

vessel can be used to treat the effluent. As part of the daily and regular monitoring, LBG will follow the Vapor Emission Response Plan.

3.2.10 Continued Operations and Maintenance

For the first month of operation, LBG will monitor the system weekly and from the beginning of the second month to the remainder of the treatment period, LBG will monitor the system once a month. The following data will be recorded on each visit:

- Summary of system operation;
- air flow data and calculations;
- summary of temperatures;
- laboratory data for all sample ports sampled;
- PID data for all air sample ports sampled;
- summary of gauge readings;
- total volume recovered (monthly period and total to date); and,
- summary of O&M activities.

Any additional data that may provide insight into the operation of the SSDS/SVE treatment system will also be compiled. Performance data will be reported to the NYSDEC on a monthly basis.

dmd

May 2, 2014

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APPENDIX E

Decontamination Procedures

DECONTAMINATION PROCEDURES

PROCEDURE FOR LEVEL C DECONTAMINATION

Level C decontamination, if required, will take place on plastic sheeting so all contaminated material can be contained for proper disposal.

Station 1: Segregated Equipment Drop

Deposit equipment used onsite (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Segregation at the drop reduces the probability of cross-contamination.

Equipment: various size containers
plastic liners
plastic drop cloths

Station 2: Suit/Safety Boot Wash

Thoroughly wash splash suit and safety boots. Scrub with long-handle, soft-bristle scrub brush and copious amounts of decon solution or detergent/water. Repeat as many times as necessary.

Equipment: container (30-50 gallons)
decon solution
or
detergent/water
2-3 long-handle, soft-bristle scrub brushes

Station 3: Suit/Safety Boot Rinse

Rinse off decon solution or detergent/water using copious amounts of water. Repeat as many times as necessary.

Equipment: container (30-50 gallons)
or
high-pressure spray unit
water
2-3 long-handle, soft-bristle scrub brushes

Station 4: Canister or Mask Change

If worker leaves Exclusion Zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canisters will be exchanged, depositing the old canisters in containers with plastic liners. The worker will enter the work area and return to duty.

Equipment: canister (or mask)
boot covers
gloves

Station 5:

Step 1 - Tape, Safety Boot and Outer Glove Removal

Remove safety boots and gloves and deposit in container with plastic liner.

Equipment: container (30-50 gallons)
plastic liners
bench or stool
boot jack

Step 2 - Splash Suit Removal

With assistance of helper, remove splash suit. Deposit in container with plastic liner.

Equipment: container (30-50 gallons)
bench or stool
liner

Step 3 - Facepiece Removal

Remove facepiece. Avoid touching face with gloves. Deposit facepiece in container with plastic liner.

Equipment: container (30-50 gallons)
plastic liners

Masks will be collected at a central location. Decontamination will be performed as follows:

- remove all cartridges, canisters and filters, plus gaskets or seals not affixed to their seats;

- remove elastic headbands;
- remove exhalation cover;
- remove speaking diaphragm or speaking diaphragm-exhalation valve assembly;
- remove inhalation valves;
- wash facepiece and breathing tube in cleaner mixed with warm water, preferably at 120°F to 140°F; wash components separately from the face mask; remove heavy soil from surfaces with a hand brush;
- remove all parts from the wash water and rinse twice in clean warm water;
- air dry parts in a designated clean area; and,
- wipe facepiece, valves and seats with a damp lint-free cloth to remove any remaining soap or other foreign materials.

Station 6: Inner Glove Removal

Remove inner gloves and deposit in container with plastic liner.

Equipment: container (20-30 gallons)
plastic liners

Station 7: Inner Clothing Removal (optional)

Remove clothing soaked with perspiration. Place in container with plastic liner. Do not wear inner clothing offsite if there is a possibility small amounts of contaminants might have been transferred in removing splash suit.

Equipment: container (30-50 gallons)
plastic liners

Station 8: Field Wash (optional)

Shower if highly toxic, skin-corrosive or skin-absorbable materials are known or suspected to be present. Wash hands and face if shower is not available.

Equipment: water
soap
tables
wash basins/buckets
field showers

Station 9: Redress

Put on clean clothes. A dressing trailer is needed in inclement weather.

PROCEDURE FOR LEVEL B DECONTAMINATION

Level B decontamination, if required, will take place on plastic sheeting so all contaminated material can be contained for proper disposal.

Station 1: Segregated Equipment Drop

Deposit equipment used onsite (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross-contamination.

Equipment: various size containers
plastic liners
plastic drop cloths

Station 2: Suit/Safety Boot Wash

Thoroughly wash chemical-resistant splash suit, SCBA, gloves, and safety boots. Scrub with long-handle, soft-bristle scrub brush and copious amounts of decon solution or detergent/water. Wrap SCBA regulator (if belt-mounted type) with plastic to keep out water. Wash backpack assembly with sponges or cloths.

Equipment: container (30-50 gallons)
decon solution
or
detergent/water
2-3 long-handle, soft-bristle scrub brushes
sponges or cloths

Station 3: Suit/SCBA/Boot/Glove Rinse

Rinse off decon solution or detergent/water using copious amounts of water. Repeat as many times as necessary.

Equipment: container (30-50 gallons)
or
high-pressure spray unit
water
small buckets
2-3 long-handle, soft-bristle scrub brushes
sponges or cloths

Station 4: Tank Change

If worker leaves Exclusion zone to change air tank, this is the last step in the decontamination procedure. Worker's air tank is exchanged and worker returns to duty.

Equipment: air tanks
tape
boot covers
gloves

Station 5: Tape, Safety Boot and Outer Glove Removal

Remove safety boots and gloves and deposit in container with plastic liner.

Equipment: container (30-50 gallons)
plastic liners
bench or stool
boot jack

Station 6: SCBA Backpack Removal

While still wearing facepiece, remove backpack and place on table. Disconnect hose from regulator valve and proceed to next station.

Equipment: table

Station 7: Splash Suit Removal

With assistance of helper, remove splash suit. Deposit in container with plastic liner.

Equipment: container (30-to gallons)
plastic liners
bench or stool

Station 8: Facepiece Removal

Remove facepiece. Avoid touching face with gloves. Deposit in container with plastic liner.

Equipment: container (30-50 gallons)
plastic liners

Masks will be collected at a central location. Decontamination will be performed as follows:

- remove all cartridges, canisters and filters, plus gaskets or seals not affixed to their seats;
- remove elastic headbands;
- remove exhalation cover;
- remove speaking diaphragm or speaking diaphragm-exhalation valve assembly;
- remove inhalation valves;
- wash facepiece and breathing tube in cleaner mixed with warm water, preferably 120°F to 140°F; wash components separately from the face mask; remove heavy soil from surfaces with a hand brush;
- remove all parts from the wash water and rinse twice in clean warm water;
- air dry parts in a designated clean area; and,
- wipe facepiece, valves and seats with a damp lint-free cloth to remove any remaining soap or other foreign materials.

Station 9: Inner Glove Removal

Remove inner gloves and deposit in container with plastic liner.

Equipment: container (20-30 gallons)
plastic liners

Station 10: Inner Clothing Removal (optional)

Remove clothing soaked with perspiration. Place in container with plastic liner. Do not wear inner clothing offsite since there is a possibility small amounts of contaminants might have been transferred in removing fully encapsulating suit.

Equipment: container (30-50 gallons)
plastic liners

Station 11: Field Wash (optional)

Shower if highly toxic, skin-corrosive, or skin-absorbable materials are known or suspected to be present. Wash hands and face if shower is not available.

Equipment: water
soap
small tables
basins or buckets
field showers

Station 12: Redress

Put on clean clothes. A dressing trailer is needed in inclement weather.

Equipment: tables
chairs
lockers
clothes

Procedures for Level A Decontamination

(to be formulated on a case-by-case basis)

dmd

May 2, 2014

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APPENDIX B

BCP Project Site Sign



Brownfield Cleanup Program

Queens Medallion Leasing

Site No. C241144

LBG Engineering Services, P.C.

Governor Andrew M. Cuomo

Commissioner Joseph Martens

Mayor Bill de Blasio

Transform the Past.... Build for the Future

APPENDIX C

Project Contact List

PROJECT CONTACT LIST

For information about the Site's investigation and cleanup program, the public may contact any of the following project staff:

New York State Department of Environmental Conservation (NYSDEC)

Project Manager

Mr. Jonathan Greco
NYSDEC -Division of Environmental Remediation
625 Broadway
Albany, NY 12233-7016
Telephone: (518) 402-9694
Email address: jxgreco@gw.dec.state.ny.us

Regional Citizen Participation Specialist

Mr. Thomas Panzone
NYSDEC – Office of Communications Services
Hunters Point Plaza
47-40 21st Street
Long Island City, NY 11101
Tel: (718) 482-4953
Email: tvpanzon@gw.dec.state.ny.us

New York State Department of Health

Public Health Specialist

Dawn Hettrick, P.E.
Public Health Engineer
New York State Department of Health
Bureau of Environmental Exposure Investigation
Empire State Plaza - Corning Tower, Room 1787
Albany, NY 12237
Telephone:(518) 402-7860
Email address: BEEI@health.state.ny.us

Queens Medallion Leasing

Site Owner

Exclusive Realty Services, LLC
Mr. Tony Georgiton
21-03 44th Avenue
Long Island City, NY 11101

Project Environmental Counsel

Scott Furman, Esq.
Sive, Paget & Riesel, PC
460 Park Avenue
10th Floor
New York, NY 10022
Telephone: (212) 421-2150
Email: sfurman@sprlaw.com

Project Consultant

Sean Groszkowski, CPG
Leggette Brashears & Graham, Inc.
4 Westchester Park Drive, Suite 175
White Plains, NY 10604
Telephone:(914) 694-5711
Email: Groszkowski@lbgny.com

DOCUMENT REPOSITORIES

The facilities identified below are being used to provide the public with convenient access to important project documents:

Queens Borough Public Library

Reference Section
Court Square
2501 Jackson Avenue
Long Island City, NY 11101

Queens Community Board No. 2

43-22 50th Street
2nd Floor, Room 2B
Woodside, NY 11377

APPENDIX D

Resumes



Bill Beckman has extensive experience in projects involving the use, storage, management and treatment of water. His experience includes evaluation and management of water resources such as watershed and runoff determinations, stormwater controls and management, and design, assessment and maintenance of ponds. He is also experienced in flow routing, dam design, inspection and repairs, flood stage determination, and flood assessment and analysis. He has completed projects for environmental management and permitting, such as stormwater management, water supply and diversion, and spill protection. Mr. Beckman is also experienced in the design of potable water-supply systems, including wells, transmission mains, pump houses and water treatment processes. He has considerable experience in planning and directing environmental site assessments for real estate transactions. His work has included investigation and assessment of subsurface contamination, and design of groundwater and soil remediation systems, including those that remove volatile organic compounds, petroleum hydrocarbons and heavy metals. He has supervised the design and installation of both underground and above ground storage tanks and dispensing systems for petroleum products. Mr. Beckman has also developed, constructed and analyzed many 2-D solute transport and 3-D ground-water flow models in hydrogeologic evaluations involving both ground-water supply and groundwater contamination.

Mr. Beckman's field and data analysis experience includes: collection of geophysical data from earth resistivity, seismic and gravity surveys; inspections to assess watershed characteristics; supervision of drilling, well development and aquifer testing programs; inspection of dams; interpretation of geophysical borehole logging data; directing well maintenance programs including well-loss studies; directing regional water budget analysis; and construction supervision of water-supply, water treatment, and soil and groundwater remedial systems. He has managed remedial investigations (RI), conducted feasibility studies (FS) and supervised remedial design at several CERCLA sites. Mr. Beckman has provided expert witness testimony, represented clients before local, state and federal agencies, and provided second opinion review services.

EDUCATION

M.S. in Civil and Environmental Engineering, 1978, University of Rhode Island, Kingston, Rhode Island

B.S. in Civil and Environmental Engineering, 1976, University of Rhode Island, Kingston, Rhode Island

REGISTRATION

Registered Professional Engineer in the states of Alabama, Connecticut, Delaware, Florida, Illinois, Kansas, Maine, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina and Wisconsin

Licensed Environmental Professional in the State of Connecticut.

TECHNICAL SOCIETIES

American Society of Civil Engineers

Association of Ground Water Scientists and Engineers (National Ground Water Association)

Environmental Professional's Organization of Connecticut

SUMMARY OF PROFESSIONAL EXPERIENCE

2008 to present:

Senior Vice President and Director of Leggette, Brashears & Graham, Inc., Shelton, Connecticut

1991 to 2008:

Vice President and Director of Leggette, Brashears & Graham, Inc., Wilton, Trumbull and Shelton, Connecticut

1987 to 1991:

Senior Associate with Leggette, Brashears & Graham, Inc., Wilton, Connecticut

1985 to 1987:

Associate with Leggette, Brashears & Graham, Inc., Wilton, Connecticut

1981 to 1984:

Senior Hydrologist with Leggette, Brashears & Graham, Inc., Wilton, Connecticut

1978 to 1980:

Hydrologist with Leggette, Brashears & Graham, Inc., Westport and Wilton, Connecticut

1976 to 1978:

Research Assistant, Civil Engineering Department, University of Rhode Island

SPECIFIC EXPERIENCE IN WATER RESOURCES, SUPPLY AND MANAGEMENT

New Castle, New York

Supervision of watershed hydrologic analysis using TR-20 and HEC-1 to assess the affects of storm water runoff at a residential development. The results were used to evaluate runoff control measures and to design control structures for a pond on the property.

Danbury, Connecticut

Supervised the watershed analysis to determine the pond surface elevation from a 100-year storm, the value of which formed the basis for designing repairs to a small earthen dam. Computer models TR-20 and HEC-1 were used in the analysis to evaluate and design modification of the pond outlet. Supervised the repairs made to the dam and documented the work in a report. Coordination with state and local agencies was required throughout the project.

Greenwich, Connecticut

Evaluated the hydrology and hydrogeology to assess the viability of a pond proposed for a residential estate. The work included storm-water runoff analysis, pond, berm and spillway design, flow routing through the proposed pond and spillway, evaluating the downstream conditions under possible flooding events, and representation of the client before local and state regulatory agencies.

Milford, Connecticut

Completed a pre- and post-development storm water runoff analysis for a proposed golf course. Storm water management controls were evaluated and designed, including a detention pond and an onsite storm drain system consisting of catch basins, pipe and a grit/oil/water separator. Runoff channels were designed and a plan was developed for erosion and sediment control. Floodway and floodplain hydraulic analysis of the adjacent river were completed to evaluate the potential for site development to impact water flow during larger storm events. Evaluated and designed an 11,000 gpd on site septic system for the treatment of sanitary wastes from the clubhouse, which includes a restaurant and banquet facilities. The work included field testing, projection of sanitary flows, preparation of plans and specifications, and preparation of applications to obtain local and state permits.

Sharon, Connecticut

Completed a hydrologic watershed analysis to determine peak runoff from storm events, evaluated and redesigned an existing spillway on a dam to allow passage of the peak runoff, evaluated downstream impacts from a hypothetical dam breach to prepare an emergency operations plan, and prepared plans and specifications for various repairs and improvements to the dam and spillway. The work was complete in response to a Consent Order from the Connecticut Department of Environmental Protection.

Redding, Connecticut

Developed plans and specifications for dredging an irrigation water storage pond at a golf course in order to restore the capacity of the pond. Alternatives for enlarging the pond were examined and compared with options for increasing the irrigation supply sources. Plans and specifications for maintenance of a 5-pond/stream system were also prepared. The work included delineation of contributing watersheds, calculation of peak flows and development of BMPs for sediment control.

SPECIFIC EXPERIENCE IN WATER RESOURCES, SUPPLY AND MANAGEMENT (continued)

Danby, Missouri

Completed a hydrologic analysis of pre- and post-development storm water runoff of a proposed limestone quarry; the results are being used to design storm-water management and erosion controls. Sedimentation basins were designed to serve the dual purpose of capturing sediment and controlling the release of storm water runoff. The analysis and preliminary design of a sedimentation basin for the disposal of about 850,000 cubic yards of dredged sediments was also completed, including a 130 foot high rock fill dam to serve as the impounding structure for the basin. Engineering reports and drawings were prepared to support applications for construction with the state and the Army Corps of Engineers.

Bedford, New York

Evaluated the hydrology and hydrogeology to assess the feasibility of a pond proposed for a residential estate. The work included watershed delineation, test pits to assess soil and groundwater conditions, storm-water runoff analysis, pond and spillway design, flow routing through the proposed pond and spillway, checking the capacity of nearby storm sewers, and representation of the client before local and state regulatory agencies.

Portland, Connecticut

The options for draining a 3.3-acre quarry pond were evaluated. A hydrologic evaluation of the watershed was completed in order to design sediment and erosion controls, and to prepare runoff management controls to minimize impacts to nearby wetlands and streams. The potential for quarry restoration to impact groundwater was also evaluated. Wetlands were mapped and a site plan was developed. Detailed plans of the options were prepared. Applications for permits from the local Planning & Zoning Commission and Inland Wetlands Commission were prepared and submitted. The client was represented at public hearings for both local agencies. Meetings were held with CTDEP staff to discuss permitting requirements and procedures for the project.

Chappaqua, New York

Completed a hydrologic analysis of a pond in a residential community, including watershed delineation, calculation of runoff, and routing through a sedimentation basin to reduce materials from accumulation in the pond. The spillway structure was redesigned to minimize flooding that occurred during storm events. Maintenance and dredging of the pond was included.

Bethel, Connecticut

The feasibility of a 0.2-acre pond in a low-lying area on a 5-acre residential property was evaluated, which included the mapping of wetlands and the preparation of a site plan. The watershed hydrology was evaluated, and the soils and groundwater levels were investigated. Detailed plans and specifications were prepared for use in permitting and construction. Applications for both Planning & Zoning and Inland Wetlands permits were prepared and coordinated through the review, public hearing and comment process. Construction oversight was provided and routing construction status reports were submitted to the town. As-built plans of the pond were prepared and submitted to the town in order to meet a condition in one of the permits.

SPECIFIC EXPERIENCE IN WATER RESOURCES, SUPPLY AND MANAGEMENT (continued)

Chappaqua, New York

Plans to conduct maintenance dredging in a portion of a 9-acre pond were evaluated to provide a second opinion to the owners. The hydrology of the watershed was evaluated. BMPs were examined for potential application in the watershed to reduce the volume of sediment being carried into the lake. Local, state and federal permitting requirements were identified and summarized for the owners. The planned method for dredging was reviewed, along with the plans for disposal of the dredged sediments. Recommendations were made to supplement the planned maintenance dredging with the construction of sediment traps on the tributaries to the lake.

Greenwich, Connecticut

The watershed hydrology, storm water runoff, and capacities of the stream/pond system throughout the 150-acre, 18-hole golf course were evaluated. A detailed runoff analysis was completed to estimate peak flows for various storm events. Options were evaluated to reduce flooding which frequently occurs during storm events. Culvert and stream channel capacities were calculated and potential improvements evaluated. Based on a bathymetric survey of the bottom of the large pond, options for the ponds were evaluated to improve storm water management capabilities and increase storage volume in consideration of the need for irrigation at the golf course. Construction plans were prepared for removal of sediment from streams and ponds, for modification to pond outfalls, and for new culverts. Volumes of sediment to be removed from the ponds were estimated for each option. The cost of each option were estimated and presented to the client. Applications for local, state and federal permits were prepared and submitted. Local permits were obtained.

Torrington, Connecticut

To increase the storage capacity of ponds used for irrigation water, an evaluation and design was completed to remove existing sediment to deepen and enlarge two ponds. The work included a bathymetric survey of the bottoms of the ponds, evaluation of the hydrology and water flow through the ponds, design for a new outlet, preparation of construction drawings, support of the permit application to the municipality, preparation and support of an application with the CTDEP, and coordination with the Army Corps of Engineers. Upon receipt of all approvals, assistance was provided in contractor bidding and selection.

Clarksville, Missouri

As the main component of a stormwater management program to facilitate expansion of a limestone quarry, a 1,400-foot long, 35-foot high dam was designed to intercept streamflow. The work included a hydrologic evaluation of the watershed and determination of streamflows, evaluation of soil data obtained from borings drilled in the footprint of the planned dam, design of the dam and outlet, and preparing, submitting and supporting applications with the state and Army Corps of Engineers. Construction supervision was provided. The finished project resulted in the creation of a 20.5-acre lake and a 2,500-foot channel that conveyed the streamflow to an adjacent watercourse.

SPECIFIC EXPERIENCE IN WATER RESOURCES, SUPPLY AND MANAGEMENT (continued)

Bedford Corners, New York

Completed evaluation and design tasks to deepen and enlarge a pond on a residential/agricultural estate. The work included a bathymetric survey of the pond bottom, inspection of the dam, evaluation of the hydrology and streamflow through the pond, and development of an engineers report and construction drawings that were used in support of an application for a local permit.

Stamford, Connecticut

Inspected a masonry stone dam on a community pond to assess the source of water flowing out of the ground a short distance downstream of the dam. The work also included a review of construction drawings for the dam and interviews with people familiar with the dam and pond. The water was determined to be from the spillway and was being diverted through stone riprap at the base of the dam by the accumulation of leaf debris and vegetation. The water was not seepage under the dam. The findings were summarized in a letter that was submitted to the CTDEP. Assistance was also provided for preparation of an Emergency Operations Plan.

Mt. Kisco, New York

The viability of creating a pond on a private estate was assessed by evaluating the hydrologic conditions, groundwater levels, and soils in the location of the proposed pond. Due to the small contributing watershed, augmentation of the water in the pond with water from an irrigation well was projected to be necessary during dry periods. Design of the pond and outlet was completed, and construction drawings were prepared and used in obtaining a permit from the town.

Katonah, New York

To alleviate flooding conditions in the area of a pond on a residential property, an evaluation was completed to identify modifications to the pond and outlet that would reduce the magnitude and frequency of flooding during larger storm events. Construction drawings were prepared that included the removal of sediment from the pond and reconstruction of the outlet.

Croton-On-Hudson, New York

Evaluation of the significance and severity of seepage downstream of a masonry stone dam and inspection of the condition of the dam. Approaches to fix the seepage and make repairs to the dam without drawing down the lake were evaluated. For each approach, the ease of implementation and regulatory approval requirements were evaluated. A report that summarized the advantages, disadvantages and costs of the various approaches was prepared and submitted to the owner.

Redding, Connecticut

Assessed the viability of constructing a pond on a residential estate. The soils, groundwater level and contributing watershed were evaluated to develop a design in which the outlet elevation was selected to maximize the utilization of groundwater as the source of water to the pond. Cuts into the hillside were balanced by fills for the berm in order to create the pond.

SPECIFIC EXPERIENCE IN WATER RESOURCES, SUPPLY AND MANAGEMENT (continued)

Fairfield, Connecticut

Assessed the viability of constructing a pond on a residential property. The soils and groundwater levels were evaluated by drilling borings and a hydrologic evaluation of the contributing watershed was completed to define surface water contribution to the proposed pond. A preliminary design for the pond, the normal water level in the pond and the outlet was prepared.

Pawling, New York

Repairs to a combined stone masonry/earth fill dam were assessed and designed to stop leakage through the dam. The work included an inspection of the dam, development of an approach for stopping leakage, preparation of construction drawings for the repairs, coordination with the municipality for the work permit, and construction supervision.

Orange, Connecticut

Evaluated the condition of a farm pond dam and the cause of water observed below the dam to determine the ability of the pond and dam to accept stormwater runoff from planned commercial development of the property. The dam was inspected and the proposed storm water management system was reviewed to compare the rate and volume of storm water to enter the pond with the storage capacity of the existing pond. Repair and maintenance items for the dam and an outlet from the pond were recommended.

North Salem, New York

Evaluated the cause of road runoff flowing through a residential property and depositing sand and sediment into a farm pond. The contributing watershed was defined and options for rerouting the runoff and eliminating sediment deposition to the pond were identified and summarized for the owner. Represented the owner in negotiations with the town in order to implement corrective actions.

Newtown Square, Pennsylvania

In response to a directive to the owner from the state, measures to repair identified deficiencies were developed. The dam and conditions were inspected, a hydrologic analysis was completed to understand flows into the pond and through the outlet of the dam, modifications to the outlet were designed, and construction drawings and specifications were prepared. A breach analysis was completed to define the downstream inundation area as part of the Emergency Operation Plan that was prepared to meet regulatory requirements.

Doylestown, Pennsylvania

An Emergency Operations Plan was prepared to meet regulatory requirements. The work included an inspection of the pond, dam and outlet, an evaluation of the outlet and flow through the pond, and a breach analysis to define the downstream inundation area.

Bloomfield, Connecticut

Evaluation of an office park water supply consisting of eight high-yield bedrock wells. Recommendations were made for improved yield and well operation and an estimate developed for total safe yield of the system.

SPECIFIC EXPERIENCE IN WATER RESOURCES, SUPPLY AND MANAGEMENT (continued)

Brandenburg, Kentucky

Siting an industrial water-supply well to develop the required yield while avoiding the capture of nearby organic contamination in the aquifer.

Creswell, North Carolina

Computer model analysis of the effects of a proposed peat harvesting operation on a five-layer aquifer system in a Coastal Plain environment. A three-dimensional model was used to simulate dewatering for removal of the surficial peat layer and the operation of several deep supply wells, to allow for the evaluation of regional and local changes in heads and flows and the estimation of ground-water inflow.

Fairfield County, Connecticut

Hydrogeologic evaluation to determine groundwater yields and environmental impacts of small water supplies for numerous residential and industrial developments. Also, provided expert testimony and assistance in obtaining permits.

Hampton, New Hampshire

Identification of primary, secondary and indirect recharge areas to the supply wells of the municipal water system. Watershed protection guidelines were developed and recommendations made for installation of several monitor wells and enactment of a regular monitoring program.

Massachusetts and New Hampshire

Evaluation of supply wells and operations for seven member companies of the American Water Works Service Corporation resulting in recommendations to improve well yield and system operations.

Parkersburg, West Virginia

Utilization of a computer model to evaluate the effects of dredging in the Ohio River on nearby industrial water-supply wells, heavily dependent on river infiltration.

Rockland County, New York

Computer model analysis of the Spring Valley Water Company's 14 mgd Ramapo Valley Well Field in a buried glacial valley environment. Of primary concern was defining the effects of well field operation on flow in the Ramapo River and developing an optimum well field management plan in regard to various flow conditions of the river.

Saudi Arabia

Model evaluation of a proposed 40 mgd well field for the King Khalid Military City under numerous situations and well combinations. Pump design and specifications were based on the model results.

Biron, Wisconsin

Supervised the design, permitting and construction of a 16-inch water main to connect a new 500 gpm supply well with an existing storage tank. The design and permitting for the well house and water treatment for disinfection and corrosion control was also completed.

SPECIFIC EXPERIENCE IN WATER RESOURCES, SUPPLY AND MANAGEMENT (continued)

Mount Olive, New Jersey

Supervised the design of a water main to connect a new 800 gpm supply well with an existing storage tank, well house, and water treatment for disinfection and corrosion control. Provided technical support during construction and start-up of the well.

Somers, New York

Supervised the design, including plans and specifications, of wells, hydraulic controls and transmission piping for separate multiple well systems for irrigation.

Lewisboro, New York

Supervised the design, including plans and specifications of a well, hydraulic controls and transmission piping for a potable water supply at an office building. Technical support was provided to obtain the necessary permits and approvals.

Mt. Kisco, New York

Designed equipment, piping and pump house to collect water from a well field comprised of four bedrock wells with a design yield of 240 gpm, to treat the water for disinfection, corrosion control and radon, and to convey the treated water to the existing municipal potable water distribution system. The work included coordination of contractors during construction and obtaining the necessary permits and approvals for constructing and operating the wells and treatment system.

Greenwich, Connecticut

Evaluated and designed a potable water system to serve a private school. The work for the system included pumps for the bedrock wells, filtration, iron treatment, disinfection, atmospheric and pneumatic storage tanks, booster pumps, and operational and backup controls. Testing was conducted and applications prepared for State permits, which were obtained on behalf of the client. Coordinated construction oversight and system start-up.

Deep River, Connecticut

Evaluated and designed upgrades to potable water systems in junior and senior high schools as part of the schools renovation projects. The work for the system included pumps for the bedrock wells, piping from the wells to the utility rooms in each school, filtration, and disinfection. Testing was conducted and applications prepared for State permits, which were obtained on behalf of the client.

Westport, Connecticut

Conducted a second opinion review of a watershed analysis to check the results of a TR-20 and HEC-1 analysis of a frequently flooding stream. The review included an assessment of the adequacy of the proposed stream channel modifications. A design of a small earthen berm was prepared to protect the client's property and presentations were made to local agencies to obtain approvals for construction.

Stamford, Connecticut

Provided expert witness services with regard to storm water runoff from adjacent properties causing damage to the client's property. The work included a site investigation of runoff patterns, technical assistance to the attorney, and testimony in court.

**SPECIFIC EXPERIENCE IN WATER RESOURCES, SUPPLY AND
MANAGEMENT (continued)**

New Milford, Connecticut

Evaluated the impact of a proposed condominium development on the surface water and groundwater runoff to onsite and offsite wetlands. The work included a site inspection, evaluation of the development plans, identification of the watershed and its characteristics, review of published data, and representation of the client before a local regulatory agency.

New Canaan, Connecticut

Completed a second-opinion technical review for the municipality of the storm water management plan for a 60-unit residential development that had been submitted to the municipality for approval.

Ridgefield, Connecticut

Provided expert witness services with regard to storm water runoff from an adjacent property causing damage to the client's property. The work included a site inspection, review of available technical information, investigation of runoff patterns, review of depositions, technical assistance to the attorney prior to and during the trial, and testimony in court.

New Rochelle, New York

Developed a plan to control the entry of offsite storm water runoff onto a property and to control the onsite process water and storm water. The work was completed in response to an Order of Consent that had been issued by the New York State Department of Environmental Conservation to the property owner. The plan was approved and implemented.

Deep River, Connecticut

The existing on site septic systems for the junior and senior high schools were evaluated and upgrades were designed as part of the overall renovations of these facilities. The work included field testing, review of existing sanitary flows and projection of future sanitary flows, evaluation and design of upgrades to meet current regulations, preparation of plans and specifications, coordination with local and state regulatory agencies, and preparation of applications to obtain necessary local and state approvals.

SPECIFIC EXPERIENCE IN SOIL & GROUNDWATER CONTAMINATION

Apple Valley, Minnesota

Design and implementation of a recovery/treatment system to eliminate free hydrocarbon product and reduce to acceptable levels the dissolved components of hydrocarbons in the water table aquifer at a petroleum bulk storage terminal.

Brooklyn, New York

Monitoring of fluid levels and conducting aquifer pump tests in order to define the extent of hydrocarbon product and implement a recovery system at a terminal and tank farm. Computer evaluation of various recovery techniques. Design of a multi-well system for the recovery of free product and remediation of groundwater containing VOCs.

Danbury, Connecticut

Conducted an environmental site assessment on an industrial property which was found to have soils containing lead and hydrocarbon compounds. Alternatives were evaluated; remediation of soil was coordinated and supervised.

Deepwater, New Jersey

Development of a computer program which contoured water-level and water-quality data for use in monitoring the multi-aquifer system and evaluating the effectiveness of the recovery well system in containing and reducing chemical concentrations at a chemical manufacturing facility.

West View, Pennsylvania

Development of a ground-water computer model to evaluate proposed remedial measures to prevent the further contamination of public water-supply wells from chemicals emanating from a nearby chemical plant.

Plumstead Township, New Jersey

Project Manager of hydrogeologic investigations for the Remedial Investigation/Feasibility Study at three Superfund sites. These studies were directed at defining the extent of contamination and evaluating alternatives for remediation. Investigative techniques included electromagnetic terrain conductivity and multi-level monitor wells.

Watertown, Wisconsin

Conducted a Feasibility Study for remediation of ground water and soils containing VOCs and developed conceptual design of remedial system. Detailed design of systems for recovery and treatment of groundwater and soils. Supervised construction management, start-up activities, and operation and maintenance of the systems.

Suffern, New York

Technical manager of computer modeling of TCEA plume in the vicinity of a municipal well field. The solute transport model was developed from field data obtained during the Remedial Investigation and was used to evaluate alternatives during the Feasibility Study for this Superfund listed site.

**SPECIFIC EXPERIENCE IN SOIL & GROUNDWATER CONTAMINATION
(continued)**

Paulsboro, New Jersey

Assisted in the evaluation and design of liquid hydrocarbon recovery system installed in the water table aquifer at a petroleum refinery. Periodic review of recovery system to ensure continued operation. Computer modeling to evaluate effectiveness of recovery system and estimate remaining product in the aquifer. Design and implementation of an investigation and monitoring program for potential contamination in deep aquifers at the site. Alternatives for remediation were evaluated and a recommendation was made to the client.

Connecticut and New York

Numerous Phase I and II environmental assessments of Properties in Connecticut and New York to define site conditions and potential risks associated with hazardous or toxic chemicals. The information developed is used by involved parties prior to transfer of property ownership or refinancing.

Guayama, Puerto Rico

Completed a Feasibility Study at a CERCLA site involving TCE contamination of several public supply wells and asbestos in soils. Various processes were identified and alternatives were evaluated in detail, including cost analysis, according to EPA FS protocols.

Greenwich, Connecticut

Design of a hydrocarbon/groundwater recovery system at a maintenance garage for an electric utility company. The system included wells equipped with air-ejector pumps which discharged to a treatment unit. Engineering drawings and specifications were provided for contractor use and as-built drawings were supplied at the completion of the project.

New Windsor, New York

Design of a hydrocarbon/groundwater recovery system at a petroleum terminal/tank farm. The system included a high capacity recovery well, equipped with a pump that discharges to an air stripper. Effluent from the air stripper flows to the municipal sewer. The system was equipped with automatic controls and winterized to allow year-round operation. The work included construction management and system start-up and operation.

Patterson, New York

Design of a leachate collection and treatment system, including rerouting the drainage of surface water, at an unauthorized non-hazardous industrial waste landfill. The leachate collection system will mitigate the potential impact of the landfill on adjacent wetlands and is the first stage in the overall remediation of the landfill.

New Fairfield, Connecticut

Managed an environmental site assessment that identified contaminated soils and a potentially leaking UST. Follow-up work included closure and removal of the UST and excavation of soils with hydrocarbon product. The remediation of soils contaminated by waste coolants was also coordinated.

**SPECIFIC EXPERIENCE IN SOIL & GROUNDWATER CONTAMINATION
(continued)**

Connecticut

Supervision of numerous projects for preparing Storm Water Pollution Prevention Plans, coordination with clients to implement the plans, and supervision of monitoring and sampling efforts conducted for the clients to meet regulatory requirements. Several sites included design of runoff treatment and control measures.

North Branford, Connecticut

Supervision of a Phase II investigation targeted on a PCE release at a former dry-cleaning establishment. Evaluation of remedial options and costs. Coordination with state agencies and clients (attorneys). Presentation of expert witness testimony.

Gaithersburg, Maryland

Review of technical file, coordination with the client and attorneys, presentation of expert witness testimony for case involving liability of planned remediation of petroleum contamination in soil and groundwater at a service station.

East Hartford, Connecticut

Supervised the closure of two 20,000-gallon USTs, including remediation of impacted soil and groundwater, and the installation of a 10,000-gallon AST. The work included design of base support for the AST and technical support for obtaining state and local permits and approvals.

BIBLIOGRAPHY

"The Ramapo Valley Aquifer Model: A Case Study of Aquifer Modeling for Well Field Management Alternatives," Proceedings of the NWWA Eastern Regional Conference on Ground-Water Management, November 1983.

"Considerations in the Development of a Ground-Water Contaminant Transport Model," presented at the 36th Annual Meeting of the AWWA-Pennsylvania Section, April 1984.

"Computer Aided Design of Ground-Water Monitoring Programs," Proceedings of the ASCE Hydraulics Division Specialty Conference on Hydraulics and Hydrology in the Small Computer Age, August 1985.

"Well Field Management Designed to Minimize Impact on Surface Water Flow," Proceedings of the ASCE Symposium on Engineering Hydrology, August 1987.



Based in the firm's White Plains, New York office, Sean Groszkowski manages environmental projects with multi-million dollar construction and remedial costs that cross a wide spectrum of environmental disciplines, including: regulatory compliance; hazardous waste investigations and cleanups; hydrogeological investigations; environmental assessments; contaminant fate and transport modeling; and litigation support. He has developed experience through a wide range of project types, environmental conditions, and multiple regulatory agency liaisons. Sean has a strong background in site characterization, corrective action plan development and in the design and implementation of remedial systems. He is acutely familiar with federal, State and local environmental regulations and has developed a familiar relationship with the administrators of those agencies throughout the Tri-State Area.

Sean specializes in management of inactive hazardous waste site remediation under the New York State Brownfield Cleanups Program (BCP). With these large interdisciplinary projects, Sean is involved in the project development from initial site assessment, application and entry into the BCP to permit acquisition and remedial construction management and subsequently progress through to regulatory site closure and site management. These sites have involved a range of contaminants that pose particular challenges to remediation including the following: PCBs; chlorinated solvents; petroleum; viscous urethanes; and mercury, lead, and other heavy metals.

Sean's areas of expertise include development and/or implementation of: Phase I & II Environmental Site Assessments (ESAs); property transaction risk assessment and environmental reserve cost estimations; regulatory liaison communications (Local, City, State and Federal); regulatory compliance activities (USEPA, VCP, BCP, RCRA, CEQR, TSCA, Spills...); Remedial Investigation Work Plans and hydrogeologic investigations (characterization and delineation of soil, groundwater and soil vapor contamination); Feasibility Studies and pilot tests; development and implementation Remedial Action Work Plans, Remedial Designs (viable remedial technologies) and Site Management Plans; application of risk-based corrective action approaches; solid waste, hazardous waste and waste-water collection and treatment system management; indoor air quality surveys; soil vapor intrusion mitigation systems; design and implementation of dewatering systems; and, data evaluations and preparation of reports. Additional

Sean has provided technical support, performed contaminant modeling and has created exhibits in cases of expert witness testimony, and has represented clients before local and state agencies. He is often the liaison between the client and regulatory agencies and is the client representative tasked with citizen participation and public relations issues.

Sean Groszkowski (continued)

EDUCATION

B.A. in Geosciences, 1999, Franklin & Marshall College, Lancaster, Pennsylvania

TECHNICAL SOCIETIES AND LICENSES

Association of Ground Water Scientists and Engineers (National Ground Water Association)

American Academy of Environmental Engineers (Member)

Certified Professional Geologist – AIPG Member #: CPG-11657
American Institute of Professional Geologists

Transportation Worker Identification Credential (TWIC®) Card Holder

Secure Worker Access Consortium (SWAC) – (Membership in Process)
Port Authority of New York and New Jersey

US Coast Guard Captains License (25-Ton Masters) – Merchant Mariner Credential

CERTIFICATION & SKILLS

OSHA Health and Safety Operations at Hazardous Materials Sites, 29 CFR 1910.120(e) (3), 40 hours, with annual refresher courses

LPA-1 Lead Paint Inspection System (Currently Lapsed)

Extensive knowledge in standards, regulations, and laws of NYSDEC, NYS DOH, EPA, OSHA, NIOSH, and CDC

Excellent computer skills in: MS Office, MS Project, MS Access, ArcGIS, AutoCAD, AQTESOLV, Adobe, and miscellaneous additional programs.

CONTINUING EDUCATION

The New School (NYC) - April 2011
Environmental Law and Science for Policy Analysts and Sustainability Managers
Guest speaker selected to discuss Brownfield regulation and contaminant remediation technologies.

Vapor Intrusion Mitigation Technologies Presentation (By LST) 2012



Sean Groszkowski (continued)

SUMMARY OF PROFESSIONAL EXPERIENCE

2011 to present:

Senior Associate at Leggette, Brashears & Graham, Inc., White Plains, New York

2008 to 2010:

Associate at Leggette, Brashears & Graham, Inc., White Plains, New York

2005 to 2007:

Senior Hydrogeologist at Leggette, Brashears & Graham, Inc., White Plains, New York

2002 to 2004:

Hydrogeologist II at Leggette, Brashears & Graham, Inc., White Plains, New York

2000 to 2002:

Hydrogeologist I at Leggette, Brashears & Graham, Inc., White Plains, New York

1999 to 2000:

Project Manager at International Valuation and Inspection Environmental, Inc.
(IVI Environmental)

SOIL, GROUNDWATER & SOIL VAPOR CONTAMINATION EXPERIENCE AND RESPONSIBILITIES

Sean's career start as a project manager with an environmental consulting firm, performing Phase I Environmental Site Assessments for the purpose of due diligence. This provided him with direct experience of initial evaluations of properties for the purpose of assessing the risk of potential negative environmental impacts. The provided a very practical foundation for his future in Site characterization and development of remedial strategies for contaminated properties.

In the last thirteen years with LBG, Sean has managed and directed a large variety of soil groundwater and soil vapor contamination projects. He has prepared numerous technical reports on groundwater quality investigations and monitoring (as the principal technical editor of all major report sections). Some of Sean's current consulting and hydrogeologic experience and responsibilities (past and current) include:

- performance of ASTM-compliant Phase I ESAs;
- technical, financial, and personnel administration of environmental projects including construction oversight management;
- development of technical scopes of work, work plans, and cost estimates
- environmental permitting;
- subsurface remedial investigation work plan development for collection of subsurface characterization samples (soil, groundwater and soil vapor samples);
- Specification of sampling and analytical testing protocols;
- boring geologic formation evaluation;
- monitor/extraction/delineation/injection well design and installation;
- development of groundwater pumping test work plans and pumping test data evaluation;
- development of dual phase extraction (DPE) pilot tests and combined DPE and air sparge (AS) pilot test work plans and pilot test data evaluation;
- development of dewatering work plans to facilitate soil excavation activities;
- underground storage tanks/aboveground storage tank/chemical bulk storage tank registration, deregistration and closure activities;
- remedial alternatives analysis evaluations and feasibility studies;
- development of remedial system design;
- incorporation of alternative strategies to address site-specific geologic conditions (horizontal recovery wells in soils with low hydraulic conductivity);
- implementation of RCRA corrective action measures;
- collection and management of data;
- report preparation and technical review;
- litigation support for evaluation of contaminant fate and transport with respect to offsite impact;
- contaminant modeling to determine contributions for comingled plumes;
- environmental liability risk assessments; and
- third-party oversight; and,
- acting as community and regulatory agency liaison.

**SOIL, GROUNDWATER & SOIL VAPOR CONTAMINATION
EXPERIENCE AND RESPONSIBILITIES (continued)**

Sean has established a solid practical framework for his project management responsibilities through over 12 years of field work. With LBG, Inc. since 2000, Sean has had the opportunity to work in the environmental field through a period of rapid development of state programs to identify and address groundwater and water supply contamination issues, and apply state-of-the-art policy and technical practices to many site studies. He actively participated with the NYSDEC during the state's transition from the Voluntary Cleanup Program to the current Brownfield Cleanup Program. He managed the soil, groundwater and soil vapor quality components of projects at many sites subject to the directives of the VCP, BCP, RCRA, Superfund, and hazardous waste regulations. Some of Sean's field supervision experience and responsibilities (past and current) include:

- performance of Phase I environmental site assessments for property transactions and for development of subsurface investigations;
- field supervision of Phase II subsurface investigation activities;
- supervision of the installation of monitoring, extraction, delineation and injection wells (via GeoProbe, hollow stem auger, mud rotary, air rotary, jetting/water lifting, bedrock coring, and horizontal drilling);
- remedial construction management;
- supervision of excavation activities (C&D, non-hazardous and hazardous waste);
- C&D, non-hazardous and hazardous waste stream management;
- groundwater treatment and product recovery system engineering;
- Site characterizations using video scoping, electro-tracing and geophysical testing techniques;
- siting and feasibility studies;
- air and water discharge permit acquisition;
- indoor air quality and soil vapor intrusion sampling;
- supervision of short and long-term water and multi-phase pumping tests in consolidated and unconsolidated materials;
- supervision of air sparge and combined air sparge- dual phase extraction pilot tests;
- sampling of water from surface and subsurface sources;
- measurement of in-stream flow and stream shape parameters;
- measurements of groundwater and separate-phase hydrocarbon thicknesses in monitor wells;
- asbestos inspections and lead-based paint surveys.

SPECIFIC EXPERIENCE IN HAZARDOUS WASTE SITE REMEDIATION

Former Paint Manufacturing Facility

Mount Vernon, New York

Brownfield Cleanup Program Site

Project Manager responsible for technical management, environmental assessment oversight, site monitoring and hazardous waste remediation of several areas associated with a former paint and lacquer manufacturing facility including:

- Work plan preparations and collaboration with New York State agency representatives;
- installation of product delineation groundwater monitor wells;
- collection of multiple soil samples from each well location (at 5 foot intervals);
- assessments of soil vapor and indoor air samples for potential indoor air soil vapor intrusion impact;
- removal of interior flooring material (wood and concrete) from historical manufacturing areas to facilitate soil excavations and UST removals;
- design and installation of a sub-slab depressurization system;
- removal/closure of approximately 42 underground storage tanks, ranging in size from 275-gallon to 10-000 gallon capacity;
- excavation of interior 'hot spot' locations to remove free-phase saturated soil;
- management of characterization, disposal and filing requirements for hazardous waste streams generated from the onsite excavation activities (heavy metals, VOCs, polyurethanes);
- administration of a long-term groundwater monitoring program;
- development and implementation of groundwater pumping test work plans and slug test activities to assess onsite hydrogeologic characteristics;
- assessment of the Site geology and hydrogeology to assess remedial alternatives;
- installation of a two horizontal groundwater extraction wells to facilitate groundwater remediation as well as to create a hydraulic barrier at the property line to prevent offsite contaminant migration;
- installation of a horizontal soil vapor extraction well to facilitate remediation of inaccessible residual contaminated soil;
- maintenance of a boom system preventing free-phase leachate from entering an adjacent river.
- development and administration of citizen participation and community awareness activities; and,
- development of an interim remedial measure to perform long-term soil and groundwater remediation.
- development of a comprehensive Site Management Plan; and,
- Completion of annual Site certifications of implemented and functioning Engineering Controls and Institutional Controls.

SPECIFIC EXPERIENCE IN HAZARDOUS WASTE SITE REMEDIATION

(Continued)

**Former Plating Facility
Information Technology High School
Long Island City, New York
Voluntary Cleanup Program Site**

Project Manager responsible for technical management, environmental assessment oversight, site monitoring and hazardous waste remediation (heavy metals and chlorinated solvents) of several areas associated with a former metal plating facility (listed as a Class 2 Inactive Hazardous Waste Site) including:

- Work plan preparations and collaboration with New York State agency representatives;
- installation of product delineation and groundwater monitor wells (overburden and bedrock);
- collection and characterization of the subsurface soils;
- assessments of soil vapor and indoor air samples for potential indoor air soil vapor intrusion impact;
- removal of interior concrete slab throughout all of the slab on grade levels of the building;
- performance of 'hot spot' soil excavation activities in the interior of the building to remove soil contaminated with hazardous levels of heavy metals (primarily lead)
- design and installation of a sub-slab depressurization system;
- design and installation of a soil vapor barrier/concrete composite cover for interior restoration;
- design and implementation of a dewatering plan to facilitate the installation of an elevator at an elevation beneath the groundwater table;
- performance of 'hot spot' soil excavation activities in the exterior alleyway (former drum storage area) of the building to remove residual soil contaminated with hazardous levels of tetrachloroethylene (PCE);
- performance of 'hot spot' soil excavation activities in the exterior courtyard of the building to remove soil contaminated with hazardous levels of lead;
- management of characterization, disposal and filing requirements for hazardous waste streams generated from the onsite excavation activities (heavy metals and chlorinated solvents);
- administration of a long-term groundwater monitoring program;
- hydrogeologic assessment of the Site geology to assess remedial alternatives;
- installation of a two horizontal groundwater extraction wells to facilitate groundwater remediation as well as to create a hydraulic barrier at the property line to prevent offsite contaminant migration;
- installation of a combined remedial system incorporating sub-slab depressurization, soil vapor extraction wells and groundwater extraction to facilitate remediation of inaccessible residual contamination as well as protecting the indoor air from soil vapor intrusion;
- development and administration of citizen participation and community awareness activities;
- development of a comprehensive Site Management Plan; and,
- Completion of annual Site certifications of implemented and functioning Engineering Controls and Institutional Controls.

SPECIFIC EXPERIENCE IN HAZARDOUS WASTE SITE REMEDIATION

(Continued)

Dry Cleaners

Staten Island, New York

Voluntary Cleanup Program Site

Project Manager responsible for technical management, environmental assessment oversight, site monitoring and hazardous waste remediation (chlorinated solvents) of several areas associated with a former dry-cleaning facility (listed as a Class 2 Inactive Hazardous Waste Site) including:

- Work plan preparations and collaboration with New York State agency representatives;
- installation of lateral delineation groundwater monitor wells as well as vertical delineation cluster groundwater monitor wells;
- collection and characterization of the subsurface soils;
- assessments of soil vapor and indoor air samples for potential indoor air soil vapor intrusion impact;
- development of a horizontal trench SVE pilot test to assess feasibility of exterior SVE to address potential soil vapor intrusion issues as well as to remediate the residual vadose zone contamination;
- design and installation of a soil vapor barrier/concrete composite cover for mitigation of soil vapor intrusion issues;
- management of characterization, disposal and filing requirements for hazardous waste streams generated from the onsite excavation activities (heavy metals and chlorinated solvents);
- administration of a long-term groundwater monitoring program;
- background research of historical surface water features and local utility features potentially impacting subsurface groundwater flow paths;
- hydrogeologic assessment of the Site geology to assess remedial alternatives;
- development of a comprehensive Site Management Plan; and,
- Completion of annual Site certifications of implemented and functioning Engineering Controls and Institutional Controls.

SPECIFIC EXPERIENCE IN HAZARDOUS WASTE SITE REMEDIATION

(Continued)

Former Paint Manufacturing Facility

Brooklyn, New York

Voluntary Cleanup Program Site

Project Manager responsible for technical management, environmental assessment oversight, site monitoring and hazardous waste remediation of a former paint and lacquer manufacturing facility. The remedial investigation and cleanup activities have been and continue on the Site property as well as adjacent and surrounding properties due to offsite contaminant migration. Several specific key project responsibilities include:

- Work plan preparations and collaboration with New York State and New York City agency representatives;
- installation of product delineation wells and groundwater monitor wells;
- collection and characterization of the subsurface soils;
- assessments of soil vapor and indoor air samples for potential indoor air soil vapor intrusion impact;
- implementation of interim remedial measures to address significant contaminant source material (soil, dissolved phase and free phase product);
- removal of interior concrete flooring to facilitate soil excavation and UST removals;
- excavation of interior 'hot spot' locations via trench-box support to remove free-phase saturated soil;
- design and installation of a sub-slab depressurization system;
- removal/closure of 5 underground storage tanks, ranging in size from 1,080-gallon to 1,500 gallon capacity;
- design and installation of a soil vapor barrier/concrete composite cover for interior restoration;
- management of characterization, disposal and filing requirements for hazardous waste streams generated from the onsite excavation activities (heavy metals and VOCs);
- administration of a long-term groundwater monitoring program;
- development and implementation of groundwater pumping test work plan to assess onsite hydrogeologic characteristic;
- hydrogeologic assessment of the Site geology to assess remedial alternatives;
- development of dual phase extraction (DPE) pilot tests and combined DPE and air sparge (AS) pilot test work plans and pilot test data evaluation;
- development and implementation of a community wide soil vapor intrusion sampling round;
- development and administration of citizen participation and community awareness activities;
- development of final remedial design for long-term soil, groundwater, free phase product and soil vapor remediation;
- development of a comprehensive Site Management Plan; and,
- Completion of annual Site certifications of implemented and functioning Engineering Controls and Institutional Controls.

SPECIFIC EXPERIENCE IN HAZARDOUS WASTE SITE REMEDIATION

(Continued)

Former Coal-Fired Powerstation

Brooklyn, New York

Brownfield Cleanup Program Site

Project Manager responsible for technical management, environmental assessment oversight, site monitoring and hazardous waste remediation (PCBs, heavy metals, VOCs and SVOCs) of several areas associated with a former coal-fired powerstation. Several specific key project responsibilities include:

- completion of a preliminary Site environmental remedial cost impact assessment to evaluate the feasibility and potential liability of the property transaction;
- preparation of an initial interim remedial measures cost estimate to evaluate initial cleanup phase costs to address the majority of the onsite contamination 'hot spots';
- development and administration of citizen participation and community awareness activities;
- collaboration with various New York State and New York City agency representatives;
- Evaluation of multiple historical resources to develop a site development and use history for the purpose of identifying potential site areas for focusing remedial effort;
- detailed preparations to complete the required Remedial Action Work Plan outlining the future clean-up activities at the Site, including:
 - installation of product delineation wells and groundwater monitor wells;
 - development of all QQ/QC procedures of the completion of the project;
 - development of waste handling and decontamination procedures for the project;
 - development of a detailed work plan for sheeting (excavation support) and performing dewatering to facilitate the excavation of TSCA hazardous PCB contaminated soil at depth (20 ft bg);
 - development of site reconstruction plans and procedures;
 - development and implementation of required design investigation activities (slug tests, pumping test...);
 - development of site remedial alternatives analysis;
- management of characterization, disposal and filing requirements for hazardous waste streams generated from the onsite excavation activities (PCBs, heavy metals, VOCs and SVOCs);
- hydrogeologic assessment of the Site geology to assess remedial alternatives
- development of final remedial design;
- installation, implementation and OM&M of a potential long-term remedial system;
- administration of a long-term groundwater monitoring program;
- hydrogeologic assessment of the Site geology to assess remedial alternatives;
- development of a comprehensive Site Management Plan; and,
- Completion of annual Site certifications of implemented and functioning Engineering Controls and Institutional Controls.

SPECIFIC EXPERIENCE IN HAZARDOUS WASTE SITE REMEDIATION

(Continued)

Former Paint Manufacturing Facility

Brooklyn, New York

RCRA Facility Closure Activities

Project Manager responsible for technical management, environmental assessment oversight, site monitoring and hazardous waste management for activities related to the RCRA closure activities for a former paint and lacquer manufacturing facility. Several specific key project responsibilities include:

- Negotiations with the New York State and Federal representatives to ensure the client maintained the authority to manage the RCRA Closure activities;
- RCRA Closure Work Plan preparations and collaboration with New York State, New York City and federal US EPA agency representatives;
- Oversight for the characterization, waste disposal facility locating, and waste disposal activities for over 200 drums of RCRA waste with varying waste classifications (and hazardous waste characteristics);
- Management of Chemical Bulk Storage (CBS) tanks associated with historical manufacturing activities;
- management of characterization, disposal and filing requirements for hazardous waste streams generated from the closure activities (heavy metals and VOCs);
- negotiations and acquisition of a site-specific waiver for waste consolidation to minimize disposal costs associated with like wastes;
- acquisition of required permits to facilitate all closure activities;
- project coordination with client and additional responsible parties (financial guarantor and legal representatives); and,
- Completion RCRA Closure Summary Report.

SPECIFIC EXPERIENCE IN SURFACE WATER

Westchester County, New York

Completion of volume calculations for a local watershed drainage-basin and a subsequent impact assessment. This was completed to evaluate potential sheet-flow runoff values for impact to a downgradient property.

Westchester County, New York

Golf Course Monitoring

Performance of stream flow calculations via cross-sectional flow analysis as well as by using weir calculations. The stream flow calculations were used in conjunction with surface water laboratory analytical results to assess potential impact to the surface water from the golf course operations.

Various Sites in New York

Completion of and implementation of Storm Water Pollution Protection Plans (SWPPP) for various construction sites. These SWPPPs include the institutional controls for ensuring proper management of Site activities as well as the installation and operation of project-specific infrastructure to ensure proper materials management.

SPECIFIC EXPERIENCE IN AIR QUALITY INVESTIGATIONS

Project Sites:

New Rochelle, New York

LBG performed an assessment of an industrial building located downgradient of a listed BCP Site. The upgradient Site is responsible for a chlorinated solvent plume that is migrating beneath the Site. LBG performed additional subsurface characterization activities to characterize the onsite extent of the contamination. To ensure protectiveness of the indoor air quality, LBG designed and installed a lateral trench sub-slab depressurization system to prevent the build-up of chlorinated solvent vapors beneath the building slab. Although the SSDS piping network was installed with the intent to be passive, it was designed with connections which enable connection to a portable vacuum blower for periodic active high vacuum extraction quantitative dye trace activities to determine discharge paths for interior utility pipes; water jetting video scoping activities; interior and exterior excavation activities to repair utility pipes/conduits.

Cortlandt Manor, New York

Performed a Property Impact Assessment (PIA) to evaluate potential property exposure from metals migrating onsite as wind-blown dust in ambient air from an adjacent landfill. The air sampling consisted of dust wipe sample from the interior and exterior of the onsite building/structure as well as active air sampling from an air sampling station.

Industrial Hygiene Monitoring

Marshall, Michigan

Responsible for the management of monitoring personnel to provide a safe environment for the petroleum spill cleanup activities. Responsible for the collection of personal benzene air samples as well as multi-gas monitoring to ensure safe work environments for employees during cleanup work.

Indoor Air Quality Studies

NYC Public High School

Coordinated and conducted numerous indoor air quality studies at various locations as part of the Site Management Plan. The indoor air quality surveys were the result of nuisance odors observed throughout the school that impacted normal function. Responsible for the review of data and reports.

Indoor Air Quality Study

Mammaroneck NY

Responsible for conducting an indoor air quality study for nuisance odors within a single family residence associated with a petroleum spill at an adjacent gasoline station. Responsible for the review of data and reports.

Soil Vapor Intrusion Investigations

Multiple Sites in New York

Responsible for the development and performance of soil vapor intrusion investigations associated with BCP and VCP sites. The results of the investigations are reviewed and presented in report format with a comparative analysis using the NYS Dept. of Health indoor air guidance document for indoor air soil vapor intrusion. Where necessary, LBG developed and implemented mitigation actions to ensure protectiveness at respective Sites.

SPECIFIC EXPERIENCE IN PETROLEUM SPILL CLEANUP RESPONSE

Project Sites:

Dobbs Ferry, NY

Conduct emergency response investigation and coordinate cleanup in response to a fuel oil above ground storage tank overfill at a commercial building. The project involved management of interactions with multiple state and local agencies. The spill impacted commercial spaces of which several hundred people frequented daily. As a result, company operation shut-downs were required. LBG directly performed tasks including, but not limited to: project management, field supervision, data evaluation, waste consolidation and disposal, health and safety and decontamination oversight.

Marshall, Michigan

Conduct emergency response investigation and coordinate cleanup in response to pipeline spill. All activities were performed under multiple regulatory agencies. As a representative of LBG, the primary responsibility was for fulfilling the role of operations inspector. This role required the management and coordination of 4-20 contract personnel involved in the cleanup of submerged oil recovery along the Kalamazoo River. In addition to the field management, responsibilities also included participating in the development of daily operation assignments as well as daily periodic progress updates and end-of-day progress meetings. Due to the nature of the contamination as well as the regulatory requirements, health and safety monitoring was a continuous aspect of the project. At times, this resulted in required decontamination activities, for which LBG was responsible for the oversight.

SPECIFIC EXPERIENCE IN PROPERTY TRANSFER ASSESSMENTS

Project Sites and Responsibilities:

Phase I Environmental Site Assessments

Project Manager responsible for the completion of over 100 Phase I ESAs in New York, New Jersey and Connecticut. Projects performed for various lending institutions, developers, governmental agencies, private property owners, non-profit organizations, and others. The Phase I ESAs were prepared in accordance with the American Society for Testing & Materials (ASTM) standard E1527-05 and the All Appropriate Inquires (AAI) where applicable. In addition, many of the ESAs have been completed in accordance with client specific needs to augment the ASTM standard. When applicable, Phase II ESAs have been designed and implemented based on the findings of the Phase I ESAs.

New York, New York

Performed Phase I Environmental Site Assessment for a 42-story office building in New York City's Financial District. Included in the assessment was asbestos sampling and lead-based paint analysis.

Due Diligence for a Multiple Property Portfolio Transactions

White Plains, New York

Performed Phase I Environmental Site Assessments for multiple office park building to facilitate a property portfolio sale. The results of the status reviews for these sites were used in the determination of action for the transaction.

Due Diligence for a Multiple Property Portfolio Transactions (East Coast)

Provided file review for historical environmental reports that were available for multiple sites that were the part of a property portfolio sales transaction. The results of the status reviews for these sites were used in the determination of action for the transaction.

Detroit, Michigan

Performed a detailed asbestos survey for multiple-apartment building complex for Department of Housing and Urban Development (HUD).

SPECIFIC EXPERIENCE IN LITIGATION SUPPORT

Hauppauge, New York

Analysis of an industrial facility and a dry cleaners with multiple and overlapping plumes of chlorinated solvents. The project analysis consisted of trying to determine the source and origin of the various plumes constituents and reviewing of many project investigation and characterization documents. Additionally, LBG developed calculations of contaminant mass contribution volumes to determine client responsibility. The site assessment also incorporated groundwater modeling using the Quick Domenico (QD) analytical fate-and-transport model to predict downgradient concentrations and the resultant contribution to the comingled contaminant plume.

SPECIFIC EXPERIENCE IN GROUNDWATER CONTAMINATION

Project Sites and Responsibilities:

Brooklyn, New York

Project hydrogeologist for a step-pumping test of two newly redeveloped recovery wells. An investigation and remediation project at a former petroleum terminal underlain by several million gallons of free-phase product. Activities included supervising the installation of groundwater monitor wells, geologic sampling, recovery-well step testing and shut-down testing. Responsibilities included monitoring and adjusting pump rates and analysis of pumping test data with respect to specific capacity of the recovery wells.

Massapequa, New York

Conducted a remedial investigation and designed/installed a treatment system at a private residence. Activities included subcontractor coordination and supervision, application of bioremediation product and report preparation.

Oceanside, New York

Project hydrogeologist for an investigation project at a former petroleum bulk storage facility. Acquired soil samples at limited access sites using the hand-auger technique. Installed micro-wells for groundwater sampling.

New York, New York

Project Hydrogeologist for a 4-well dewatering project. The project Site (adjacent to the East River) required installation of four 8-inch diameter dewatering wells and SPDES discharge permitting. The dewatering activities were performed over a 2-week period.



Brian Hawe's hydrogeologic experience includes collection of soil and groundwater samples; drilling supervision and sampling during the installation of groundwater monitor and recovery wells; development and test pumping of recovery wells, monitor well design; air-sparging (AS)/soil-vapor extraction (SVE) system maintenance; supervision of underground storage tank (UST) and hazardous soil removal; and, installation of soil vapor sampling points.

Brian's field supervision duties include the installation of monitor and bedrock wells by using hollow-stem auger and air rotary; and the installation of horizontal wells using horizontal drilling techniques. In addition to well installation, Brian has supervised short and long-term pumping tests from environmental extraction wells and water supply wells.

EDUCATION

B.S. in Environmental Science, minor in Geology, 2003, University of Delaware, Newark, Delaware

CONTINUING EDUCATION

Health and Safety Operations at Hazardous Materials Sites, 29 CFR 1910.120(e) (3), 40 hours, with annual updates

SUMMARY OF PROFESSIONAL EXPERIENCE

2005 to present:

Hydrogeologist at Leggette, Brashears & Graham, Inc., White Plains, New York

2004 to 2005:

Field Technician at Baltec, Inc., Brewster, New York

SPECIFIC EXPERIENCE IN GROUNDWATER CONTAMINATION

Mount Vernon, New York

Supervised the Voluntary Cleanup of a Brownfield property involving the removal of USTs, excavation of contaminated soil, installation of both horizontal and vertical monitoring wells, installation of soil vapor sampling points, supervision of several pumping tests and reconstruction activities.

Rochester, New York

Completed Phase I Environmental Site Assessment on 2.1 million square foot facility.

Multiple Locations

Supervised UST removal as well as soil excavation; and, gauged and sampled monitor wells.



David Morelli, based in the firm's White Plains, New York office, manages a wide range of environmental projects including hydrogeological investigations, environmental site assessments, and the development and implementation of remedial strategies. Dave is acutely familiar with Federal, State and Local regulations throughout New York State/City and Tri-State Area and has developed working relationships with representatives and case managers of these agencies.

Dave's experience with soil and groundwater remediation includes feasibility study and cost analysis, budget management, regulatory report preparation, and design and implementation of in-situ and ex-situ remedial programs such as air-sparging/soil-vapor extraction (AS/SVE), multi-phase extraction (MPE), bioremediation technologies, in-situ chemical oxidation (ISCO), surfactant injection, and monitored natural attenuation modeling.

Dave's field experience includes supervision of underground storage tank (UST) closures and removal of contaminated soil; drilling supervision (hollow-stem auger, mud-rotary, air rotary and rock coring) and well development; groundwater pumping/recovery testing; the collection of water from surface and subsurface sources; operation and maintenance of soil and groundwater remediation systems; and soil-vapor surveys.

His extensive experience with current investigative and remedial technologies have benefited his client's with lower cost solutions to complex site conditions. His communication and problem solving abilities have enabled beneficial outcomes for his clients with regulatory agencies and other counterparties.

EDUCATION

M.S. in Geological Oceanography, 2002, University of Rhode Island, Graduate School of Oceanography, Narragansett, Rhode Island

B.S. in Geology, 1999, University of Rhode Island, Kingston, Rhode Island

CONTINUING EDUCATION

Health and Safety Operations at Hazardous Materials Sites, 29 CFR 1910.120(e) (3), 40 hours, with annual updates

Hazardous Waste Operations and Emergency Response Supervisor, 29 CFR 1910.120, 8 hours, with annual updates

Hazard Communications (HAZCOM) with Global Harmonization System (GHS), 29 CFR 1910.1200

Excavation Trenching and Shoring (Competent Person), 29 CFR 1926.650

MTBE & Other Fuel Oxygenates: Comprehensive Site Assessment and Successful Ground Water Remediation, American Petroleum Institute (API), Long Island Ground Water Institute (LIGRI), 2004

SUMMARY OF PROFESSIONAL EXPERIENCE

2006 to present:

Senior Hydrogeologist at Leggette, Brashears & Graham, Inc., White Plains, New York

2002 to 2005:

Hydrogeologist II at Leggette, Brashears & Graham, Inc., White Plains, New York

SPECIFIC EXPERIENCE IN GROUNDWATER CONTAMINATION

New York State

2006 through present, Project Manager for an annual average of 80 to 100 retail petroleum remediation sites concurrently. During this time period, approximately 150 NYSDEC Case numbers for various retail petroleum locations have been closed with a "No Further Action" status. Activities have included design and installation of various in-situ and ex-situ remediation systems and programs, environmental reserve preparation, strategic planning using a tiered method of prioritizing and selecting sites for investigation and remediation, coordination of field personnel, report preparation and review, and budget development and management.

Troy, New York

Supervised and directed all field activities associated with the excavation, transportation and disposal of over 2,000 tons of petroleum contaminated soil along with the treatment and discharge to storm sewer of over 200,000 gallons of groundwater during a gasoline station renovation. A "No Further Action" letter was received from NYSDEC.

Elmont, New York

Project hydrogeologist for a hydrogeologic investigation to delineate the horizontal and vertical extent of an MTBE plume which was encountered 40 to 75 feet below the water table and extended over 3,400 feet offsite and directly adjacent to a municipal water supply well. The width of the plume ranges from 150 feet to 500 feet along its length. The investigation consisted of 24 multiple-level wells; each multiple-level well was constructed with 18 individual sampling points set at 5 foot depth intervals down to 100 feet below grade. The investigation and remedy is currently ongoing.

Oceanside, New York

Designed and implemented an Exposure Assessment for a petroleum release from a former gasoline station. Activities included fate and transport modeling of the existing petroleum plume, the design of a monitored natural attenuation groundwater sampling program, data interpretation, modeling and conducting a limited risk assessment for quantitatively determining risk factors for human contact with volatile organic compounds through various exposure pathways. NYSDEC closed the case number associated with the site as a direct result of the Exposure Assessment report.

Brooklyn, New York

Project hydrogeologist for the decommissioning of a former paint manufacturing facility; including numerous subsurface investigations, hazardous waste removal, groundwater monitoring. Development and implementation of remedial strategies are in progress.

**SPECIFIC EXPERIENCE IN GROUNDWATER CONTAMINATION
(continued)**

Mount Vernon, New York

Project hydrogeologist for the decommissioning of a former paint manufacturing facility; including numerous subsurface investigations, hazardous waste removal, groundwater monitoring. Development and implementation of remedial strategies are in progress.

Croton-on-Hudson, New York

Project hydrogeologist for a surface-water and groundwater monitoring program at an 18-hole private golf club. Samples collected on a quarterly basis from streams, monitor wells and potable residential wells and analyzed primarily for the presence of pesticides which were used on the golf course. Samples are also collected during defined storm events when significant overland flow is occurring. Sampling protocols follow a strict Site Management Plan audited by an outside firm.

Pound Ridge, New York

Project hydrogeologist for a five well 72-hour step rate pumping test, which included the monitoring of 22 offsite residential wells. Conducted data analysis and interpretation and participated in report preparation. The project was completed at the site of a proposed 18-hole golf course which was developed as a result of the successful test.

Schenectady, New York

Project hydrogeologist for multi-phase extraction remediation project. Activities include groundwater sampling, sampling of remediation system fluids, operation and maintenance of multi-phase extraction remediation system.

Cedarhurst, New York

Project hydrogeologist for several subsurface investigations and remediation projects at an active gasoline station. Activities include supervision of groundwater monitor well installation, soil sample collection, groundwater sample collection and product recovery.

Staten Island, New York

Project hydrogeologist for investigation in the vicinity of a former dry cleaning facility. Delineation of the horizontal and vertical extent of chlorinated solvent contamination within the soil and groundwater. Activities included determination of groundwater flow direction, vertical and horizontal extent of DNAPL, and source area concentrations.

SPECIFIC EXPERIENCE IN PROPERTY TRANSFER ASSESSMENTS

New Jersey, New York and Connecticut

Completion of site inspections and reporting for property transfer Environmental Site Assessments (ESA) since 1999. Typically these ESAs are completed in accordance with the ASTM Standard E1527, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process. In addition, many of the ESAs have been completed in accordance with client specific needs to augment the ASTM standard. When applicable, Phase II ESAs have been designed and implemented based on the findings of the Phase I ESAs. ESAs have been prepared for clients seeking financing to purchase real property for investigation purposes and selling real property.

Long Island City, New York

December 2000 to present. Supervised a Voluntary Cleanup Program and was responsible for project management, including subsurface investigation, groundwater sampling, hazardous waste removal, vapor barrier design, remedial system design, construction and implementation, operation and maintenance, and was responsible for the Health and Safety of onsite personnel. Also responsible for conducting a Community Air Monitoring Program, consisting of real-time air monitoring of volatile organic compounds and particulate concentrations.

APPENDIX E

Community Air Monitoring Plan

**QUEENS MEDALLION LEASING
21-03 44TH AVENUE
LONG ISLAND CITY, NEW YORK**

**COMMUNITY AIR MONITORING PLAN
NYSDEC SITE NO. C241144**

Prepared For

Exclusive Realty Services, LLC

May 2014

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**QUEENS MEDALLION LEASING
21-03 44TH AVENUE
LONG ISLAND CITY, NEW YORK**

**COMMUNITY AIR MONITORING PLAN
NYSDEC SITE NO. C241144**

1.0 INTRODUCTION

Exclusive Realty Services, LLC (heretofore referred to as “ERS” or the “Volunteer”) is undertaking the remediation of the property located at 21-03 44th Avenue in Long Island City, Queens, New York (heretofore referred to as the ‘Site’). A Site Location Map is shown on figure 1. The Site is located in Long Island City, which is an urban setting in an area that has historically been used for manufacturing purposes. The Site consists of a two-story building and a small area of land. The Site is located on the southwestern corner of the city block bounded by 21st Street to the west, 44th Avenue to the south, 43rd Avenue to the north, and 22nd Street to the east. A site plan is shown on figure 2.

On January 7, 2014, the application for entry of the Site into the Brownfield Cleanup Program (BCP) was approved by the New York State Department of Environmental Conservation (NYSDEC). On January 16, 2014, the completed Brownfield Cleanup Agreement (BCA) for the Site was executed by both the NYSDEC and ERS. Under the NYSDEC BCP, the Site Name is listed as Queens Medallion Leasing and is recorded as Site No. C241144.

On behalf of ERS, Leggette, Brashears & Graham, Inc. (LBG) has developed a Supplemental Remedial Investigation Work Plan (SRIWP) for the Site to meet requirements set by NYSDEC. LBG has prepared this Community Air Monitoring Plan (CAMP) as a supplemental governing document in association with the SRIWP.

This CAMP will be implemented during the drilling activities at the Site (or other ground invasive activities that involve moving existing Site soils around or off the Site) in connection with supplemental remedial investigation. Specifically, this CAMP outlines the air quality monitoring procedures to be followed to protect the surrounding/downwind community (i.e., offsite receptors, including residents and workers) from potential airborne contaminant releases that may be generated as a direct result of the Project activities. This CAMP is con-

sistent with the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan (included as Appendix I).

The Site is located adjacent to 21st Street and 44th Avenue. A Site Plan is shown on figure 2. The Site was historically an industrial facility that performed metal plating approximately 20 to 25 years ago. Presently, the Site has been renovated, and is occupied by Queens Medallion Leasing. No industrial activity has taken place at the Site since 1996. As a result of the historical property uses, the subsurface environmental condition at the Site has been negatively impacted by various contaminants.

Based on the historical investigations performed at the Site, the contaminants of concern (COC) are chromium and perchloroethylene (PCE) a chlorinated volatile organic compound (VOC). The COCs which were detected at concentrations exceeding applicable soil cleanup objectives and groundwater quality standards, were observed to be present beneath the Site as well as upgradient and downgradient of the Site. Prior investigations for the Site were conducted by Vertex Engineering Services, Inc. (Vertex) in 2004, Galdun Frankel Environmental (GFE) in 2005 and LBG in 2007.

Additionally, a NYSDEC Superfund investigation was performed by ARCADIS Malcolm Pirnie, Inc. in relation to the area-wide PCE groundwater contaminant plume. As a result of the investigation and conclusions of the Remedial Investigation Report (RIR) the NYSDEC has labeled the Site a contributor of hexavalent chromium contamination and a potential contributor to the chlorinated volatile organic compound (CVOC) contamination.

As a result of the Superfund investigation RIR, the NYSDEC is requiring limited supplemental remedial investigation activities to ensure that no residual contaminant source areas are present beneath the Site.

2.0 SUPPLEMENTAL REMEDIAL INVESTIGATION SCOPE OF WORK

In order to address whether a potentially unidentified source area is present beneath the Site, an area-specific Supplemental Remedial Investigation (SRI) will be performed at the Site. The SRI will be comprised of a limited subsurface investigation, which will consist of advancing one (1) soil boring at the Site in the location of the former subsurface structure VSS-9.

The proposed soil boring will be installed using the GeoProbe drilling method. The location of the proposed soil boring is presented on figure 3.

During the drilling, continuous soil samples will be collected at 5-foot intervals from grade to approximately 25 ft bg (feet below grade) (or the top of the bedrock surface). The soil samples will be evaluated in the field and recorded on geologic logs by the onsite LBG hydrogeologist. The geologic log will also document the depth at which the groundwater interface is identified. Each sample will be screened for the presence of petroleum components using a photoionization detector (PID). Soil samples will be collected from the soil boring at two intervals: 1) one sample from the vertical interval which exhibits the highest PID concentration as observed during the field screening; and 2) one from the top of bedrock. In the event no significantly elevated PID concentrations are observed, the two (2) soil samples will be collected from the following two intervals: 1) one from the approximate groundwater interface; and 2) one from the top of bedrock. All soil samples will be collected in laboratory supplied sample jars and stored in a cooler on ice. Samples will be shipped under chain of custody to a New York State approved laboratory for analysis of VOCs and Target Analyte List (TAL) metals and hexavalent chromium. The analytical laboratory results for the soil sample will be compared to the Restricted Use Soil Cleanup Objectives (RUSCOs) in accordance with the Standards, Criteria and Guidance (SCGs) as outlined in 6 NYCRR Part 375-6.8(b) for the selected land use of Restricted Commercial.

Following the collection of the soil samples from the soil boring, the soil boring will be backfilled. In the event that the soil extracted from the boring does not exhibit elevated levels of VOCs (via the field PID screening) or visual evidence of impact, the cuttings will be used for backfilling the boring. In the event that elevated VOCs or visual evidence of impact is observed, the following procedure will be followed:

- all soil will be drummed onsite in a New York State Department of Transportation (NYSDOT) approved 55-gallon drum;
- the completed soil boring will be backfilled with clean sand to approximately 6 inches below grade;
- the drummed soil will be sampled and submitted to a New York certified laboratory for waste characterization analysis; and,

- following waste characterization, the soil cuttings will be shipped offsite to a certified disposal facility permitted for the waste.

Following the soil sampling and backfilling, the surface of the boring will be restored to its original condition as documented prior to the completion of the soil boring.

Following the SRI, a Remedial Investigation Report (RIR) describing the results of the subsurface investigation field activities will be prepared. The report will include methodologies and procedures of all field work, geologic log for the soil boring, laboratory analytical reports and results presented in tabular and map form. The results of the investigation will be used to characterize the environmental status of the subsurface beneath the Site. This data will then be used to evaluate potential remedial alternatives for the Site (presented as an Alternatives Analysis) and to select a preferred remedial alternative (presented as a Remedial Action Work Plan).

3.0 AIR MONITORING PROCEDURES FOR INTRUSIVE ACTIVITIES

Odor, dust and other nuisances will be maintained within acceptable levels to be protective of the health and safety of onsite workers and the community, and to minimize any potential impact to the community.

The monitoring programs and action levels for odor, dust and other nuisances are established in the Health and Safety Plan (HASP). The procedures below outline the monitoring programs as well as the passive mitigation measures inherent in the design of the SRIWP followed by active measures which can be taken to prevent/should an action levels be exceeded.

In the event that the action level is exceeded for odor and/or dust and/or other nuisances, it will likely be exceeded first in the work zone before being exceeded at the Site perimeter. Ongoing monitoring within the work zone and if necessary, immediate mitigation of potential impacts as action levels are approached will therefore serve to prevent action levels being exceeded at the Site perimeter.

Air monitoring will be performed during the following activities: ground invasive work; handling of free-phase product/non-aqueous phase liquid (NAPL); and any other activi-

ties which may release VOCs or particulates into the atmosphere. As such, the monitoring will ensure the prevention of over exposure to workers at the Site as well as tracking and minimizing the potential for negative impact to properties surrounding the Site.

Frequent air monitoring will be conducted at 30-minute intervals within the 20 Foot Zone. The monitoring frequency may be modified to conform with the requirements of the onsite activities. Determinations on the required monitoring frequency will be made by the Health and Safety Officer (HSO). The results of all air monitoring activities will be recorded on daily air monitoring logs. A copy of the air monitoring field sheet is presented as Appendix II.

3.1 Particulates/Dust

The air will be monitored in real-time during the drilling activities (or other ground invasive activities that involve moving existing Site soils/fill around or off the Site). Of note, the CAMP will remain in effect during the performance of future excavation or remediation activities. As a result, monitoring and potentially mitigation activities will be performed to ensure minimal impact to the workers onsite as well as the surrounding community.

3.1.1 Particulates/Dust Monitoring

Air monitoring for particulates (i.e., dust) will be performed continuously during any drilling, excavation or ground invasive activities using both air monitoring equipment and visual observations. Monitoring equipment capable of measuring particulate matter smaller than 10 microns (PM-10) and will be used to monitor upwind (background), work zone and downwind locations, at heights approximately 4 feet to 5 feet above land surface (i.e., the breathing zone). This equipment will log instantaneous concentrations for subsequent reporting. Upwind work zone and downwind concentrations will be measured at the start of each workday and periodically throughout the day (at 30 minute to 1 hour intervals) thereafter to establish background conditions. The CAMP coordinator (the onsite field supervisor or HSO) will record the wind direction and speed as described below. These readings will allow the CAMP coordinator to ensure that CAMP monitoring locations are appropriate based upon the wind

direction. The particulate monitoring equipment will be calibrated at the start of each day and as necessary throughout the day. The monitoring results will be compared to the following:

- If the downwind PM-10 particulate level is 100 ug/m³ (micrograms per cubic meter) greater than background (upwind perimeter) or if airborne dust is observed leaving the work area, then dust suppression techniques shall be employed. Work may continue with dust suppression techniques, provided that downwind PM-10 particulate levels do not exceed 150 ug/m³ above the upwind level and provided that no visible dust is migrating from the work area. (Dust suppression techniques will also be applied in other circumstances as described in the HASP).
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 ug/m³ above the upwind level, work will cease. The situation will be re-evaluated and changes implemented to ensure particulate levels are less than 150 ug/m³ above background conditions and to prevent visible dust migration.

Wind speed and wind direction will be observed and recorded continuously throughout the day. Meteorological data including temperature and barometric pressure will be recorded at a minimum once a day. These results will be utilized to position the particulate monitoring equipment in appropriate upwind and downwind locations.

There may also be situations where visible dust is generated by excavation activities and migrates to downwind locations but is not detected by the monitoring equipment at or above the action levels. Therefore, if visible dust is observed leaving the working area, dust suppression techniques such as those described in the SRIWP and/or HASP will be employed.

If dust suppression techniques do not lower particulates to 150 ug/m³ below background or if visible dust persists, additional measures, including work suspension if necessary, will be implemented to remedy the situation.

All air monitoring data, meteorological data, and the monitoring locations will be recorded in the daily air monitoring logs and will be available for NYSDEC and NYSDOH review.

3.1.2 Dust Control Plan

Dust emissions can occur from hauling debris and traffic over unpaved areas. All appropriate fugitive dust control measures will be employed to reduce the generation and spread of dust, and to ensure that the New York City Air Pollution Control Code regulating construction-related dust emissions is followed.

This dust control plan consists of passive and active mitigation measures capable of controlling emissions of dust during invasive onsite and/or offsite work. The following sections outline potential dust mitigation measures which may be utilized at the Site:

3.1.2.1 Passive Mitigation Measures

Passive mitigation measures for excessive dust generation include:

- most of the excavated materials will be moist to wet and have a low potential for dust generation;
- most of the excavation work will occur below grade, which will serve to reduce the wind generation of dust and the spread of dust;
- the in situ waste classification and “load-and-go” approach (if utilized) will reduce the amount of dust generation associated with the double-handling of waste;
- rollofts will be covered and waste will be covered when not being excavated;
- the waste haul route will be directed through the industrial area to the east of the landfill mitigating the potential for increased dust in the residential areas; and,
- onsite roads will be limited in total area to minimize the area required for water spraying.

In the event that a dust action level is exceeded, the Contractor will identify the source of the elevated dust and take immediate steps to reduce dust to acceptable levels. The specific action taken will depend on the source of the elevated dust. Potential mitigation measures that the Contractor may use are presented below.

3.1.2.2 Active Mitigation Measures

Active mitigation measures for excessive dust generation include:

- dust suppression will be achieved through the use of water misting (provided by onsite municipal water);
- the rate and height of waste release from the excavator bucket into the trailers will be monitored to minimize dust generation;
- work may be suspended if conditions of high dust generation cannot be controlled; and,
- vehicles will be decontaminated before departing the Site.

The Contractor will maintain a supply of dust control material onsite. Dust control materials may include water spraying or application of materials like wood chips.

3.2 Volatile Organic Compounds/Odors

The air will be monitored in real-time during the drilling activities (or other ground invasive activities that involve moving existing Site soils/fill around or off the Site). As a result, monitoring and potentially mitigation activities will be performed to ensure proper personal protection equipment (PPE) is utilized by workers, to minimize impact to the workers onsite as well as minimize impact to the surrounding community.

3.2.1 Volatile Organic Compound Monitoring

Air monitoring for VOCs will be performed continuously during the drilling activities or ground invasive activities and/or handling/disruption of contaminated materials (concurrent with particulate monitoring). This activity description includes handling of contaminated soil or groundwater, as well as any other activities which may release VOCs into the atmosphere. The monitoring will ensure the prevention of over exposure to workers at the Site and to citizens surrounding the Site.

VOCs will be monitored at the downwind perimeter of the immediate work area or Site perimeter on a continuous basis. Upwind concentrations will be measured at the start of each workday and periodically thereafter (not less than three times per day) to establish background conditions.

The monitoring work will be performed using equipment appropriate to measure the types of contaminants known to be present at the Site. This equipment will consist of a MiniRAE 2000 PID or equivalent PID capable of detecting total hydrocarbons at a sensitivity of 0.1 ppm (parts per million). The equipment will be calibrated daily at a minimum.

While performing the air monitoring activities, the following qualifying criteria will dictate required actions with respect to onsite work activities as well as required mitigation procedures.

- If the ambient air concentration of organic vapors exceeds 5 ppm above background at the perimeter of the work area, activities will be halted and monitoring continued. If the organic vapor level decreases below 5 ppm above background, work activities can resume. If the organic vapor levels are greater than 5 ppm over background but less than 25 ppm over background at the perimeter of the work area, activities can resume provided the organic vapor level 200 feet downwind of the work area or half the distance to the nearest residential or commercial structure, whichever is less, is below 5 ppm over background.
- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities will be shutdown. When work shutdown occurs, downwind air monitoring as directed by the Safety Officer will be implemented to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Major Vapor Emission section.
- If any organic levels greater than 5 ppm over background are identified 200 feet downwind from the work area or half the distance to the nearest residential or commercial property, whichever is less, all work activities will be halted.
- If, following the cessation of the work activities, or as the result of an emergency, organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the work area, then the air quality will be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20 Foot Zone).

If efforts to abate the emission source are unsuccessful and if the following levels persist for more than 30 minutes in the 20 Foot Zone, then the Major Vapor Emission Response Plan shall automatically be placed into effect. Additionally, the Major Vapor Emission Response Plan shall be immediately placed into effect if organic vapor levels are greater than 10 ppm above background. Upon activation, the following activities will be undertaken:

- All regulatory agency Project Contacts as listed in the HASP of the SRIWP will be notified.
- Frequent air monitoring will be conducted at 30-minute intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the HSO.

The location of air monitoring stations will vary based on wind direction and will be determined daily by the onsite supervisor (HSO, project manager, etc.). The location of air monitoring stations for each day's activities will be recorded in the Daily Report.

Exceedances observed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers and included in the Daily Report.

3.2.2 Odor Control Plan

This odor control plan consists of passive and active mitigation measures capable of controlling emissions of nuisance odors onsite and offsite. The following odor mitigation measures may be utilized at the Site: VOC and/or nuisance odor emissions can occur from excavation activities, hauling debris and traffic over unpaved areas. All appropriate odor control measures will be employed to minimize the potential for negative impact to the surrounding community.

The following sections outline potential odor control measures which may be utilized at the Site.

3.2.2.1 Passive Mitigation Measures

Passive mitigation measures VOC/odor impacts to surrounding properties include:

- If possible, in-situ waste classification and “load-and-go” approach may be utilized to reduce the amount of odor generation associated with the total surface area and duration of exposure from stockpiles, and from the double-handling of waste.
- Open excavations that are not being actively excavated may be shrouded with tarps and/or other covers.
- Roll-offs will be covered with plastic polyethylene liner.
- The waste trucking route will be directed through an approved truck route, mitigating the potential for increased odor in the residential areas.
- Trucks transporting wastes offsite will be covered.

3.2.2.2 Active Mitigation Measures

Active mitigation measures include:

- The rate of work may be slowed or suspended in times of high odor release.
- Highly odoriferous processes may be limited to specific times of day, temperatures or wind conditions.
- If necessary, an odor control system utilizing a non-toxic, odor neutralizing solution, such as “airSolution” (Ecolo Odor Control Systems) or an odor controlling foam may be used at the Site.
- In the event that odor cannot be controlled within the work area and/or the community, excavation of odoriferous waste may be suspended during times when winds are blowing toward the residential areas, warm weather, and/or during times of day when there is generally a higher public presence outside (commuting times, lunch hour and after school).
- Where odor nuisances have developed during remedial work and cannot be corrected, or where the release of nuisance odors cannot otherwise be avoided due to onsite conditions or close proximity to sensitive receptors, odor control will

be achieved by sheltering excavation and handling areas under tented containment structures equipped with appropriate air venting/filtering systems.

If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of all other complaints about the project. Implementation of all odor controls, including the halt of work, will be the responsibility of the Volunteer and performed under the direction of the Volunteer's Remedial Engineer, who is responsible for certifying the Final Engineers Report (FER).

4.0 ADDITIONAL NUISANCE CONTROL PLAN

In addition to the outlined air monitoring activities, the completion of the onsite remediation and construction activities will comply with applicable control measures for construction noise as well as rodent control.

4.1 Noise Control Plan

Noise levels are expected to remain below the action level at the Site perimeter. In the event that a noise action level is exceeded, the Contractor will identify the source of the elevated noise and take immediate steps to reduce noise to acceptable levels. The specific action taken will depend on the source of the elevated noise and may include, for example, installation of a barrier wall, turning off all idling vehicles or removing a piece of equipment from service.

Construction noise is regulated by the New York City Noise Control Code and by the Environmental Protection Agency noise emission standards for construction equipment. These federal and local requirements mandate that certain classifications of construction equipment and motor vehicles meet specified noise emissions standards. Except under exceptional circumstances, construction activities must be limited to weekdays between the hours of 7 a.m. and 6 p.m. Construction material will also be handled and transported in such a manner as to not create unnecessary noise. Therefore, no significant adverse noise impacts are expected to occur as a result of the construction.

Community complaints will be handled in a manner similar to the exceedance of an action level, but will also include assessment of the root cause analysis of the complaint and adequacy of monitoring measures in addition to revising mitigation measures if appropriate. If a community complaint is received, the following will be documented under this procedure to address the steps taken to further mitigate the impacts identified, and the follow-up measures/monitoring to confirm that appropriate corrective action(s) have been implemented:

- time, date and person that identified an issue;
- the nature of the issue;
- the steps taken to assess the root cause of the issue;
- mitigation measures implemented; and,
- follow-up measures or monitoring conducted to confirm the issue is resolved.

4.2 Other Nuisances

If necessary, pest control tasks related to the onsite activities may be required within construction areas or adjacent areas. This could include control of insects or vertebrates other than rats and mice.

This work is to be performed prior to demolition, excavation, and site preparation and throughout the Contract, so that rodents and other pests do not disperse from or infest the project area. If required, the rodent control plan will be developed and implemented by a contractor that has specific training and experience in vertebrate pest management, commercial rodent control, general pest control, and integrated pest management.

5.0 PROJECT REPORTING

Daily Field Sheets will be maintained by onsite field personnel. These field sheets will outline Site activities performed for each day. These Daily Field Sheets will be submitted to the NYSDEC and NYSDOH Project Managers (via e-mail) at the end of each day following the reporting period. Daily Reports will include a description of daily activities as well as a summary of air monitoring results, odor and dust problems and corrective actions, and all complaints received from the public.

Monthly reports (if requested) will be submitted to NYSDEC and NYSDOH Project Managers within one week following the end of the month of the reporting period.

Complaints from the public regarding nuisance or other site conditions will be handled on an individual basis. Once a complaint is filed with regards to site remedial action activities, the NYSDEC will be notified and all required steps will be taken to rectify the cause of the complaint.

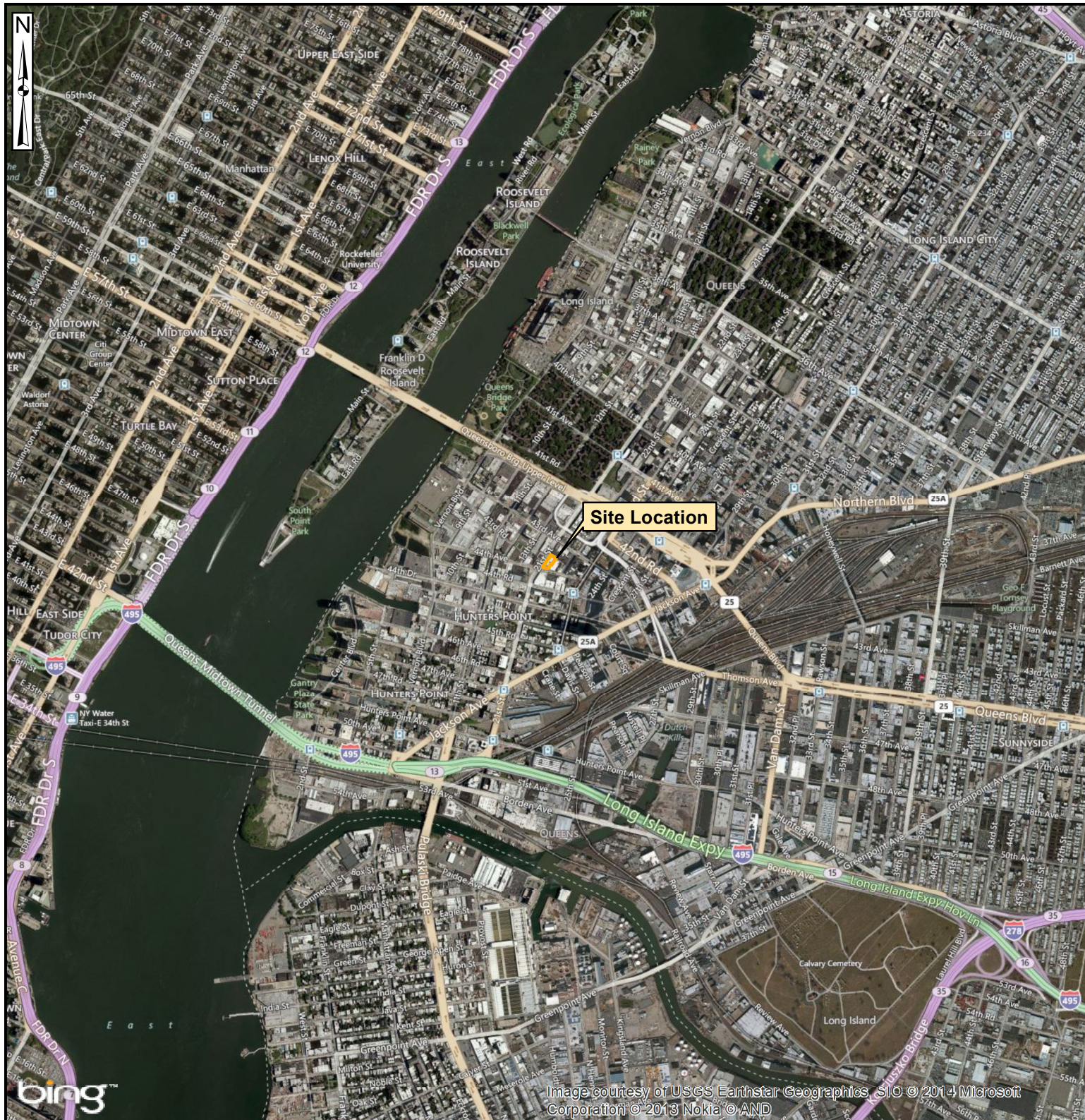
A Final Engineers Report (FER) and a Site Management Plan (SMP) will be submitted to NYSDEC following the completion of the SRIWP and subsequent implementation of the Remedial Action. The FER will provide the documentation that the remedial work performed at the Site was completed and has been performed in compliance with NYSDEC approved RAWP. This will include a summary of the CAMP activities and the results. The FER will include the following certification by the Remedial Engineer: "I certify that all invasive work during the remediation and all invasive development work were conducted in accordance with Site control monitoring and mitigation actions as defined in the Remedial Action Work Plan and its inclusive Community Air Monitoring Plan."

SCG:dmd

May 2, 2014

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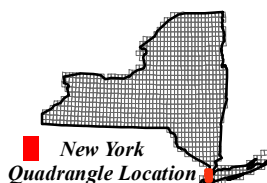
FIGURES



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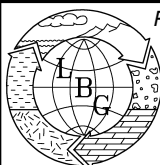
Legend

Site Boundary



QUEENS MEDALLION 21-03 44TH AVENUE LONG ISLAND CITY, NEW YORK

SITE LOCATION



Prepared by:
LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Services
4 Westchester Park Drive, Suite 175
White Plains, New York 10604
(914) 694-5711 www.lbgweb.com

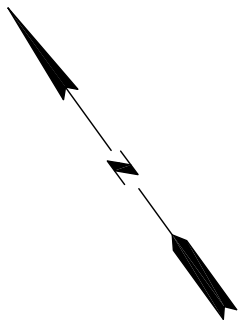
DATE: 03/27/14

FILE: Z:\QMedallion\gis\

DRAWN BY: ZT

CHECKED BY: SG

FIGURE: 1



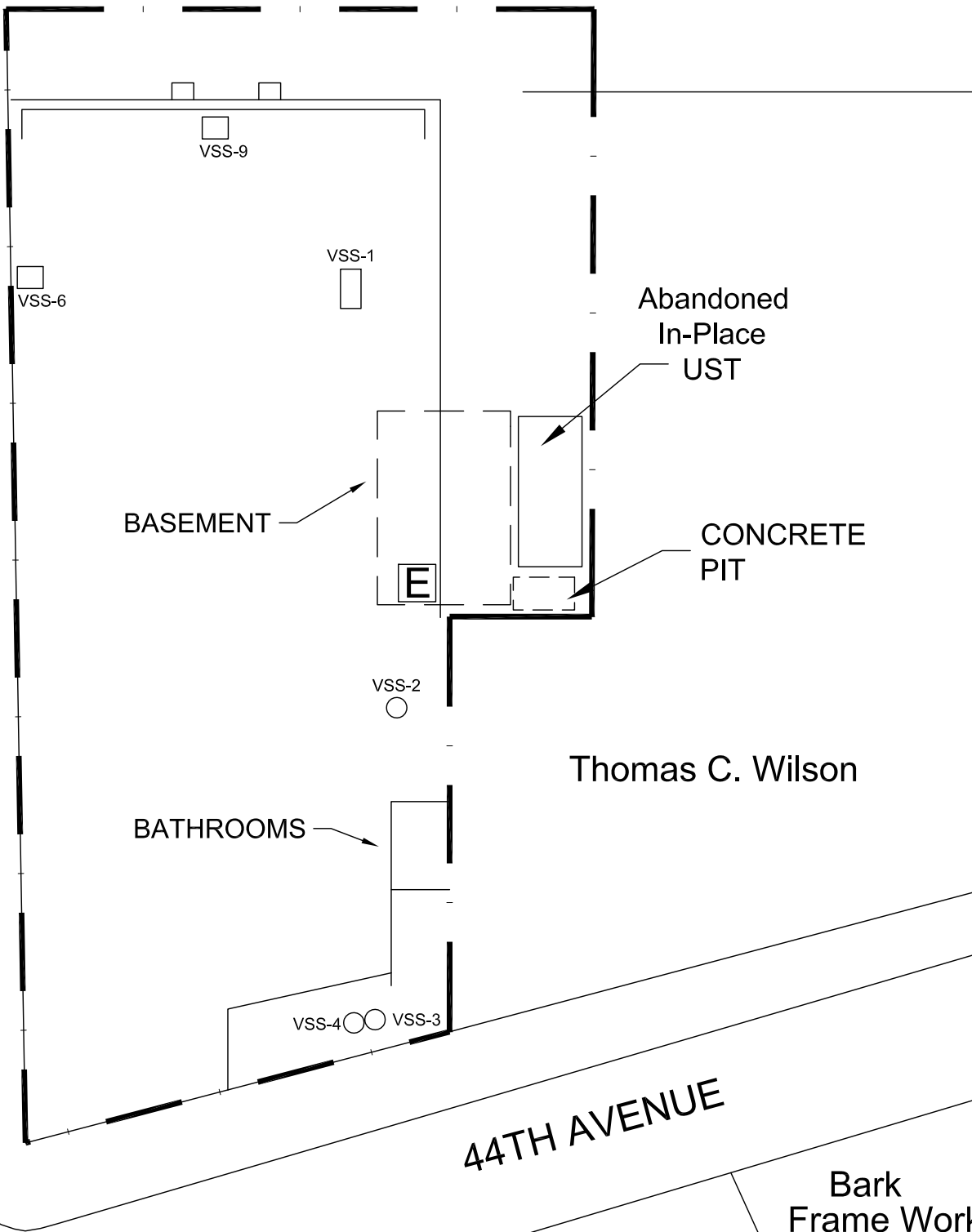
ARGO
Envelope

McQuay NY
Air Conditioning
Parts & Services

Limes
Transmission
21st Street
Auto Repair, Inc.

21 ST STREET

Wills Building



44TH AVENUE

Bark
Frame Works

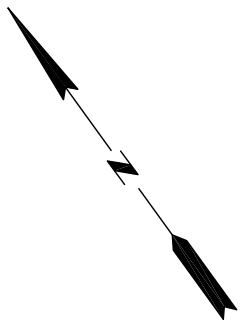
VACANT/
Supertrend, Inc.

LEGEND

— — — — — PROPERTY BOUNDARY



QUEENS MEDALLION 21-03 44TH AVENUE LONG ISLAND CITY, NEW YORK			
SITE PLAN			
	PREPARED BY: LEGGETTE, BRASHEARS & GRAHAM, INC. Professional Ground-Water and Environmental Services 110 Corporate Park Drive, Suite 112 White Plains, New York (914) 694-5711		
	FILE: white plains\bern	DRAWN BY: SCG	CHECKED BY: SG
DATE: 5/22/13			FIGURE: 2



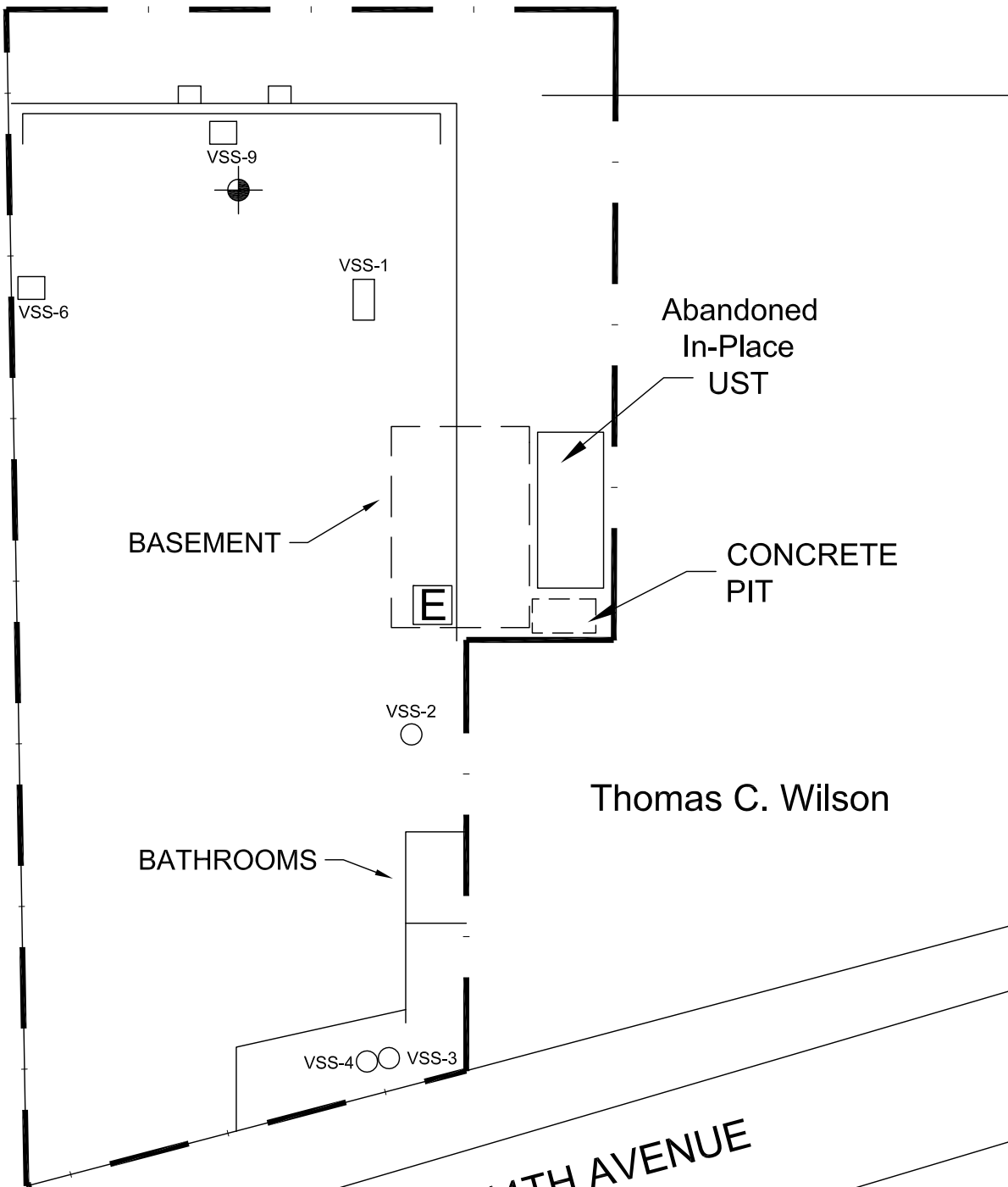
ARGO
Envelope

McQuay NY
Air Conditioning
Parts & Services

Limes
Transmission
21st Street
Auto Repair, Inc.

21 ST STREET

Wills Building



44TH AVENUE

Bark
Frame Works

VACANT/
Supertrend, Inc.

LEGEND

PROPERTY BOUNDARY



PROPOSED GEOPROBE
SOIL BORING LOCATION



SCALE IN FEET

QUEENS MEDALLION 21-03 44TH AVENUE LONG ISLAND CITY, NEW YORK			
PROPOSED SRIWP SAMPLE LOCATION MAP			
	PREPARED BY: LEGGETTE, BRASHEARS & GRAHAM, INC. Professional Ground-Water and Environmental Services 110 Corporate Park Drive, Suite 112 White Plains, New York (914) 694-5711		
	FILE: white plains\bern	DRAWN BY: SCG	CHECKED BY: SG
			DATE: 5/22/13
			FIGURE: 3

APPENDIX I

APPENDIX 1A

New York State Department of Health Generic Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate NYSDEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.
- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

All 15-minute readings must be recorded and be available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

All readings must be recorded and be available for State (DEC and DOH) personnel to review.

APPENDIX II

Air Monitoring Log

Date

Page: of

HSO Name

Equipment

Calibration

Background

Project

Location

Dust Meter ($\mu\text{g}/\text{m}^3$)

Weather

Conditions

PID (ppm)

[illegible]

Additional Daily Site Notes/Comments

APPENDIX F
Citizen Participation Plan

**QUEENS MEDALLION LEASING
21-03 44th AVENUE
LONG ISLAND CITY, QUEENS
COUNTY, NEW YORK 11101**

**CITIZEN PARTICIPATION PLAN
NYSDEC BCP SITE NO. C241144**

Prepared For

Exclusive Realty Services, LLC

May 2014

**LBG ENGINEERING SERVICES, P.C.
Professional Environmental & Civil Engineers
4 Westchester Park Drive, Suite 175
White Plains, NY 10604
(914) 694-5711**

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(at end of report)

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QUEENS MEDALLION LEASING
21-03 44th AVENUE
LONG ISLAND CITY, QUEENS COUNTY, NEW YORK 11101

CITIZEN PARTICIPATION PLAN
NYSDEC BCP SITE NO. C241144

1.0 WHAT IS NEW YORK’S BROWNFIELD CLEANUP PROGRAM?

New York’s Brownfield Cleanup Program (BCP) works with private developers to encourage the voluntary cleanup of contaminated properties known as “brownfields” so that they can be reused and developed. These uses include recreation, housing, and business.

A *brownfield* is any real property that is difficult to reuse or redevelop because of the presence or potential presence of contamination. A brownfield typically is a former industrial or commercial property where operations may have resulted in environmental contamination. A brownfield can pose environmental, legal, and financial burdens on a community. If a brownfield is not addressed, it can reduce property values in the area and affect economic development of nearby properties.

The BCP is administered by the New York State Department of Environmental Conservation (NYSDEC) which oversees Applicants that conduct brownfield site investigation and cleanup activities. An Applicant is a person who has requested to participate in the BCP and has been accepted by NYSDEC. The BCP contains investigation and cleanup requirements, ensuring that cleanups protect public health and the environment. When NYSDEC certifies that these requirements have been met, the property can be reused or redeveloped for the intended use.

For more information about the New York State BCP, please go online at: <http://www.dec.ny.gov/chemical/8450.html>.

2.0 CITIZEN PARTICIPATION ACTIVITIES

Why NYSDEC Involves the Public and Why It Is Important

NYSDEC involves the public to improve the process of investigating and cleaning up contaminated sites, and to enable citizens to participate more fully in decisions that affect their health, environment, and social wellbeing. NYSDEC provides opportunities for citizen

involvement and encourages early two-way communication with citizens before decision-makers form or adopt final positions.

Involving citizens affected and interested in site investigation and cleanup programs is important for many reasons. These include:

- Promoting the development of timely, effective site investigation and cleanup programs that protect public health and the environment;
- Improving public access to, and understanding of, issues and information related to a particular site and that site's investigation and cleanup process;
- Providing citizens with early and continuing opportunities to participate in NYSDEC's site investigation and cleanup process;
- Ensuring that NYSDEC makes site investigation and cleanup decisions that benefit from input that reflects the interests and perspectives found within the affected community; and
- Encouraging dialogue to promote the exchange of information among the affected/interested public, State agencies, and other interested parties that strengthens trust among the parties, increases understanding of site and community issues and concerns, and improves decision-making.

This Citizen Participation (CP) Plan provides information about how NYSDEC will inform and involve the public during the investigation and cleanup of the site identified above. The public information and involvement program will be carried out with assistance, as appropriate, from the Applicant.

Project Contacts

Appendix A identifies NYSDEC project contact(s) to whom the public should address questions or request information about the site's investigation and cleanup program. The NYSDEC project contacts include the designated Project Manager as well as the designated Citizen Participation Specialist. The public's suggestions about this CP Plan and the CP program for the site are always welcome. Interested people are encouraged to share their ideas and suggestions with the project contacts at any time.

Locations of Reports and Information

Four (4) document repositories have been established at the locations below, where all applicable project documents will be made available to the public.

Electronic copies of all files and/or reports associated with the environmental activities at the site will be maintained and available for review at the following local document repository locations:

<u>Document Repository 1</u>	<u>Document Repository 2</u>
Queens Borough Public Library Court Square 2501 Jackson Avenue Long Island City, NY 11101 Telephone: (718) 937-2790 Hours of Operation: Mon., Thur. & Fri. - 11 a.m. to 7 p.m. Tue. & Wed. - 1 p.m. to 7 p.m. Sat. & Sun. - Closed	Queens Community Board No. 2 43-22 50 th Street 2 nd Floor, Room 2B Woodside, NY 11377 Telephone: (718)-533-8773 e-mail - qn02@cb.nyc.gov <i>By Scheduled Appointment</i> Hours of Operation: Mon. - Fri. - 9 a.m. to 5 p.m. Sat. & Sun. - Closed

These document repositories will be regularly inspected to ensure that all material related to the site investigation and remediation activities are available for review. These locations provide convenient access to important project documents for public review and comment. Some documents may be placed on the NYSDEC website. If this occurs, NYSDEC will inform the public in fact sheets distributed about the site and by other means, as appropriate. The locations of the document repositories maintaining information related to the Site's investigation and cleanup program also are identified in Appendix A.

Site Contact List

A site contact list has been generated and is on file with the NYSDEC Regional Citizen Participation Specialist (see Appendix A). This list has been developed to keep the community informed about, and involved in, the site's investigation and cleanup process. The site contact list will be used periodically to distribute fact sheets that provide updates about the status of the project. These will include notifications of upcoming activities at the site (such as fieldwork),

as well as availability of project documents and announcements about public comment periods. The site contact list includes, at a minimum:

- chief executive officer and planning board chairperson of each county, city, town and village in which the site is located;
- residents, owners, and occupants of the site and properties adjacent to the site;
- the public water supplier which services the area in which the site is located;
- any person who has requested to be placed on the site contact list;
- the administrator of any school or day care facility located on or near the site for purposes of posting and/or dissemination of information at the facility; and
- location(s) of reports and information.

The site contact list will be reviewed periodically and updated as appropriate. Individuals and organizations will be added to the site contact list upon request. Such requests should be submitted to the NYSDEC project contact(s) identified in Appendix A. Other additions to the site contact list may be made at the discretion of the NYSDEC project manager, in consultation with other NYSDEC staff as appropriate.

CP Activities

Notices and fact sheets help the interested and affected public to understand contamination issues related to a site, and the nature and progress of efforts to investigate and clean up the site.

Public forums, comment periods and contact with project managers provide opportunities for the public to contribute information, opinions and perspectives that have potential to influence decisions about the site's investigation and cleanup.

The table at the end of this section identifies the CP activities, at a minimum, that have been and will be conducted during the site's investigation and cleanup program. The flowchart in Appendix B shows how these CP activities integrate with the site investigation and cleanup process. Elements of the investigation and cleanup process that match up with the CP activities are explained briefly in Section 5.

The public is informed about these CP activities through fact sheets and notices distributed at significant points during the program. Public notices will be made at several key milestones during the remediation activities.

The initial public notice announcements for this project are being made through this mailing to the Site Contact List. It should be noted that the NYSDEC Division of Environmental Remediation (DER) is "going paperless". The ultimate goal is to distribute citizen participation information about contaminated sites electronically by way of county e-mail listservs. As such, subsequent notices for this project will be issued electronically through the NYSDEC listserv distributions. Several key benefits of listserv distribution include:

- it is fast and convenient, coming right to your e-mail inbox;
- it is easy to share information with others;
- it is comprehensive; you receive updates on all sites in the counties you choose;
- it stretches taxpayer dollars by reducing labor, paper, printing and postage; and
- it helps the environment by reducing our "carbon footprint."

To receive site information by e-mail via listserv distribution, sign up through the GovDelivery service at the following website: <http://www.dec.ny.gov/chemical/61092.html>. It is quick, free, and it will help keep you better informed. Sign up for one or more contaminated sites county listservs and have site information sent right to your e-mail inbox. Sign-up can be completed as follows:

1. Enter your email address in the box below and click "submit".
2. You will be taken to the GovDelivery "New Subscriber page". Here you will confirm your e-mail, select how frequently you would like to receive updates and choose a password (optional). Once you have done this, click "submit".
3. You will see all the topics that you can subscribe to. Scroll down to the bottom of the list to category "*Environmental Site Cleanup and Permitting Information by County*".
4. Click on the + sign in the small box next to the category to expand it to see all the counties.

5. Click the box by the county name to select it (*i.e.*, *Queens for this BCP Site*). You may select as many counties as you want. Click the box again to un-select a county.
6. In the last step, you will be asked to give your zip code. Enter it and click "submit".

You will get an e-mail back from GovDelivery listing all the county listservs that you have subscribed to. You can easily change account information, such as your e-mail address or unsubscribe at any time. In instances where electronic delivery is not an option, the public can still request that they be notified by paper via regular mail delivery.

The public is encouraged to contact project staff at any time during the Site's investigation and cleanup process with questions, comments, or requests for information.

This CP Plan may be revised due to changes in major issues of public concern identified in Section 3 or in the nature and scope of investigation and cleanup activities. Modifications may include additions to the site contact list and changes in planned citizen participation activities.

Technical Assistance Grant

NYSDEC must determine if the site poses a significant threat to public health or the environment. This determination generally is made using information developed during the investigation of the site, as described in Section 5.

If the site is determined to be a significant threat, a qualifying community group may apply for a Technical Assistance Grant (TAG). The purpose of a TAG is to provide funds to the qualifying group to obtain independent technical assistance. This assistance helps the TAG recipient to interpret and understand existing environmental information about the nature and extent of contamination related to the site and the development/implementation of a remedy.

An eligible community group must certify that its membership represents the interests of the community affected by the site, and that its members' health, economic well-being or enjoyment of the environment may be affected by a release or threatened release of contamination at the site.

For more information about TAGs, go online at <http://www.dec.ny.gov/regulations/2590.html>

Note: The table identifying the citizen participation activities related to the site's investigation and cleanup program are presented on the next page.

Citizen Participation Requirements (Activities)	Timing of CP Activity(ies)
<u>Application Process:</u>	
<ul style="list-style-type: none"> • Prepare Site contact list • Establish document repositories 	COMPLETED
<ul style="list-style-type: none"> • Publish notice in Environmental Notice Bulletin (ENB) announcing receipt of application and 30-day public comment period • Publish above ENB content in local newspaper • Mail above ENB content to site contact list • Conduct 30-day public comment period 	COMPLETED
<u>After Execution of Brownfield Site Cleanup Agreement:</u>	
<ul style="list-style-type: none"> • Prepare Citizen Participation (CP) Plan 	Before start of Remedial Investigation
<u>Before NYSDEC Approves Remedial Investigation (RI) Work Plan:</u>	
<ul style="list-style-type: none"> • Distribute fact sheet to site contact list about proposed RI activities and announcing 30-day public comment period about draft RI Work Plan • Conduct 30-day public comment period 	<p>Before NYSDEC approves RI Work Plan.</p> <p>If RI Work Plan is submitted with application, public comment periods will be combined and public notice will include fact sheet.</p> <p>Thirty-day public comment period begins/ends as per dates identified in fact sheet.</p>
<u>After Applicant Completes Remedial Investigation:</u>	
<ul style="list-style-type: none"> • Distribute fact sheet to site contact list that describes RI results 	Before NYSDEC approves RI Report
<u>Before NYSDEC Approves Remedial Work Plan (RWP):</u>	
<ul style="list-style-type: none"> • Distribute fact sheet to site contact list about proposed RWP and announcing 45-day public comment period • Public meeting by NYSDEC about proposed RWP (if requested by affected community or at discretion of NYSDEC project manager) • Conduct 45-day public comment period 	<p>Before NYSDEC approves RWP.</p> <p>Forty-five day public comment period begins/ends as per dates identified in fact sheet.</p> <p>Public meeting would be held within the 45-day public comment period.</p>
<u>Before Applicant Starts Cleanup Action:</u>	
<ul style="list-style-type: none"> • Distribute fact sheet to site contact list that describes upcoming cleanup action 	Before the start of cleanup action.
<u>After Applicant Completes Cleanup Action:</u>	
<ul style="list-style-type: none"> • Distribute fact sheet to site contact list that announces that cleanup action has been completed and that summarizes the Final Engineering Report (FER) • Distribute fact sheet to site contact list announcing issuance of Certificate of Completion (COC) 	At the time NYSDEC approves FER. These two fact sheets are combined if possible if there is not a delay in issuing the COC.

3.0 MAJOR ISSUES OF PUBLIC CONCERN

This section of the CP Plan identifies major issues of public concern that relate to the site. Additional major issues of public concern may be identified during the course of the Site's investigation and cleanup process.

The contamination beneath the site is the result of historical activities on the site. Based on previous investigations performed on the site, hexavalent chromium and volatile organic compounds (VOCs) were reported to be present in the subsurface (soil, groundwater and/or soil vapor).

The site is located within an Environmental Justice Area. Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Environmental justice efforts focus on improving the environment in communities, specifically minority and low-income communities, and addressing disproportionate adverse environmental impacts that may exist in those communities.

The site is located in an area with a large Hispanic-American population. Therefore, all future fact sheets will be translated into Spanish as well.

In addition, there may be impacts with regards to noise, odor and/or truck traffic.

Current Site Condition Contaminant Exposure Risks

The analytical results from current site conditions as well as past remedial investigations indicate that there is no plausible offsite exposure scenario for the onsite soil and/or groundwater contamination present beneath the site. The current redeveloped status of the site which incorporates an impermeable cap throughout the entire site. The only exposure pathway via these media is through dermal contact and/or ingestion by visitors, trespassers or contractors. Currently there is no exposure pathway for soil and/or groundwater contamination at the site. Therefore, the potential exposure risk for residual contamination at the site to impact surrounding properties via ingestion and/or dermal contact is low.

Due to the current redeveloped status of the site which incorporates an impermeable cap throughout the entire site, the only contaminant exposure pathway currently at the site consists

of inhalation of VOCs through soil vapor intrusion. The most likely current contamination exposure pathway for people living and working at adjacent properties would be via soil vapor intrusion resulting in VOC impact to indoor air quality.

Potential Future Contaminant Exposure Risks

As a result of the anticipated remedial actions (i.e., ground invasive activities), the possible contamination exposure on the site (to remediation and/or construction contractors) will be considered direct exposure whereby a product can find its way into food, water or air supplies by direct transfer. All Health and Safety precautions will be taken to ensure site workers exposed to onsite contamination use appropriate personal protection equipment (PPE) for respective site contaminants. Additionally, best practices will be followed with regards to all materials handling associated with ground invasive activities.

The potential future risk of contamination exposure to offsite surrounding properties via ingestion and/or dermal contact is low. The most likely contamination exposure pathway for people living and working at adjacent properties would be via offsite migration of VOCs and/or dust resulting from the institution of the remedial actions. Applicable site management measures will be implemented to prevent offsite impact resulting from the implementation of any future remedial actions.

4.0 SITE INFORMATION

Introduction and Site Description

This Exclusive Realty Services, LLC (heretofore referred to as “ERS” or the “Volunteer”) is undertaking the remediation and potential redevelopment of the former Bern Associates, Long Island City property located at 21-03 44th Avenue, Long Island City, New York (heretofore referred to as the “Site”). A Site Location Map is presented as figure 1. The Site property is listed as a two-story building and a small land area that was used for metal plating approximately 20 to 25 years ago. Presently, the Site is not used as an industrial facility and no industrial activities have taken place since 1996. The building at 21-03 44th Avenue is currently in use as commercial office space and as a taxi leasing business. The vicinity of the Site consists of a New York City high school located approximately 350 feet to the south,

isolated residential properties approximately 500 feet to the southeast and southwest along 44th Avenue and as a primarily residential block 700 feet to the north along 45th Avenue. The building has a concrete floor and a gravel covered alley is located to the east of the building. A Site Plan is presented as figure 2.

The Site is now the subject of an environmental remediation pursuant to the NYSDEC BCP. ERS has entered into the BCP with the NYSDEC and is listed as the volunteer for Site No. C241144. As per the Brownfield Cleanup Agreement (BCA), the Site was registered with the name “Queens Medallion Leasing”.

As a result of the historical property uses, the subsurface environmental condition at the Site has been negatively impacted by various contaminants. LBG Engineering Services, P.C. (LBGES) and Leggette, Brashears & Graham, Inc. (LBG) on behalf of ERS, have prepared a Supplemental Remedial Investigation (SRI) Work Plan and all related supplemental and governing documents to determine the extent of residual subsurface contamination (if present) beneath the Site. Following the SRI, a Remedial Action Work Plan (RAWP) will be prepared and implemented at the Site to address residual contamination present at the Site and to mitigate potential negative impacts to the Site.

ERS, in cooperation with the NYSDEC and New York State Department of Health (NYSDOH), will inform and involve the public during the investigation and remediation of the Site. The purpose of this CP Plan is to provide a framework for disseminating information to the public and provide the public with an opportunity to become informed and involved during the SRI and future remediation activities under the BCP program.

This CPP provides summary information regarding the background related to the contamination identified to date, different phases of the investigation and remediation process, the opportunities for citizen participation, the primary contacts for various State and Local agencies, information on how to find out and access available documents and, the list of affected and interested parties.

The SRI and remediation activities at the Site will be conducted under the NYSDEC BCP. This CP Plan is designed to provide an area-wide comprehensive approach to citizen participation and achieve the following objectives:

- keep the public informed of planned or ongoing actions, the nature of environmental conditions, the environmental and/or public health threats the contamination may pose, the responses under consideration and the progress being made;
- create opportunities for the public to provide information, opinions and perspectives on the work being conducted; and
- ensure open communication between the public and project staff throughout the investigation and remediation process.

ERS, in cooperation with the NYSDEC and the NYSDOH, will implement the activities described in this plan. Implementation of this CPP may evolve during the investigation and remediation process and changes may be made to the plan as conditions warrant.

History of Site Use, Investigation and Cleanup

The Site is located in an urban setting in an area that has historically been used for manufacturing purposes. The Site is a two-story vacant industrial building and a small area of land that was historically used for metal plating approximately 20 to 25 years ago. Presently, the Site is not used as industrial facility and no industrial activity has taken place since 1996. A Site Plan is shown on figure 2. The contaminants of concern (COC) are chromium and tetrachloroethene (PCE) which is a chlorinated volatile organic compound (CVOC).

Prior investigations conducted by Vertex Engineering Services, Inc. (Vertex) in 2004 and (GFE) in 2005 identified the presence of chromium in soil beneath the Property and chromium and PCE in groundwater upgradient, beneath, and downgradient of the Property.

The Vertex investigation included installation of seven groundwater monitoring wells (MW-1 through MW-7), collection and analysis of groundwater samples and sediment samples from the Property and offsite.

The Vertex investigation concluded that chromium was present in soil and groundwater beneath the Property and PCE was detected in groundwater upgradient, beneath, and downgradient of the Property. The highest concentration of PCE in ground water was detected in a downgradient monitoring well (MW-1) located on the sidewalk outside the Property on

44th Avenue. Chromium was detected in residual sludge and sediment in several subsurface traps located inside of the building. The sludge and sediment were removed and post excavation soil samples showed that the remediation was successful in reducing the chromium concentrations.

The GFE investigation consisted of installation of seven soil borings, collection of soil and groundwater samples, laboratory analysis of soil and groundwater samples, determination of groundwater quality and direction of flow and investigation of a concrete vault located at the east side of the building. The GFE work also included the permanent closure of a 7,500-gallon underground No. 4 heating oil storage tank (UST). No petroleum contamination was found in the soil.

The results of the Vertex and GFE investigations were described in the following reports which are included on the attached CD.

- Vertex letter report titled "Structure Clean-out and Sewer Line Tracing," 21-03 44th Avenue, Long Island City, New York, dated July 30, 2004; and,
- GFE report titled "Report of Environmental Investigation and Remediation," 21-03 44th Avenue, Long Island City, NY, dated August 29, 2005 and prepared by GFE.

The results of a subsurface investigation completed by Leggette Brashears & Graham, Inc. (LBG) in 2007 suggested that there are two possible sources of VOC groundwater contamination located both upgradient and sidegradient of the Property.

A NYSDEC (also referred to as the "Department") Superfund investigation was performed by ARCADIS Malcolm Pirnie, Inc. in relation to the area-wide PCE groundwater contaminant plume. As a result of the investigation and conclusions of the Remedial Investigation Report (RIR) the Department has labeled the Property a contributor of hexavalent chromium contamination and a potential contributor to the chlorinated VOC contamination.

Most recently, based on communications between the Volunteer and the NYSDEC, NYSDEC is requiring limited supplemental remedial investigation activities to ensure that no residual contaminant source areas are present beneath the Property. Additionally, the

NYSDEC is requiring the development of a remedial action plan to ensure the onsite building is protected from impacts associated with the subsurface contamination (mitigation of potential soil vapor intrusion risk) as well as to address any source area contamination beneath the Property. As per the results of historical environmental characterization activities, the contamination beneath the Property consists of dissolved phase hexavalent chromium (likely attributed at least in part to historic operations at the Property) and chlorinated solvents (likely related to an upgradient property). The highest known concentrations of the dissolved phase contamination are located beneath the eastern perimeter (alley), the southeastern corner of the Property and immediately downgradient of the Property. These areas correlate with the location of a bedrock trough which encompasses the approximate outline of the alley (as delineated as part of the ARCADIS RIR).

5.0 INVESTIGATION AND CLEANUP PROCESS

Application

The Applicant has applied for and been accepted into New York's Brownfield Cleanup Program as a Volunteer. This means that the Applicant was not responsible for the disposal or discharge of the contaminants or whose ownership or operation of the Site took place after the discharge or disposal of contaminants. The Volunteer must fully characterize the nature and extent of contamination onsite, and must conduct a qualitative exposure assessment, a process that characterizes the actual or potential exposures of people, fish and wildlife to contaminants on the Site and to contamination that has migrated from the Site.

The Applicant proposes that the Site will be used for restricted commercial purposes.

To achieve this goal, the Applicant will conduct investigation and cleanup activities at the Site with oversight provided by NYSDEC. The BCA executed by NYSDEC and the Applicant sets forth the responsibilities of each party in conducting these activities at the Site.

Investigation

The partial Site investigation activities have been performed at the Site before it entered into the BCP. For the partial investigations, NYSDEC will determine if the data are useable.

The Applicant will conduct an investigation of the site officially called a “supplemental remedial investigation” (SRI). This investigation will be performed with NYSDEC oversight to supplement Site characterization data obtained from historical environmental Site investigation activities. The Applicant must develop a Supplemental Remedial Investigation Work Plan (SRIWP), which is subject to public comment.

The site investigation has several goals:

- 1) define the nature and extent of contamination in soil, surface water, groundwater and any other parts of the environment that may be affected;
- 2) identify the source(s) of the contamination;
- 3) assess the impact of the contamination on public health and the environment; and,
- 4) provide information to support the development of a proposed remedy to address the contamination or the determination that cleanup is not necessary.

When the investigation is complete, the Applicant will prepare and submit a report that summarizes the results. This report also will recommend whether cleanup action is needed to address site-related contamination. The investigation report is subject to review and approval by NYSDEC.

NYSDEC will use the information in the investigation report to determine if the Site poses a significant threat to public health or the environment. If the Site is considered a significant threat, it must be cleaned up using a remedy selected by NYSDEC from an analysis of alternatives prepared by the Applicant and approved by NYSDEC. If the Site does not pose a significant threat, the Applicant may select the remedy from the approved analysis of alternatives.

Proposed Supplemental Remedial Investigation

In order to address whether a potentially unidentified source area is present beneath the Site, an area-specific SRI will be performed at the Site. The SRI will be comprised of a limited subsurface investigation, which will consist of advancing one (1) soil boring at the Site in the location of the former subsurface structure VSS-9. The proposed soil boring will be in-

stalled using the GeoProbe drilling method. The location of the proposed soil boring is presented on figure 3.

During the drilling, continuous soil samples will be collected at 5-foot intervals from grade to approximately 25 ft bg (feet below grade) (or the top of the bedrock surface). The soil samples will be evaluated in the field and recorded on geologic logs by the onsite LBG hydrogeologist. The geologic log will also document the depth at which the groundwater interface is identified. Each sample will be screened for the presence of petroleum components using a photoionization detector (PID). Soil samples will be collected from the soil boring at two intervals: 1) one sample from the vertical interval which exhibits the highest PID concentration as observed during the field screening; and 2) one from the top of bedrock. In the event no significantly elevated PID concentrations are observed, the two (2) soil samples will be collected from the following two intervals: 1) one from the approximate groundwater interface; and 2) one from the top of bedrock. All soil samples will be collected in laboratory supplied sample jars and stored in a cooler on ice. Samples will be shipped under chain of custody to a New York State approved laboratory for analysis of VOCs and Target Analyte List (TAL) metals and hexavalent chromium. The analytical laboratory results for the soil sample will be compared to the Restricted Use Soil Cleanup Objectives (RUSCOs) in accordance with the Standards, Criteria and Guidance (SCGs) as outlined in 6 NYCRR Part 375-6.8(b) for the selected land use of Restricted Commercial.

Following the collection of the soil samples from the soil boring, the soil boring will be backfilled. In the event that the soil extracted from the boring does not exhibit elevated levels of VOCs (via the field PID screening) or visual evidence of impact, the cuttings will be used for backfilling the boring. In the event that elevated VOCs or visual evidence of impact is observed, the following procedure will be followed:

- all soil will be drummed onsite in a New York State Department of Transportation (NYSDOT) approved 55-gallon drum;
- the completed soil boring will be backfilled with clean sand to approximately 6 inches below grade;

- the drummed soil will be sampled and submitted to a New York certified laboratory for waste characterization analysis; and,
- following waste characterization, the soil cuttings will be shipped offsite to a certified disposal facility permitted for the waste.

Following the soil sampling and backfilling, the surface of the boring will be restored to its original condition as documented prior to the completion of the soil boring.

Following the SRI, a Remedial Investigation Report (RIR) investigation report describing the results of the subsurface investigation field activities will be prepared. The report will include methodologies and procedures of all field work, geologic log for the soil boring, laboratory analytical reports and results presented in tabular and map form. The results of the investigation will be used to evaluate the environmental status of the subsurface in the former location of VSS-9 and, if necessary, outline recommendations for additional work.

Alternatives Analysis and Remedial Selection

Following NYSDEC approval of the RIR, a Remedial Action Work Plan (RAWP) will be submitted to NYSDEC for approval under the BCP agreement. The RAWP will include an Alternatives Analysis (AA) presenting the evaluation of potential remedial strategies for the Site. The AA will outline various remedial alternatives and will summarize the conceptual design of the Engineering Controls (ECs) to be installed and implemented at the Site (if applicable) as well as the Institutional Controls (ICs) that will address residual contamination that will be left in-place beneath the Site and to minimize the potential for human health exposure (if applicable). A preferred remedial action will be selected based on the AA.

The RAWP will be developed for the preferred remedy, and it will outline the scope of work for implementation. Tentatively, the RAWP will consist of the installation of the sub-slab depressurization system (SSDS) and/or soil vapor extraction (SVE) system for the Site to mitigate the potential impact to indoor air quality (via soil vapor intrusion) resulting from residual subsurface soil vapor contamination present beneath the Site. The RAWP will include the methodologies and procedures for the proposed field work. The RAWP will present the

detailed specifications that will be followed for its implementation. Tentatively, the primary scope for the RAWP will include:

- detailed construction specifications for the installation of the components of the SSDS/SVE system (extraction sumps, header pipes, discharge stack...);
- specifications for the extraction equipment (vacuum pump) that will facilitate the active operation of the SSDS/SVE system;
- the specifications for the anticipated vapor phase treatment; and,
- the operation, maintenance and monitoring plan (OM&M Plan) proposed for the SSDS/SVE system following installation and commencement.

Cleanup Action

NYSDEC will consider public comments, and revise the draft RAWP if necessary, before approving the proposed remedy. The New York State Department of Health (NYSDOH) must concur with the proposed remedy. After approval, the proposed remedy becomes the selected remedy.

The Applicant may then design and perform the cleanup action to address the site contamination. NYSDEC and NYSDOH will oversee the activities.

Following NYSDEC approval of the RAWP, the field work required for the implementation of the approved remedy at the Site will commence.

When the Applicant completes cleanup activities, it will prepare a Final Engineering Report (FER) that certifies that cleanup requirements have been achieved or will be achieved within a specific time frame. NYSDEC will review the report to be certain that the cleanup is protective of public health and the environment for the intended use of the Site.

A Site Management Plan (SMP) will be submitted with the FER to NYSDEC following implementation of the Remedial Action defined in the RAWP. Under the BCP, NYSDEC approval of a FER and SMP is required prior to the issuance of a Release and Covenant Not To Sue. The FER will provide the documentation that the remedial work required under the RAWP has been completed and has been performed in compliance with the plan. The FER will provide a comprehensive account of the locations and characteristics of all material re-

moved from the Site and surrounding properties including the surveyed map(s) of all sources. The FER will include as-built drawings for all constructed elements, certifications, manifests, bills of lading as well as the complete SMP (formerly the Operation and Maintenance Plan). The FER will provide a description of the changes in the Remedial Action from the elements provided in the RAWP and associated design documents. The FER will provide a tabular summary of all performance evaluation sampling results and all material characterization results and other sampling and chemical analysis performed as part of the Remedial Action. The FER will provide test results demonstrating that all mitigation and remedial systems are functioning properly. The FER will be prepared in conformance with DER-10. The FER will include written and photographic documentation of all remedial work performed under this remedy. The FER will include an itemized tabular description of actual costs incurred during all aspects of the Remedial Action.

Certificate of Completion

When NYSDEC is satisfied that cleanup requirements have been achieved or will be achieved for the Site, it will approve the FER. NYSDEC then will issue a Certificate of Completion (COC) to the Applicant. The COC states that cleanup goals have been achieved, and relieves the Applicant from future liability for site-related contamination, subject to certain conditions. The Applicant would be eligible to redevelop the Site after it receives a COC.

Site Management

Site management is the last phase of the site cleanup program. This phase begins when the COC is issued. Site management may be conducted by the Applicant under NYSDEC oversight, if contamination will remain in place. Site management incorporates any IC/ECs required to ensure that the remedy implemented for the site remains protective of public health and the environment. All significant activities are detailed in a SMP.

An IC is a non-physical restriction on use of the Site, such as a deed restriction that would prevent or restrict certain uses of the property. An IC may be used when the cleanup action leaves some contamination that makes the Site suitable for some, but not all uses.

An EC is a physical barrier or method to manage contamination. Examples include: caps, covers, barriers, fences, and treatment of water supplies.

Based on the analytical results from the past Superfund Remedial Investigation, it was determined that there are chlorinated VOC impacts to indoor air quality as a result of soil vapor intrusion to both onsite and offsite properties.

As a result, it is reasonable to conclude that following completion of the selected remedial action, ICs will be required for the Site. The ICs for the Site may consist of (but not be limited to):

1. an environmental easement preventing groundwater use at the Site will be required; and,
2. maintenance of a SMP regulating any future ground invasive activities.

In addition to any recorded ICs, ECs may be required at the Site to ensure protection of human health and the environment. The ECs for the Site may consist of (but not be limited to):

1. a SSDS and/or SVE system to mitigate the potential for soil vapor intrusion; and,
2. a soil vapor barrier to mitigate the potential for soil vapor intrusion.

As stated, the Superfund Remedial Investigation identified chlorinated VOC impacts to indoor air quality (as a result of soil vapor intrusion) to offsite properties. However, remedial actions to address offsite impacts are beyond the scope of the BCA.

Site management also may include the operation and maintenance of a component of the remedy, such as an active contaminant extraction and treatment system. Site management continues until NYSDEC determines that it is no longer needed.

Long-term management of EC/ICs and of residual contamination will be executed under the Site-specific SMP that will be developed and included in the FER. The SMP will be submitted as part of the FER but will be written in a manner that allows its removal and use as a complete and independent document. The SMP will describe appropriate methods and procedures required to ensure compliance with all ECs and ICs that are required by the Deed

Restriction. Once the SMP has been approved by the NYSDEC, compliance with the SMP will be required by the grantor of the Deed Restriction and grantor's successors and assigns. Site Management continues in perpetuity or until released in writing by NYSDEC. The property owner is responsible to ensure that all Site Management responsibilities defined in the Deed Restriction and the SMP are performed.

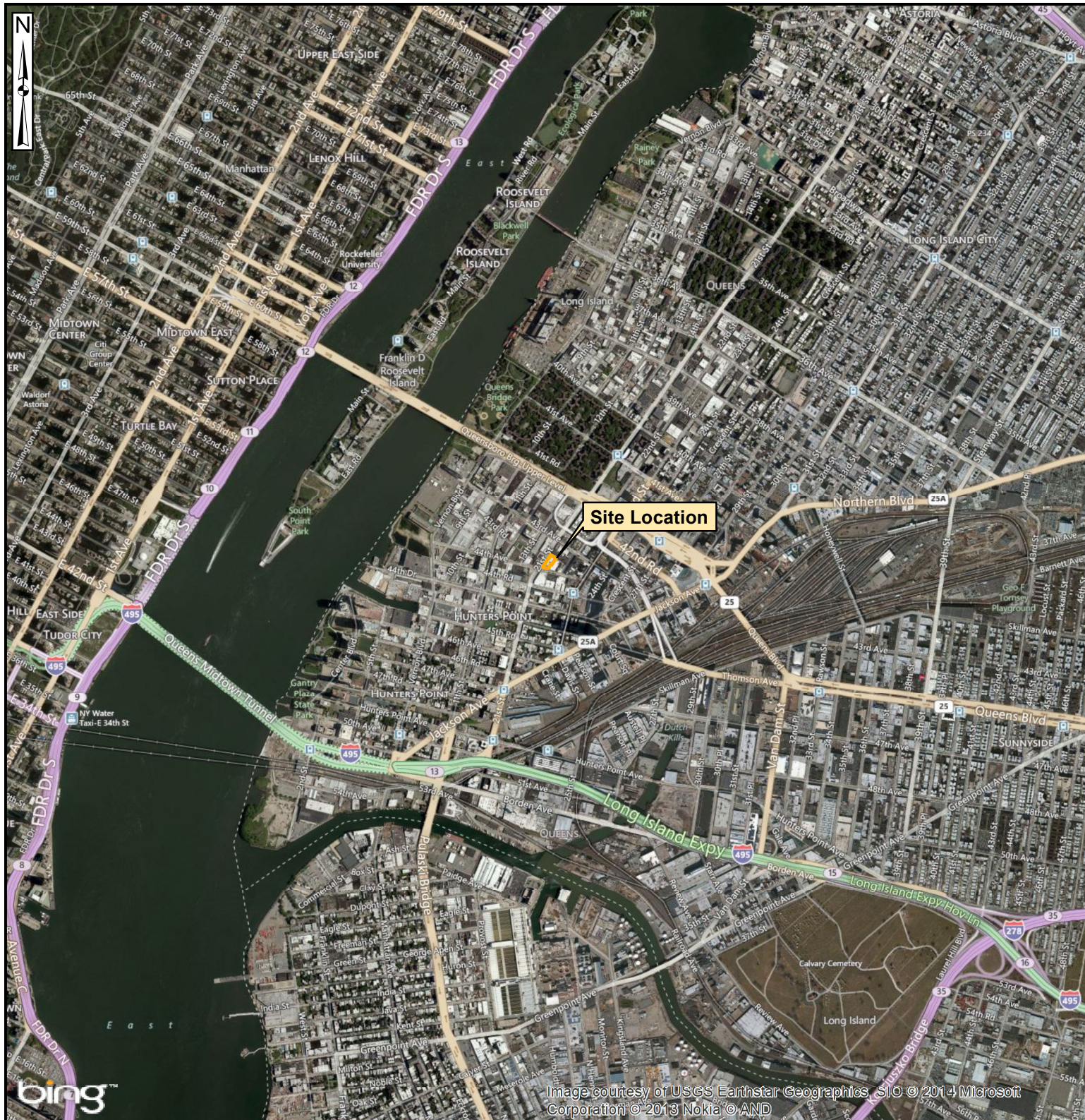
Site management activities, reporting, and EC/IC certification will be scheduled on a certification period basis. The certification period will be annually.

dmd

May 2, 2014


f:\reports\furman\exclusive_realty_bcp\2014\riwp\appendix - citizen participation plan\citizen participation plan - update 4-25-14.docx

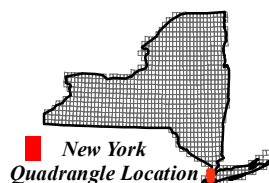
FIGURES



2,000 1,000 0 2,000 Feet

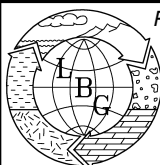
Legend

 Site Boundary



QUEENS MEDALLION 21-03 44TH AVENUE LONG ISLAND CITY, NEW YORK

SITE LOCATION



Prepared by:
LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and Environmental Services
4 Westchester Park Drive, Suite 175
White Plains, New York 10604
(914) 694-5711 www.lbgweb.com

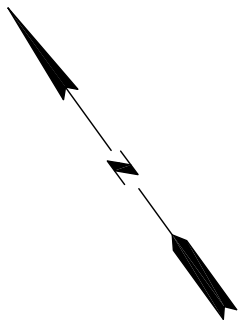
DATE: 03/27/14

FILE: Z:\QMedallion\gis\

DRAWN BY: ZT

CHECKED BY: SG

FIGURE: 1



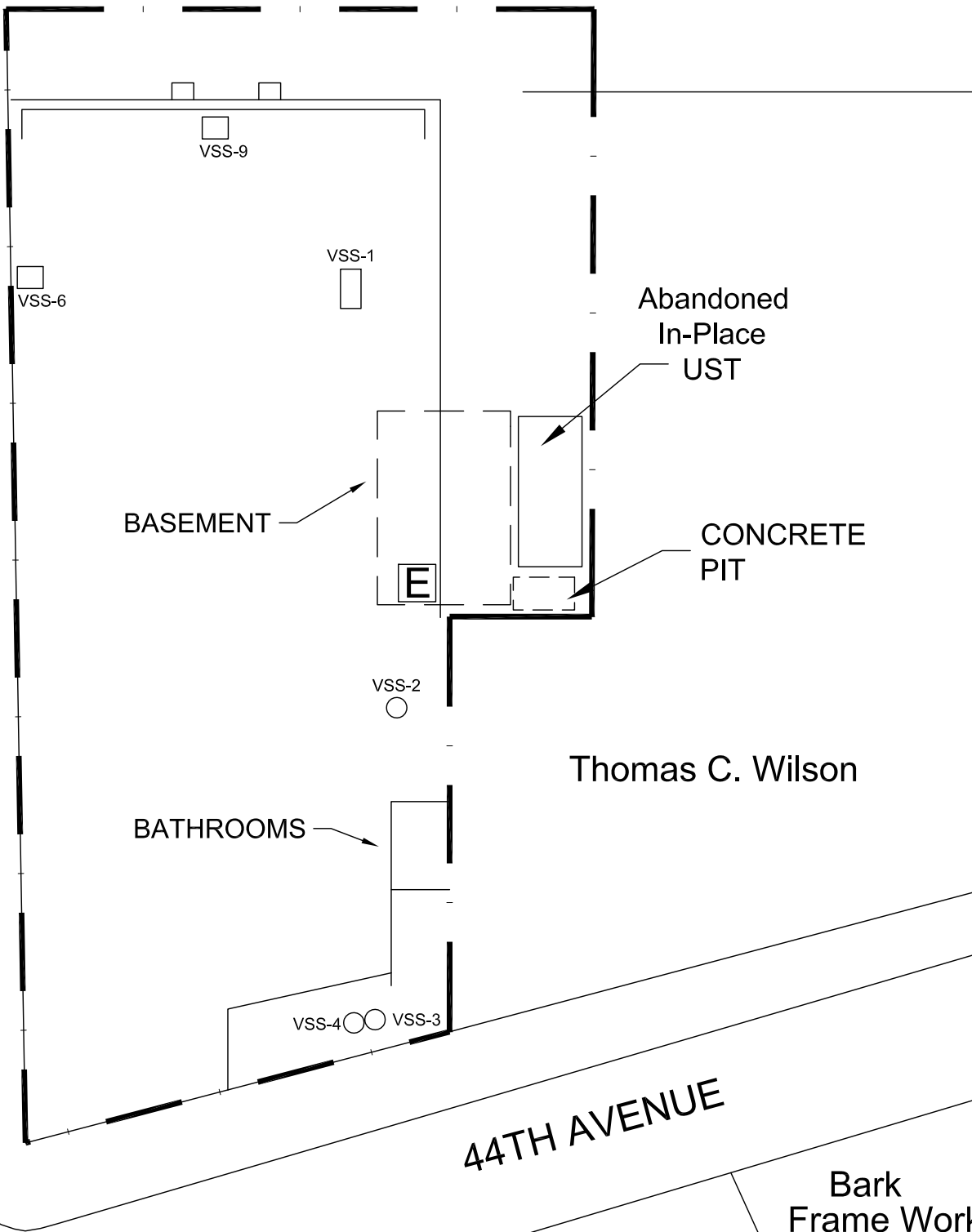
ARGO
Envelope

McQuay NY
Air Conditioning
Parts & Services

Limes
Transmission
21st Street
Auto Repair, Inc.

21 ST STREET

Wills Building



44TH AVENUE

Bark
Frame Works

VACANT
Supertrend, Inc.

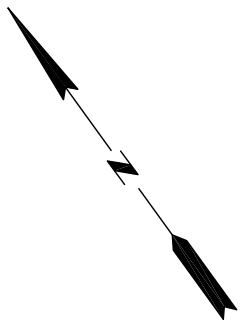
LEGEND

— — — — — PROPERTY BOUNDARY



SCALE IN FEET

QUEENS MEDALLION 21-03 44TH AVENUE LONG ISLAND CITY, NEW YORK			
SITE PLAN			
	PREPARED BY: LEGGETTE, BRASHEARS & GRAHAM, INC. Professional Ground-Water and Environmental Services 110 Corporate Park Drive, Suite 112 White Plains, New York (914) 694-5711		
	FILE: white plains\bern	DRAWN BY: SCG	CHECKED BY: SG
			DATE: 5/22/13
			FIGURE: 2



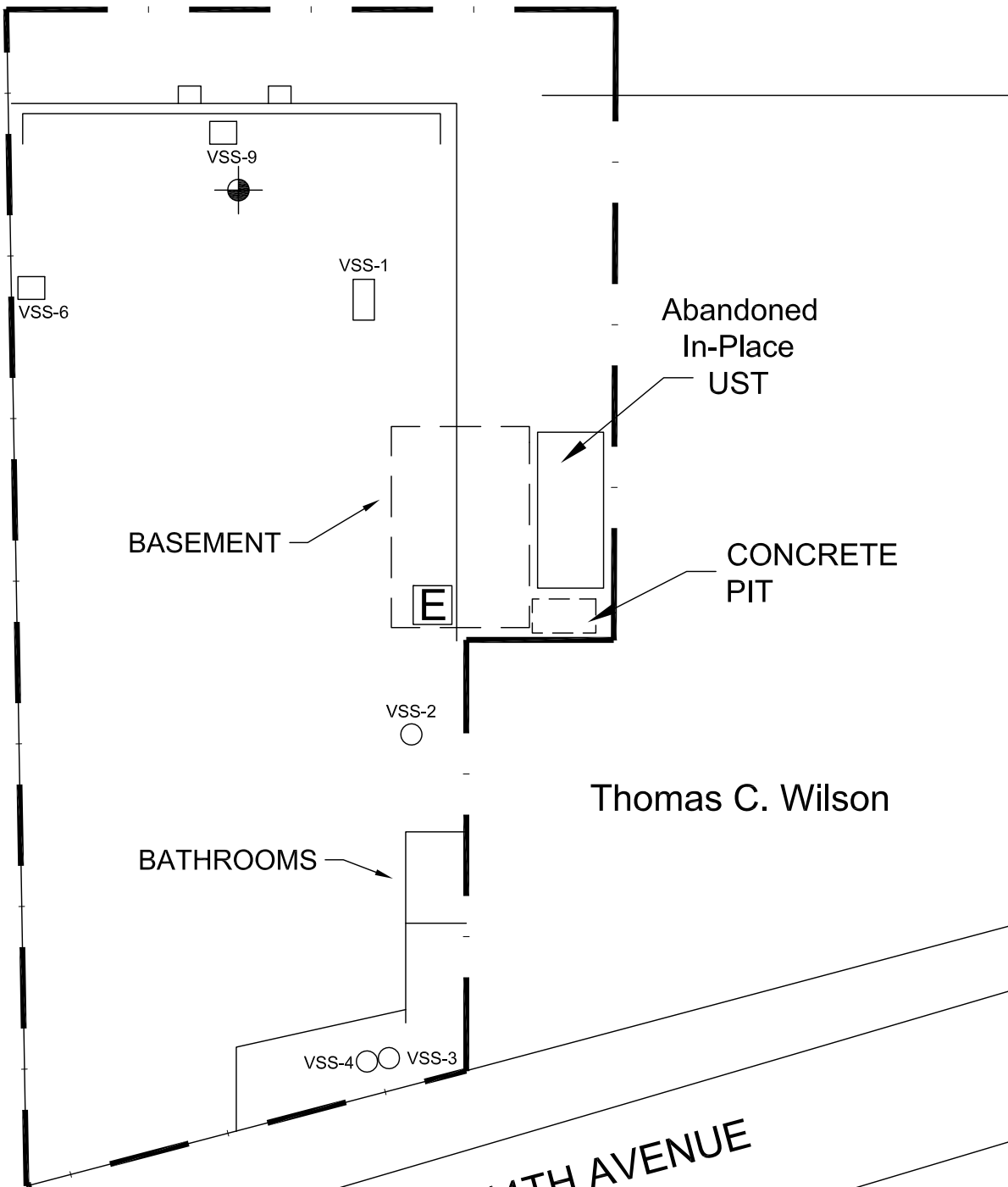
ARGO
Envelope

McQuay NY
Air Conditioning
Parts & Services

Limes
Transmission
21st Street
Auto Repair, Inc.

21 ST STREET

Wills Building



Thomas C. Wilson

44TH AVENUE

Bark
Frame Works

VACANT
Supertrend, Inc.

LEGEND

PROPERTY BOUNDARY



PROPOSED GEOPROBE
SOIL BORING LOCATION



SCALE IN FEET

QUEENS MEDALLION
21-03 44TH AVENUE
LONG ISLAND CITY, NEW YORK

PROPOSED SRIWP SAMPLE LOCATION MAP



PREPARED BY:
LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water and Environmental Services
110 Corporate Park Drive, Suite 112
White Plains, New York
(914) 694-5711

FILE: white plains\bern

DRAWN BY: SCG

CHECKED BY: SG

DATE: 5/22/13
FIGURE: 3

APPENDIX A

Project Contact List and Locations of Reports and Information

PROJECT CONTACT LIST

For information about the Site's investigation and cleanup program, the public may contact any of the following project staff:

New York State Department of Environmental Conservation (NYSDEC)

Project Manager

Mr. Jonathan Greco
NYSDEC -Division of Environmental Remediation
625 Broadway
Albany, NY 12233-7016
Telephone: (518) 402-9694
Email address: jxgreco@gw.dec.state.ny.us

Regional Citizen Participation Specialist

Mr. Thomas Panzone
NYSDEC – Office of Communications Services
Hunters Point Plaza
47-40 21st Street
Long Island City, NY 11101
Tel: (718) 482-4953
Email: tvpanzon@gw.dec.state.ny.us

New York State Department of Health

Public Health Specialist

Dawn Hettrick, P.E.
Public Health Engineer
New York State Department of Health
Bureau of Environmental Exposure Investigation
Empire State Plaza - Corning Tower, Room 1787
Albany, NY 12237
Telephone:(518) 402-7860
Email address: BEEI@health.state.ny.us

Queens Medallion Leasing

Site Owner

Exclusive Realty Services, LLC
Mr. Tony Georgiton
21-03 44th Avenue
Long Island City, NY 11101

Project Environmental Counsel

Scott Furman, Esq.
Sive, Paget & Riesel, PC
460 Park Avenue
10th Floor
New York, NY 10022
Telephone: (212) 421-2150
Email: sfurman@sprlaw.com

Project Consultant

Sean Groszkowski, CPG
Leggette Brashears & Graham, Inc.
4 Westchester Park Drive, Suite 175
White Plains, NY 10604
Telephone:(914) 694-5711
Email: Groszkowski@lbgny.com

DOCUMENT REPOSITORIES

The facilities identified below are being used to provide the public with convenient access to important project documents:

Queens Borough Public Library

Reference Section
Court Square
2501 Jackson Avenue
Long Island City, NY 11101

Queens Community Board No. 2

43-22 50th Street
2nd Floor, Room 2B
Woodside, NY 11377

APPENDIX B

Brownfield Cleanup Program Process

Appendix Brownfield Cleanup Program Process

