HSI SITE 10071, GEORGIA PORTS AUTHORITY-BAINBRIDGE TERMINAL

MONITORING & MAINTENANCE PLAN

November 13, 2017

Reference File: 400007

Prepared for:

GEORGIA PORTS AUTHORITY

P.O. Box 2406

Savannah, Georgia 31402

Prepared by:

ENVIRONMENTAL INTERNATIONAL CORPORATION

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SECTION 1

1. INTRODUCTION

1.1 Background

The approximately 65-acre parcel owned by the Georgia Ports Authority (GPA) located at 1321 Spring Creek Road in Bainbridge, Decatur County, Georgia (Tax Parcel Nos. B0420-020-000 and B0420-021-A00) (Property) has been the subject of multiple soil and groundwater investigation and remediation activities since 1993. These activities are summarized and described in the 2012 Voluntary Investigation and Remediation Plan (VIRP) (EIC, 2012) and in seven subsequent VIRP semi-annual reports (EIC, 2013a, 2013b, 2014a, 2014b, 2015a, 2015b, and 2016), submitted to the Georgia Environmental Protection Division (EPD). The Property layout is illustrated in Figure 1-1.

The primary constituents of concern (COCs) at the Property are pesticides, which predominantly consist of alpha- (α-), beta- (β-), delta- (δ-), and gamma- (γ-) benzenehexachloride (BHC) isomers. Currently, soil exceeding the Type IV risk reduction standards (RRS) established in the VIRP is limited to two areas of concern (AOCs) on the Property, AOC-1 and AOC-2. These two AOCs are shown in Figure 1-1. Attachment A includes a surveyed map illustrating the horizontal limits of both AOC-1 and AOC-2.

AOC-1 is located south of and adjacent to the former Rock Salt Warehouse and is surrounded by security fencing that GPA installed, per EIC's specifications in the Third VIRP Semi-annual Progress Report (EIC, 2014a). AOC-2 includes Warehouse No. 3, Warehouse No. 2, and surrounding paved areas.

The Soil Investigation Summary (Attachment B) provides information regarding the background for each AOC, relevant soil samples collected within or near each AOC, and the horizontal extents of contaminated soils.

As discussed in the VIRP, the remediation of COC containing soils within both AOCs was determined to be impractical. In January 2017, EIC submitted a CSR to EPD certifying completion of all activities proposed in the VIRP and documented the establishment of engineering controls at the site to manage the BHC contamination in AOC-1 and AOC-2 (EIC, 2017). In a letter dated August 31, 2017, the Georgia Environmental Protection Division (EPD) concurred with EIC's CSR compliance certification (EPD, 2017). Therefore, both AOCs are subject to appropriate engineering and institutional controls to prevent human exposure to COC containing soils.

A third AOC, designated as AOC-3 was originally identified in the VIRP. This AOC encompassed an area along a drainage ditch and swale features north and east of Warehouse 3. However, as discussed in the Attachment B, Soil Investigation Summary, AOC-3 is no longer considered to be an area of concern by the EPD and is therefore not shown in Figure 1-1. The COCs within AOC-1 and AOC-2 have been fully delineated.

1.2 Purpose

This Monitoring and Maintenance Plan (MMP) is a part of an Environmental Covenant for the Property (GPA, 2017). Per the Environmental Covenant, the Property shall be used only for non-residential purposes, as defined in Section 391-3-19-.02 of the of the Georgia Hazardous Site Response Act (HSRA) Rules O.C.G.A. §12-8-90 et seq. (OCGA, 2015).

The primary purpose of this MMP is to include all relevant material pertaining to the design and maintenance specifications for the engineering controls in AOC-1 and AOC-2. The MMP also includes land disturbance covenants and restrictions as well as the mandatory reporting procedures for the two areas of concern.

SECTION 2

2. ENGINEERING CONTROLS

2.1 AOC-1

The majority of AOC-1, illustrated in Figure 1-1, is an open area with grass cover, although a minor portion of the area is forested. In accordance with the GPA Bainbridge Terminal VIRP, a security fence was installed to manage contaminated soils within AOC-1. The security fence remains closed and remains locked, unless opened by an authorized GPA representative for site visits or maintenance operations. In addition to the security fence, a permanent engraved granite marker was conspicuously installed at the southern end of AOC-1, near a security fence entrance gate, to identify AOC-1 on the Property. As discussed further in Section 3.0, additional measures, which include institutional controls, will also be utilized to prevent human exposure from COCs in AOC-1.

The security fence surrounding AOC-1 was constructed in January 2014 with the following specifications:

- The fence is constructed of a seven-foot high 9-gauge chain-link wire comprised of a 2-inch mesh. The fence was installed such that there were no gaps between it and the ground surface along the entire fence boundary.
- The chain-link wire is supported with a 2-inch diameter galvanized steel support poles extending 8 feet from the ground surface and spaced 8 feet apart.
- Along the top of the chain-link wire are 3 evenly-spaced strands of barbed-wire, extending the height of the fence another foot for a total height of 8 feet. Steel brackets affixed to the top of each support pole hold the barbed wire strands outward from AOC-1 at an angle of 45 degrees from the top of the fence.
- The total perimeter length of the fence line is 1,320 feet. This length includes two 16-foot wide vehicle gates one gate in the southeast near the Office and the second in the northwest near the Rock Salt Warehouse.

2.2 AOC-2

The majority of AOC-2, illustrated in Figure 1-1, is primarily covered by pavement or building structures with concrete foundations and with relatively small areas with grass cover. As such, the pavement and buildings provide adequate control measures to prevent human exposure. A permanent granite marker was conspicuously installed near Warehouse 3 to identify AOC-2 on

the Property. As discussed further in Section 3.0, additional measures, which include institutional controls, will also be utilized to prevent human exposure from COCs in AOC-2.

2.3 Maintenance of Engineering Controls and Inspections

To maintain compliance with Type V RRS for COCs in the soil at the Property, security fencing for AOC-1 and protective surface cover for AOC-1 and AOC-2 must remain in place and be properly maintained. In addition, the permanent granite markers positioned to delineate the AOCs as a restricted area must be maintained.

The methods, procedures, and processes that must be followed to inspect and maintain the engineering controls and other fixtures of AOC-1 and AOC-2 are discussed below. Inspections will be performed annually, and will be documented using the attached Annual Inspection Report Form (Attachment C).

2.3.1 Fence Line Maintenance

Regularly scheduled inspection and maintenance of the fence surrounding AOC-1 shall be conducted to prevent human exposure to the contaminated soils within the AOC. The Fence Line Operations and Maintenance Manual, which outlines routine fence line guidelines and inspections, is included as Attachment D. The purpose of the maintenance manual is to ensure the viability of the security fence as an exposure pathway control measure as well as to ensure the health and safety of port personnel, contractors, and visitors to the Property.

Any maintenance performed on the fence will be documented using the Maintenance Evaluation Form provided as Attachment E. Any significant damage to the fence will be repaired within 60 days of discovery, and any less significant damage will be repaired within 90 days of discovery. The repairs will be made in accordance with good engineering practices, and will be conducted by qualified personnel. All maintenance, and significant changes to the fence observed during routine site inspections will be noted on the Annual Evaluation Form.

2.3.2 Permanent Markers for AOC-1 and AOC-2

The Environmental Covenant (GPA, 2017) mandates that permanent markers be installed and maintained on the Property to delineate the restricted area, as specified in Section 391-3-19-.07(10) of the HSRA Rules (OCGA, 2015). The locations of the markers are illustrated in in Figure 1-1. Disturbance or removal of the markers is prohibited.

The structural integrity of the markers will be inspected annually and maintained to avoid being crushed, broken, or defaced in a manner that causes the markers to be illegible or loose. The results of the inspection will be recorded using the Annual Inspection Report Form.

Any maintenance performed on the permanent markers will be documented using the Maintenance Evaluation Form. Any significant damage to the permanent markers will be repaired or the marker replaced within 60 days of discovery, and any less significant damage will be repaired within 90 days of discovery. The repairs will be made in accordance with good engineering practices, and will be

conducted by qualified personnel. Any significant changes to or destruction of the permanent markers observed during the inspection will be noted in the Annual Inspection Report Form.

2.3.3 Protective Cover Maintenance

Maintaining the protective grass cover for AOC-1 and AOC-2 and the impervious cover (pavement) at AOC-2 is vital in preventing exposure from COCs within these AOCs.

Specifically, the pavement protective surface cover at AOC-2 will be maintained to prevent cracks, movement, or damage that leads to soil exposure. The grass protective surface cover within AOC-1 and AOC-2 will be maintained to prevent soil erosion. The grass cover within AOC-1 and north of warehouse 3 (WH-3) within AOC-2 will be neatly maintained and cut such that the engraved granite marker near AOC-1 and the base of the security fencing surrounding AOC-1 are clearly visible.

The integrity of the protective surface cover will be inspected annually and the results of the inspection will be recorded using the Annual Inspection Report Form. Any part of the protective cover for either AOC that becomes degraded or removed, such that the COC containing soil beneath is exposed, will be replaced promptly and appropriately. Any deficiencies will be noted and addressed as soon as possible.

Any maintenance performed on the protective surface cover will be documented using the Maintenance Evaluation Form. Any significant damage to the protective surface cover will be repaired within 60 days of discovery, and any less significant damage will be repaired within 90 days of discovery. The repairs will be made in accordance with good engineering practices, and will be conducted by qualified personnel. Any significant changes to the protective surface cover observed during the inspection will be noted in the Annual Inspection Report Form.

SECTION 3

3. INSTITUTIONAL CONTROLS

As discussed in Section 1.0, in addition to engineering controls in place on the Property to prevent exposure to the established pesticide COCs in soil, institutional control measures will be utilized to further prevent exposure. In general, the institutional controls will be managed by GPA to minimize exposure and to ensure that the engineering controls set in place are properly maintained. The following subsections discuss the institutional control measures that will be utilized on the Property.

3.1 Property Use Limitations

The Property shall be used only for non-residential purposes, as defined in Section 391-3-19-.02 of the HSRA Rules as of the effective date of the Uniform Environmental Covenant (OCGA, 2015). Any residential use of the Property shall be prohibited, unless approved in advance by the director of the EPD.

3.2 Land Disturbance

Any activity on the Property within or near the established boundaries of AOC-1 and AOC-2 that may result in exposure to, or creates new exposure pathways for the COCs in soil, is prohibited.

Any land disturbance activities or other intrusive work within AOC-1 and AOC-2 that affect grass cover, pavement cover, building foundations, or soil, must be conducted in accordance with this plan. Intrusive activities include, but are not limited to, drilling; digging; placement of any objects or use of any equipment which deforms or stresses the surface beyond its load-bearing capacity; piercing the surface with a rod, spike or similar item; bulldozing; or any earthwork in general. Additionally, any contractors or terminal personnel who perform work in or near the AOCs must attend a BHC awareness program and abide by the health and safety stipulations discussed in the attached Contractor Health and Safety Plan (Attachment F).

All intrusive activities must be evaluated by a competent and qualified GPA employee or its contractor before implementation, to determine applicable health and safety requirements, and waste management and disposal requirements. During the implementation of intrusive activities, all ground cover and subsurface materials will be properly characterized and appropriately managed on-

site, and if necessary, disposed of at an approved certified off-site disposal facility with prior approval from GPA personnel.

Any excavations performed within the AOCs will be backfilled with certified clean soil or fill material and the surface will be restored with material that is comparable to and compatible with the existing protective surface covers. It may, however, be permissible to construct an impermeable surface (pavement and/or building foundation) in areas that currently have no such features, as these improvements would further limit human exposure to COCs. All intrusive activities will be conducted in compliance with applicable Occupational Health and Safety Administration (OSHA) requirements.

SECTION

4

4. PLANNED USES OF THE PROPERTY

The Property is currently utilized as a bulk storage facility for several agricultural products. In accordance with the Environmental Covenant, the primary use of the Property will not include residential use. The annual inspection will verify the use of the Property by the owners to be consistent with non-residential use. In addition, all lease agreements and other agreements concerning the use of the Property will be reviewed to ensure the language is consistent with non-residential use of the Property.

Advance written notice to EPD will be provided for any planned future changes in the use of the Property that will significantly change the condition of the security fencing and/or protective surface cover or otherwise significantly impact the engineering controls.

SECTION 5

5. REPORTING

The Property owner shall complete and submit to EPD an annual report by December 30 of each year, which will include at a minimum;

- A description of the ongoing condition of engineering controls for each AOC
- Records of any maintenance conducted for engineering controls
- Any deficiencies for AOCs noted routine inspections
- All forms, logs, and other paperwork related to inspections and maintenance of engineering and institutional controls
- All other activities associated with each AOC, which may potentially affect the engineering or institutional controls set in place, will also be included

The cover letter for the annual report will include the name, mailing address, telephone number, facsimile number, and e-mail of the person that EPD should contact regarding the requirements associated with the Property.

SECTION 6

6. REFERENCES

Environmental International Corporation (EIC), 2012. *VIRP Application, BHC Remediation.* Alpharetta, Georgia, July 31, 2012.

EIC, 2013a. *First VIRP Semi-annual Progress Report, Georgia Ports Authority – Bainbridge Terminal, HIS Site No. 10071, 1321 Spring Creek Road, Land Lot 373, Parcels: 20, 21A, and portion of Parcel 19, Bainbridge, Decatur County, Georgia.* Alpharetta, Georgia, May 9, 2013.

EIC, 2013b. *Second VIRP Semi-annual Progress Report, Georgia Ports Authority – Bainbridge Terminal, HIS Site No. 10071, 1321 Spring Creek Road, Land Lot 373, Parcels: 20, 21A, and portion of Parcel 19, Bainbridge, Decatur County, Georgia.* Alpharetta, Georgia, October 30, 2013.

EIC, 2014a. *Third VIRP Semi-annual Progress Report, Georgia Ports Authority – Bainbridge Terminal, HIS Site No. 10071, 1321 Spring Creek Road, Land Lot 373, Parcels: 20, 21A, and portion of Parcel 19, Bainbridge, Decatur County, Georgia.* Alpharetta, Georgia, April 30, 2014.

EIC, 2014b. *Fourth VIRP Semi-annual Progress Report, Georgia Ports Authority – Bainbridge Terminal, HIS Site No. 10071, 1321 Spring Creek Road, Land Lot 373, Parcels: 20, 21A, and portion of Parcel 19, Bainbridge, Decatur County, Georgia.* Alpharetta, Georgia, October 30, 2014.

EIC, 2015a. *Fifth VIRP Semi-annual Progress Report,* Georgia Ports Authority – Bainbridge Terminal, HIS Site No. 10071, 1321 Spring Creek Road, Land Lot 373, *Parcels: 20, 21A, and portion of Parcel 19, Bainbridge, Decatur County, Georgia.* Alpharetta, Georgia, May 4, 2015.

EIC, 2015b. *Sixth VIRP Semi-annual Progress Report, Georgia Ports Authority – Bainbridge Terminal, HIS Site No. 10071, 1321 Spring Creek Road, Land Lot 373, Parcels: 20, 21A, and portion of Parcel 19, Bainbridge, Decatur County, Georgia.* Alpharetta, Georgia, November 2, 2015.

EIC, 2016. *Seventh VIRP Semi-annual Progress Report, Georgia Ports Authority – Bainbridge Terminal, HIS Site No. 10071, 1321 Spring Creek Road, Land Lot 373, Parcels: 20, 21A, and portion of Parcel 19, Bainbridge, Decatur County, Georgia.* Alpharetta, Georgia, April 29, 2016.

EIC, 2017. *Compliance Status Report, HSI Site 10071. Georgia Ports Authority Bainbridge Terminal.* Alpharetta, Georgia, January 17, 2017.

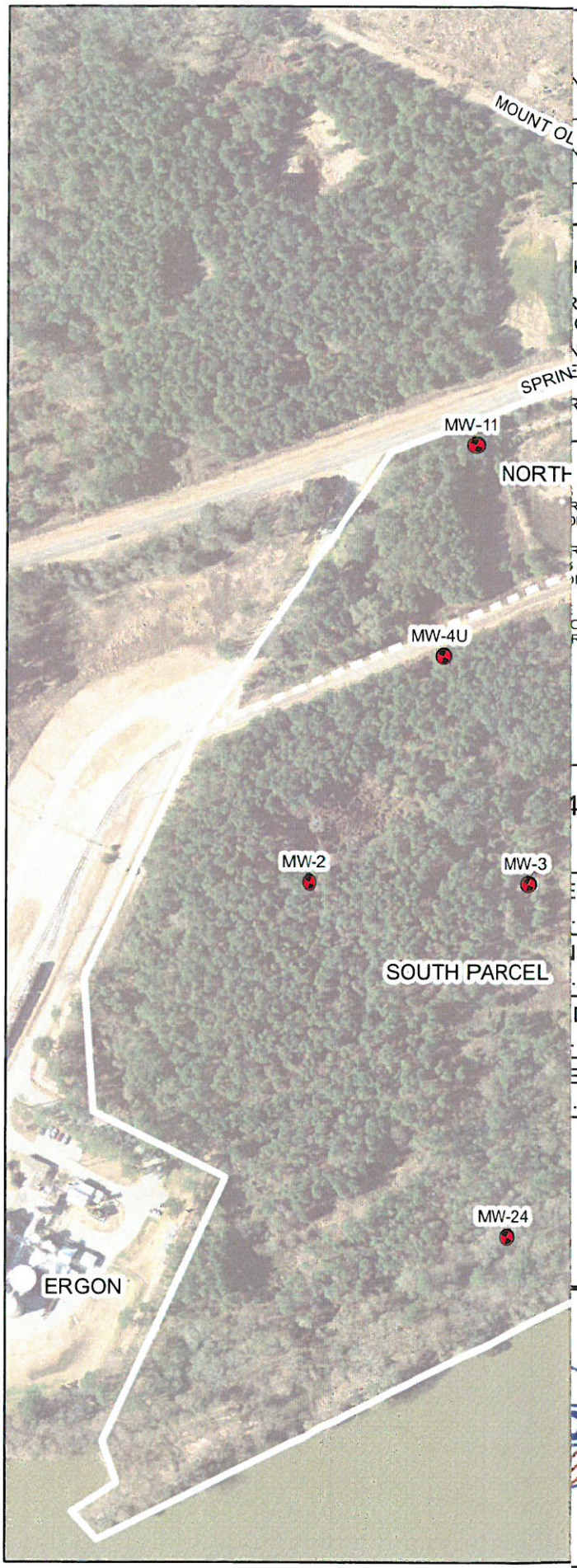
Georgia Ports Authority (GPA), 2017. *Uniform Environmental Covenant.* Bainbridge Georgia. 2017

Georgia Environmental Protection Division (EPD), 2017. *January 17, 2017 VRP Compliance Status Report April 29, 2016 Seventh VIRP Semi-Annual Progress Report, Georgia Ports Authority-Bainbridge Terminal, HIS Site No. 10071, 1321 Spring Creek Road, Bainbridge, Decatur County.* Atlanta, Georgia, August 31, 2017.

Official Code of Georgia Annotated (OCGA), 2015. *The Georgia Hazardous Site Response Act (HSRA) – O.C.G.A. §12-8-90 et seq.* Title 12, Chapter 8, Article 3, Part 2, 2015.

MAINTENANCE AND MONITORING PLAN

FIGURES



NITORING WELL
LLING WELL
NITORING WELL ID
T LOCATED

TURES
KHEAD
RTH AND SOUTH
CEL DIVISION
NBRIDGE PARCEL
R

AREAS OF CONCERN (AOC)

CURRENT AOC EXTENTS

- AOC-1 FENCELINE
- AOC-1 BOUNDARY
- AOC-2 BOUNDARY
- UNIFORM ENVIRONMENTAL COVENANT GRANITE MONUMENT

PROVIDED BY GPA. ABOVE GROUND STORAGE TANKS ON GPA NORTH PARCEL AND RTY, AS WELL AS THE WAREHOUSE AND OTHER BUILDINGS ON AGRIUM PROPERTY EMOLISHED.

ROVIDED BY GEORGIA PORTS AUTHORITY. WELL LOCATIONS PLOTTED FROM AT SITE. GRANITE MONUMENT LOCATIONS AND AOC-2 BOUNDARY ARE PLOTTED NDUCTED BY MOCK SURVEYING INC. ON FEBRUARY 16, 2016.

OCK SALT WAREHOUSE
RT SHED

400 200 0 400

Feet

ED BY:	REVISIONS		DATE: 4/22/2016
	NO.	DATE	SCALE: SEE BAR SCALE
I BY:			
			SHEET NO.: 1 OF 1
D BY:			
ED BY:			

FIGURE 1-1: SITE LAYOUT MAP

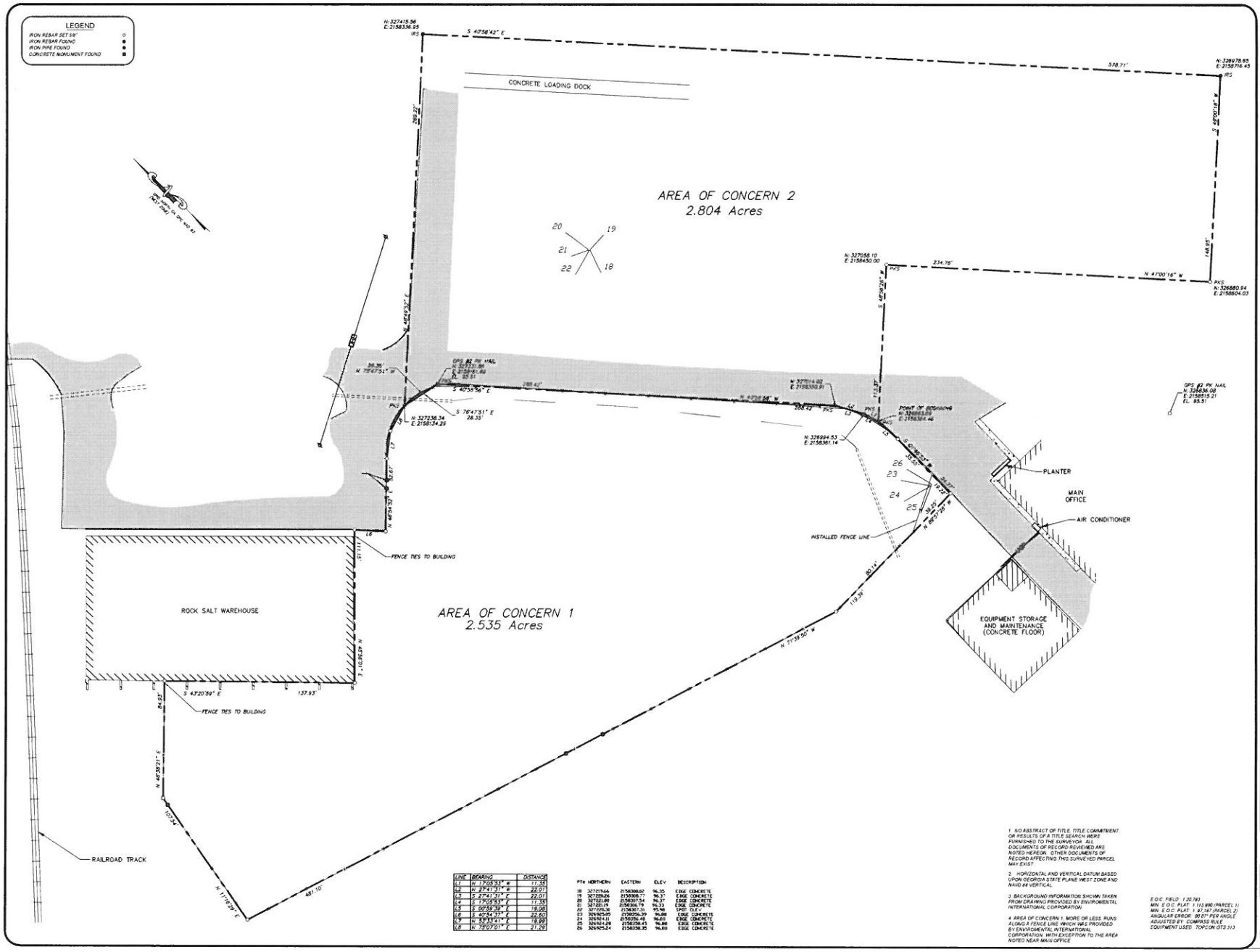
GEORGIA PORTS AUTHORITY
BAINBRIDGE TERMINAL
BAINBRIDGE, GEORGIA

ENVIRONMENTAL INTERNATIONAL CORP.
161 KIMBALL BRIDGE RD.
ALPHARETTA, GEORGIA 30009

HSI SITE 10071, GEORGIA PORTS AUTHORITY – BAINBRIDGE TERMINAL

MAINTENANCE AND MONITORING PLAN

ATTACHMENT A:
AOC Survey Map



LINE	BEARING	DISTANCE
L1	N 17°05'53" W	11.55
L2	N 27°41'51" E	22.01
L3	S 27°41'51" E	22.01
L4	S 17°05'53" E	11.55
L5	S 60°59'39" E	18.00
L6	S 40°54'37" E	22.60
L7	N 52°35'41" E	19.80
L8	N 79°07'01" E	21.29

Pt#	NORTHERN	EASTERN	ELEV	DESCRIPTION
18	327219.66	2158388.62	96.35	EDGE CONCRETE
19	327229.26	2158388.77	96.37	EDGE CONCRETE
20	327221.80	2158397.54	96.37	EDGE CONCRETE
21	327211.20	2158397.39	96.36	EDGE CONCRETE
22	327209.36	2158387.74	95.96	EDGE CONCRETE
23	326929.95	2158356.29	96.88	EDGE CONCRETE
24	326769.41	2158376.48	96.60	EDGE CONCRETE
25	326761.49	2158358.45	96.88	EDGE CONCRETE
26	326925.24	2158358.35	96.80	EDGE CONCRETE

1. NO ABSTRACT OF TITLE, TITLE COMMITMENT OR RESULTS OF A TITLE SEARCH WERE FURNISHED TO THE SURVEYOR. ALL DOCUMENTS OF RECORD REVIEWED ARE NOTED HEREON. OTHER DOCUMENTS OF RECORD AFFECTING THIS SURVEYED PARCEL MAY EXIST.

2. HORIZONTAL AND VERTICAL DATUM BASED UPON GEORGIA STATE PLANE WEST ZONE AND NAVD 88 VERTICAL.

3. BACKGROUND INFORMATION SHOWN TAKEN FROM DRAWING PROVIDED BY ENVIROMENTAL INTERNATIONAL CORPORATION.

4. AREA OF CONCERN 1, MORE OR LESS RUNS ALONG A FENCE LINE WHICH WAS PROVIDED BY ENVIROMENTAL INTERNATIONAL CORPORATION, WITH EXCEPTION TO THE AREA NOTED NEAR MAIN OFFICE

E.O.C. FIELD: 1:20,783
MIN. E.O.C. PLAT: 1:113,890 (PARCEL 1)
MIN. E.O.C. PLAT: 1:87,187 (PARCEL 2)
ANGULAR ERROR: 00.07" PER ANGLE
ADJUSTED BY: COMPASS RULE
EQUIPMENT USED: TOPCON GTS 313

MOCK SURVEYING, INC.
9134 OLD RIVER ROAD
BROOKLET, GA 30415
PH.(912) 657-4010
SURVEYING@BULLOCH.NET

GEORGIA REGISTERED No. LM002693 LAND SURVEYOR JEFFREY WAYNE MOCK

IN MY PROFESSIONAL OPINION THIS SURVEY WAS PREPARED IN CONFORMITY WITH THE TECHNICAL STANDARDS FOR PROPERTY SURVEYS IN GEORGIA AS SET FORTH IN CHAPTER 180-7 OF THE RULES OF GEORGIA BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS AND SURVEYORS AS SET FORTH IN THE GEORGIA PLAT ACT O.C.G.A. 15-6-67.

30' 15' 0' 30'
GRAPHIC SCALE: 1"=30'-0"

BOUNDARY SURVEY OF AREA OF CONCERN 1 & 2 FOR ENVIROMANTAL INTERNATIONAL CORPORATION AN AREA OF GEORGIA PORT AUTHORITY DECATUR COUNTY, BAINBRIDGE GEORGIA

PROJECT NO.:	16-012
DRAWN BY:	JWM
SURVEYED BY:	AWM
SURVEY DATE:	2-16-16
CHECKED BY:	JWM
SCALE:	1" = 30'
DATE:	2-24-16

SHEET 1 OF 1

MAINTENANCE AND MONITORING PLAN

ATTACHMENT B:
Soil Investigation Summary

HSI SITE 10071, GEORGIA PORTS AUTHORITY-BAINBRIDGE TERMINAL

SOIL INVESTIGATION SUMMARY

November 13, 2017

Reference File: 400007

Prepared for:

GEORGIA PORTS AUTHORITY

P.O. Box 2406

Savannah, Georgia 31402

Prepared by:

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SECTION

1

1. INTRODUCTION

The Georgia Ports Authority (GPA) Bainbridge Terminal site) has been the subject of multiple soil investigation and remediation activities since 1993. Soil contaminants of concern (COCs) are pesticides, which predominantly consist of alpha- (α-), beta- (β-), delta- (δ-), and gamma- (γ-) benzenehexachloride (BHC) isomers. In the Voluntary Investigation and Remediation Plan (VIRP) (EIC, 2012), EIC designated three areas of concern (AOCs) in the South Parcel of the terminal: AOC-1, AOC-2, and AOC-3 based on historical data. Since 2012, under the VIRP, EIC has conducted various delineation and management activities concerning each AOC. Figure 1-1 illustrates the locations of AOCs 1 and 2 and of the former AOC-3 at the site. Soil sampling and management measures for each AOC are described in the following sections.

SECTION

2

2. AOC-1 SOIL DELINEATION AND SECURITY FENCE

AOC-1, is located to the south of the Rock Salt Warehouse (RSW). EIC had proposed installing a security fence around AOC-1 as an engineering control in the VIRP (EIC, 2012). Comment 10 of the EPD's comment letter dated November 2, 2012, that was delivered with the VIRP approval letter, stated that the originally proposed security fencing at AOC-1 in the VIRP did not encompass all known risk reduction standards (RRS) exceedances. In the second semi-annual report, GPA submitted a revised fence line plan illustrating a fence which encompassed, not only all of the areas with RRS exceedances, but all areas of former soil sampling grids and, additionally, having an approximately 20-foot offset buffer from the sample grids. In January 2014, GPA installed the security fence per a revised fence line plan (EIC, 2014a). The following sections describe the design and installation of the security fence.

2.1 HORIZONTAL EXTENT OF COCS

Figure 2-1 identifies the soil grid sampling locations within AOC-1 and the horizontal extent of soil with the gamma BHC (Lindane) COC exceeding established RRS values. Other COCs determined to be onsite and listed in the VIRP include alpha, beta, and delta isomers of BHC. As outlined in Section 4.1.1 of the VIRP, EIC determined that it would be impractical to remediate or to remove the large volume of COCs containing soil from AOC-1 (EIC, 2012). Therefore, EIC proposed that the COC containing soil would be left in place and managed through a site covenant and engineering controls, thus preventing exposure for site workers, visitors, on-site employees, and the general public to BHC COCs. A security fence was proposed as the most practical engineering control for AOC-1 by EIC and GPA installed it per the design EIC provided.

2.2 SECURITY FENCE DESIGN PROCESS

In designing the fence, EIC first developed a fence layout based on a review of the horizontal extent of soil COCs that exceeded RRS values and considering EPD's requirement (comment letter dated November 2, 2012) that the fence should "encompass all RRS exceedances". The layout, setback with an approximately 20-foot buffer, ensured that the fence surrounded the historical soil sample grids where soil exceeded the RRS. In unpaved areas or, where the sample grids extended beneath the asphalt pavement of the main site driveway or the office parking lot, the fence was proposed to extend along the edge of the pavement – as the pavement acts as a surficial barrier limiting exposure.

After the fence alignment was finalized, EIC contracted a licensed surveyor to locate the proposed fence line adjacent to the RSW area. This survey was completed as discussed in the Second Semi-Annual Progress Report submitted on October 31, 2013 (EIC, 2013). EIC then utilized the survey data to prepare Figure 2-1 that illustrates the fence alignment and the gate locations. The primary criteria for the construction specifications of the fence was to prevent unauthorized entry. EIC designed the fence to meet the criteria as discussed in Appendix B of the Second VIRP Semi-Annual Progress Report and the design was based on general guidelines outlined by the U.S. Department of Defense and the Chain Link Fence Manufacturers Institute (DOD, 1993; CLFMI, 2013). The final fence design required 3-strands of barbed wire with a height of 1 foot along the top of the fence and limited the bottom of the fence to a height of no more than 2 inches above grade at any point along the fence. Also, the specifications included signage to be installed along the length of the fence. The signs installed along the fence line display the message, "Hazardous Area Authorized Personnel Only".

2.3 SECURITY FENCE INSTALLATION

Utilizing EIC's fence design and bid specifications, GPA managed the bidding process and the selection of a contractor to complete the installation. Since gamma-BHC (Lindane) is the only BHC isomer at the site that meets the federal definition as a hazardous waste at the site, EIC generated Figures 2-2, 2-3, and 2-4 to illustrate the areas within AOC-1 where gamma-BHC concentrations were above the RRS. These figures illustrate the Lindane exceedances at depth intervals of 0-2 feet, 2-5 feet, and greater than 5 feet below grade, respectively. These figures were also provided to the fence installation contractor to provide guidance on remaining outside the COC areas when working in AOC-1 and for the general health and safety of terminal employees and site visitors authorized to work within the fenced area.

A security fence operation and maintenance manual was also prepared for GPA to ensure the integrity of the fence line and prevent potential security breaches. A copy of the manual is included as Attachment C in the site Maintenance and Monitoring Plan.

SECTION

3

3. AOC-2 SOIL DELINEATION

In response to comment number two of the July 2, 2014 EPD comment letter documented in the Fifth VIRP Semiannual Report (EIC, 2015), in December 2014 EIC conducted soil sampling along the eastern edge of AOC-2 to complete the delineation of COCs in soil to the east of AOC-2. The following sub-sections describe the procedures and results of the AOC-2 soil delineation sampling of 2014.

3.1 AOC-2 BACKGROUND

As stated in the VIRP application, AOC-2 is primarily covered by an impermeable barrier. This barrier consists of the concrete slab foundation of Warehouse 3 and the surrounding asphalt pavement. This barrier eliminates potential direct human exposure to the underlying soil. In addition, GPA has established site covenants at the facility - as specified in the VIRP application - to eliminate exposure to construction or to underground utility workers who may potentially expose soils in the area.

In response to EPD's comment, EIC conducted soil sampling within AOC-2 along its northern boundary in June 2013 - as discussed in the Second Semi-annual Progress report (EIC, 2013). The sampling results confirmed that COCs were delineated below the established RRS along the northern unpaved area of AOC-2.

The EPD concurred with the results of the delineation of the northern boundary of AOC-2 in its July 2, 2014 comments letter. EPD, however, requested that the eastern boundary of AOC-2 be expanded to include the adjacent railroad tracks and the southern and western boundaries be expanded to abut AOC-1.

The eastern boundary of AOC-2 consists of bare soil and as such is not covered by an impermeable barrier. As the eastern boundary of AOC-2 was bare soil, EIC conducted a second AOC-2 sampling event along the eastern boundary of AOC-2 and east of the adjacent railroad tracks in December 2014. Section 3.2 includes a discussion of the soil sampling activities, soil boring survey, and analytical data evaluation regarding the delineation of the eastern boundary of AOC-2. However, as the southern and western boundaries consisted of a paved/concrete cover, which provides ample protection against human exposure, further sampling was not conducted.

As a result, the EPD requested in its October 6, 2015 comments letter to the GPA, that AOC-2 be expanded to the south and west to include the paved area between AOC-1 and AOC-2 as well as any paved area which was previously sampled and had detections of COCs above delineation criterion. Therefore, utilizing current and historical soil data files, EIC redefined the boundaries of AOC-2

AOC-2 was expanded to the south and west from its original location established in the VIRP to include warehouse 2 and its foundation as well as all the concrete covered area with COCs above delineation criterion. Figure 3-1, illustrates the new boundary for AOC-2.

3.2 DECEMBER 2014 AOC-2 SOIL SAMPLING

3.2.1 Sampling Protocol

The soil sampling program was conducted in accordance with the current U.S. EPA soil sampling procedure "Field Branches Quality System and Technical Procedures" (FBQSTP) per the EPD regulations. Each soil sample was collected following the technique established in the standard operating procedure (SOP) SESDPROC-300-R3 under the FBQSTP (EPA, 2014).

Prior to the beginning of each soil boring, each location was cleared of any surface debris such as tree limbs, leaves, or other forms of detritus. After all vegetation cover had been cleared, EIC utilized a decontaminated stainless-steel hand auger to advance a 1.5-inch diameter sand auger to collect discrete samples from the 0- to 2-foot and from the 3- to 5-foot intervals below ground surface. After each discrete soil sample was collected, the sand auger was decontaminated by washing with a phosphate free detergent, rinsing with deionized water, and allowing it to dry before reuse in accordance with EPD's Field Equipment and Decontamination guidelines SESDPROC-205 (EPA, 2011b).

After each soil sample was retrieved, it was deposited into a decontaminated stainless-steel bowl for homogenization. The homogenization was completed in accordance with EPD's guidance document SESDPROC-300-R3. The soil samples were thoroughly mixed to ensure that each sample was representative of each respective zone. Each homogenized sample was then placed into a laboratory supplied four-ounce glass jar and the jar cap securely tightened. Threads on the containers and lids were cleaned to ensure a tight seal when closed. The exterior of each sample jar was then cleaned and labeled and placed into a laboratory supplied insulated thermal container ("cooler") with ice for storage. Following all soil boring activities, unused soil was placed back into each respective borehole from which it originated.

3.2.2 Samples Submittal and Analysis

Prior to submitting the soil samples to the laboratory, EIC completed chain of custody forms and these forms accompanied all samples. EIC submitted all soil samples and COC forms to Xenco Laboratories, a Georgia Department of Natural Resources-certified laboratory located in Norcross, Georgia (Xenco), for analysis. The laboratory analyzed the soil samples for organochlorine pesticides using EPA Method 8081B/3660B (sulfur cleanup). The laboratory report was included as Attachment B of the Fifth VIRP Semiannual Report (EIC, 2015)

3.2.3 Soil Boring Survey

As documented in the Fifth Semiannual Report (EIC, 2015), EIC utilized a certified land surveyor to conduct a survey of the soil boring locations in December 2014. Based on survey data, the locations of the soil borings along the eastern boundary of AOC-2 are illustrated in Figure 3-1 with yellow highlights and labels. Figure 3-1 also illustrates other historical soil samples collected in AOC-2 for delineation purposes.

3.2.4 Data Evaluation

From Figure 3-1, it is apparent that the concentrations of the COCs in soil collected from both the 0 to 2-foot and 3 to 5-foot intervals of each of the four soil borings along the eastern boundary of AOC-2 were below RRS limits. Additionally, all samples on the eastern boundary were below the delineation standard with several samples also below the method detection limit (MDL). Considering that the COCs in AOC-2 have been delineated towards the east, EIC has determined that the eastern boundary of AOC-2 should remain unaltered as originally defined in the VIRP. Additionally, as both the northern and eastern unpaved boundaries of AOC-2 have been delineated, it is clear that the site engineering and institutional controls fully address the soil COC management objectives described in the VIRP application.

SECTION

4

4. AOC-3 SOIL DELINEATION

In response to Comment 9 of the EPD comment letter dated November 2, 2012, EIC conducted confirmatory soil sampling activities in AOC-3 in an area historically determined as a single "hot spot". This section presents the soil sampling program and an evaluation of the collected analytical data.

As established in the VIRP, the hot spot within AOC-3 was located in the sediments within a drainage ditch/swale. However, as all samples collected from these deposits by EIC were subaerial (not submerged in water), the collected samples were classified as soil rather than as sediment samples. As such, these samples are referred to as soil samples in this report.

4.1 SAMPLING OBJECTIVES

Shallow soil samples taken from AOC-3 prior to the VIRP submittal (pre-VIRP samples) by a former consultant indicated a single RRS exceedance ("hot spot") of beta-BHC concentration within a 0 to 0.5-foot interval (soil sample SD-06), as is illustrated in Figure 4-1. This soil sample was collected from the drainage ditch running north-south east of Warehouses 1, 2, and 3 in December 2012. The primary objective of the current AOC-3 soil sampling program was to reconfirm whether COCs above RRS were present within the soil of the drainage features of AOC-3 and to delineate the extent of such COCs.

4.2 SOIL SAMPLING FIELD PROGRAM

To verify if soil within AOC-3 continued to exceed the established RRS in the vicinity of the sample SD-06 location, EIC conducted 5 soil borings: one directly over the former SD-06 location and four additional borings radially surrounding this sample location, as depicted in Figure 4-1. The borings were regularly spaced apart within a radial sampling grid centered upon SD-06. Each boring was extended to a depth of 1 foot below ground surface and soil samples were collected at intervals of from 0 to 0.5 foot and from 0.5 to 1 foot below ground surface. The soil boring and sampling protocol are described in the following sections.

4.2.1 Soil Boring Locations

As geographical coordinates of boring SD-06 were not documented by the previous consultant, EIC derived the approximate latitude and longitude coordinates of the boring utilizing a drawing from a

historical report, Quantum Geographic Information Systems (QGIS) software, and a recent aerial photograph. In the field, EIC utilized an I-Phone 4S with the "GPS Data Service" application to match the determined latitude and longitude to those displayed by QGIS. A recent aerial photograph illustrating the SD-06 sample location was also utilized in the field for locating the original sample location relative to observed site features. After the SD-06 sample location was located, a survey flag was placed to mark the location as S1. EIC then marked 4 additional points at a radial distance of 10 feet away from S1 and evenly spaced apart. All locations were marked with a survey flag resulting in locations upstream, downstream, the western bank, and the eastern bank. Soil borings at these locations were identified as borings S3N, S2SA, S5W, and S4E, respectively, and as illustrated in Figure 4-1. These 4 additional sample points were chosen to delineate the horizontal extent of the only known soil with COCs concentrations above RRS within AOC-3.

4.2.2 Sampling Protocol

The soil sampling program was conducted in accordance with the current U.S. EPA soil sampling procedure "Field Branches Quality System and Technical Procedures" (FBQSTP) per the EPD regulations. Each soil sample was collected following the technique established in the standard operating procedure (SOP) SESDPROC-300-R2 under the FBQSTP (EPA, 2011a).

Once the boring locations had been appropriately marked as described in Section 4.2.1, each soil boring location was cleared of any surface debris such as tree limbs, leaves, or other forms of detritus before sampling. Once all vegetation cover had been cleared, EIC placed a 2-foot by 2-foot piece of clean plastic sheeting with a hole large enough for a 1.5-inch sand auger bit to pass through. EIC then utilized a decontaminated stainless-steel hand auger to advance a 1.5-inch diameter sand auger bit initially to a depth of 6 inches and subsequently to a depth of 1 foot at each of the 5 locations. Prior to boring, the auger was marked using a permanent marker at 6 inches and 1 foot from the bottom of the auger bit as a guide for determining sampling depths.

After each soil sample was retrieved, the sampled matrix was deposited into a decontaminated stainless-steel bowl for homogenization. The homogenization process was completed in accordance with EPD's guidance document SESDPROC-300-R2. The soil samples were thoroughly mixed to ensure that each sample was representative of the 6-inch column of collected soil. Each homogenized sample was then packed tightly into a four-ounce, labeled glass jar and the jar cap secured tightly. Threads on the containers and lids were cleaned to ensure a tight seal when closed.

After each sample was collected, the auger was decontaminated with Alconox spray, rinsed with deionized water, and dried before reuse in accordance with the EPA's Field Equipment and Decontamination guidelines SESDPROC-205-R2 (EPA, 2011b).

4.2.3 Sample Analysis

On November 5, 2013, EIC collected 2 soil samples from each of the 5 soil boring locations (a total of 10 samples), as depicted in Figure 4-1, following the sampling protocol in Section 4.2.2. All sample bottles were properly sealed and labeled in the field. Each sample was then stored with ice in an insulated container ("cooler") provided by the laboratory. A completed chain of custody form accompanied all samples. EIC submitted all soil samples to Xenco Laboratories, a Georgia Department of Natural Resources-certified laboratory located in Norcross, Georgia, for analysis.

The laboratory analyzed the soil samples for organochlorine pesticides contaminants using EPA Method 8081B/3660B (sulfur cleanup). The laboratory report is included as Attachment B in the Third VIRP Semi-annual report (EIC, 2014a).

4.3 DATA EVALUATION

EIC conducted an evaluation of the data compiled from field sampling and laboratory analysis to further define the horizontal extent of COCs above RRS in the only location within the drainage features of AOC-3 where it had previously been determined to occur. The following section outlines the results of EIC's evaluation.

Table 3-1 in the Third VIRP Semi-annual report (EIC, 2014a) is a tabulation of the soil sampling results for the primary COCs comprised of BHC isomers and other pesticides. Figure 4-1 displays a summary of the BHC isomers for each boring location, pre- and post-VIRP. Those values that exceed the delineation criteria and RRS are shown in blue and red colors, respectively.

From to Figure 4-1, it is apparent that COCs above RRS limits were previously (pre-VIRP) detected at one soil sample location. Referring to Figure 4-1, it is clear that there were no COCs detected above RRS nor delineation criteria (nor above laboratory detection limits either) in any of the 10 post-VIRP samples that EIC collected at AOC-3. Based on these findings, it is evident that the RRS exceedance originally observed within the drainage feature soil is no longer present. Therefore, the horizontal extent of shallow COCs within the soil of AOC-3 is considered to be fully delineated within AOC-3.

4.4 REMEDIAL TASKS

GPA has completed the horizontal delineation of the COCs in the shallow soils within AOC-3 area. The COCs in all 10 soil samples collected were, not only below RRS limits and delineation standards, but also were below laboratory analytical method detection limits. Based on these results, EIC recommended that no further remedial action for soil was necessary in AOC-3. Consequently, in a comments letter addressed to the GPA and dated July 2, 2014, the EPD stated that AOC-3 is no longer an area of concern (EIC, 2014b).

SECTION 5

5. REFERENCES

CLFMI (Chain Link Fence Manufacturers Institute), 2013. *Security Fencing Recommendations, http://www.associationsites.com/page.cfm?usr=clfma&pageid=887.* Accessed 8/20/2013.

Department of Defense, 1993. *Military Handbook Design Guidelines for Security Fencing, Gates, Barriers and Guard Facilities, http://www.wbdg.org/ccb/NAVFAC/DMMHN_4V/1013_10.pdf.* Accessed 8/20/2013.

Environmental International Corporation (EIC), 2012. *VIRP Application, BHC Remediation.* Bainbridge, Georgia, July 31, 2012.

EIC, 2013. *Second VIRP Semi-annual Progress Report, Georgia Ports Authority – Bainbridge Terminal, HIS Site No. 10071, 1321 Spring Creek Road, Land Lot 373, Parcels: 20, 21A, and portion of Parcel 19, Bainbridge, Decatur County, Georgia.* Bainbridge, Georgia, October 30, 2013.

EIC, 2014a. *Third VIRP Semi-annual Progress Report, Georgia Ports Authority – Bainbridge Terminal, HIS Site No. 10071, 1321 Spring Creek Road, Land Lot 373, Parcels: 20, 21A, and portion of Parcel 19, Bainbridge, Decatur County, Georgia.* Alpharetta, Georgia, April 29, 2014.

EIC, 2014b. *Fourth VIRP Semi-annual Progress Report, Georgia Ports Authority – Bainbridge Terminal, HIS Site No. 10071, 1321 Spring Creek Road, Land Lot 373, Parcels: 20, 21A, and portion of Parcel 19, Bainbridge, Decatur County, Georgia.* Alpharetta, Georgia, October 30, 2014.

EIC, 2015. *Fifth VIRP Semi-annual Progress Report, Georgia Ports Authority – Bainbridge Terminal, HIS Site No. 10071, 1321 Spring Creek Road, Land Lot 373, Parcels: 20, 21A, and portion of Parcel 19, Bainbridge, Decatur County, Georgia.* Alpharetta, Georgia, May 4, 2015.

U. S. Environmental Protection Agency (EPA), 2011a. *Soil Sampling, Operating Procedure, Number SESDPROC-300-R2, Region 4, U.S. Environmental Protection Agency, Science and Ecosystem Support Division.* Athens, Georgia, December 20, 2011.

EPA, 2011b. *Field Equipment Cleaning and Decontamination, Operating Procedure, Number SESDPROC-205-R2, Region 4, U.S. Environmental Protection Agency, Science and Ecosystem Support Division.* Athens, Georgia, December 20, 2011.

EPA, 2014. *Soil Sampling, Operating Procedure, Number SESDPROC-300-R3."* Region 4, U.S. Environmental Protection Agency, Science and Ecosystem Support Division, Athens, Georgia. August 21, 2014.

SOIL INVESTIGATION SUMMARY

FIGURES

Legend

- MONITORING WELL
- STILLING WELL
- MW-18 MONITORING WELL ID
- N.L. NOT LOCATED
- AOC-1 FENCELINE

SITE FEATURES

- BULKHEAD
- NORTH AND SOUTH PARCEL DIVISION
- BAINBRIDGE PARCEL LINES
- PIER

AREAS OF CONCERN (AOC)

CURRENT AOC EXTENTS

- AOC-1
- AOC-2
- FORMER AOC-3

NOTES:

AERIAL PHOTO WAS PROVIDED BY GPA. ABOVE GROUND STORAGE TANKS ON GPA NORTH PARCEL AND ON AGRIUM PROPERTY, AS WELL AS THE WAREHOUSE AND OTHER BUILDINGS ON AGRIUM PROPERTY HAVE SINCE BEEN DEMOLISHED

PROPERTY LINES PROVIDED BY GEORGIA PORTS AUTHORITY. WELL LOCATIONS PLOTTED FROM MULTIPLE SURVEYS AT SITE.

W.H. = WAREHOUSE
R.S.W. = FORMER ROCK SALT WAREHOUSE
T-SHED = TRANSPORT SHED

N

400 200 0 400

Feet

DESIGNED BY: A.G.	REVISIONS NO.	REVISIONS DATE	DATE: 10/6/2015
DRAWN BY: A.G.			SCALE: SEE BAR SCALE
CHECKED BY: A.S.			SHEET NO.: 1 OF 1
APPROVED BY: R.M.			

FIGURE 1-1: SITE MAP WITH AREA OF CONCERN BOUNDARIES

GEORGIA PORTS AUTHORITY
BAINBRIDGE TERMINAL
BAINBRIDGE, GEORGIA

ENVIRONMENTAL INTERNATIONAL CORP.
161 KIMBALL BRIDGE RD.
ALPHARETTA, GEORGIA 30009

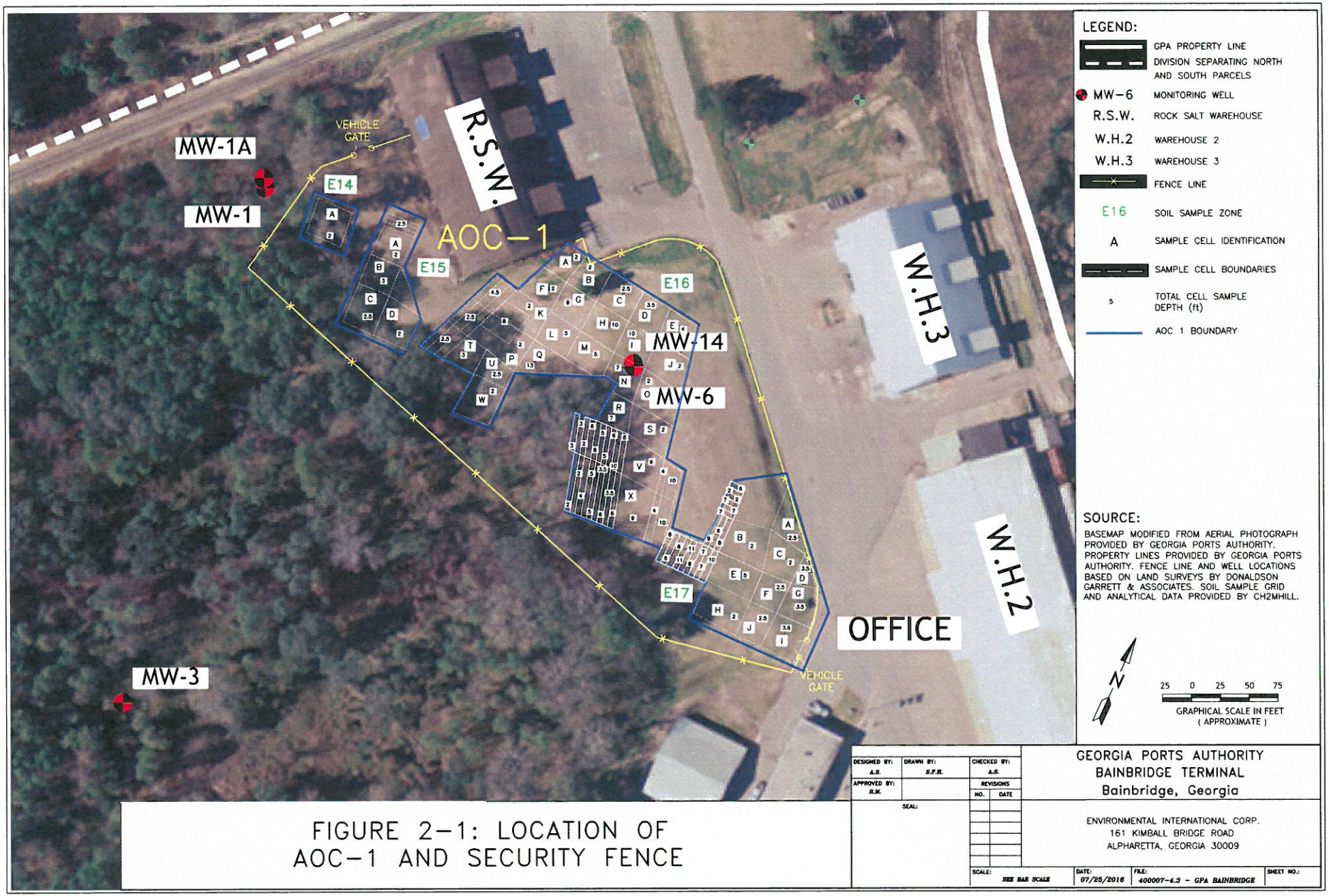


FIGURE 2-1: LOCATION OF AOC-1 AND SECURITY FENCE

DESIGNED BY: A.S.	DRAWN BY: S.F.H.	CHECKED BY: A.S.	GEORGIA PORTS AUTHORITY BAINBRIDGE TERMINAL Bainbridge, Georgia
APPROVED BY: R.M.		REVISIONS NO. DATE	
SEAL:			ENVIRONMENTAL INTERNATIONAL CORP. 161 KIMBALL BRIDGE ROAD ALPHARETTA, GEORGIA 30009
		SCALE: SEE BAR SCALE	DATE: 07/25/2016 FILE: 400007-4.3 - GPA BAINBRIDGE SHEET NO.:

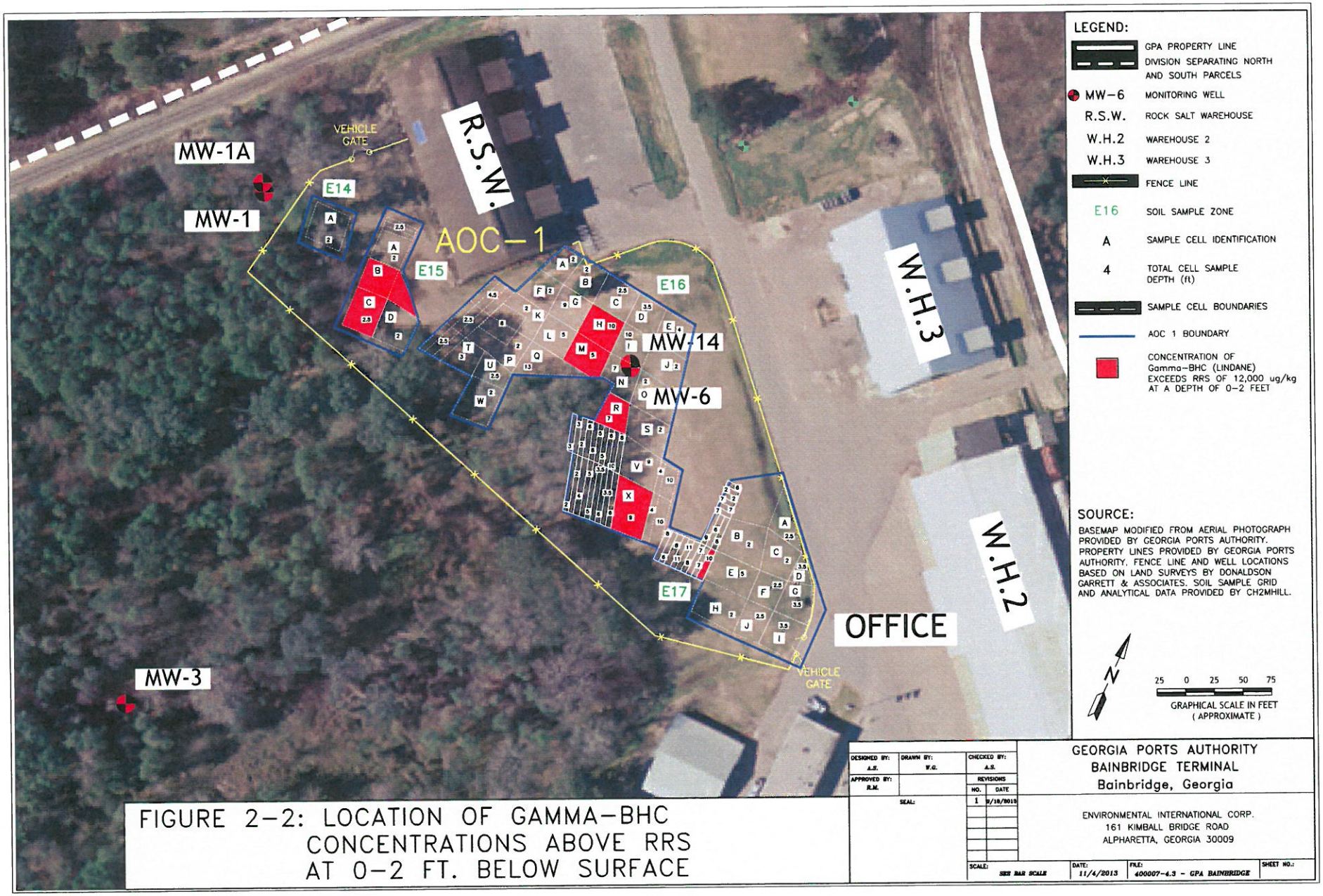


FIGURE 2-2: LOCATION OF GAMMA-BHC CONCENTRATIONS ABOVE RRS AT 0-2 FT. BELOW SURFACE

DESIGNED BY: A.S.	DRAWN BY: W.G.	CHECKED BY: A.S.	GEORGIA PORTS AUTHORITY BAINBRIDGE TERMINAL Bainbridge, Georgia
APPROVED BY: R.M.		REVISIONS NO. 1 DATE 9/10/2013	
SEAL:			ENVIRONMENTAL INTERNATIONAL CORP. 161 KIMBALL BRIDGE ROAD ALPHARETTA, GEORGIA 30009
		SCALE: SEE BAR SCALE	DATE: 11/4/2013 FILE: 400007-4.3 - GPA BAINBRIDGE SHEET NO.:

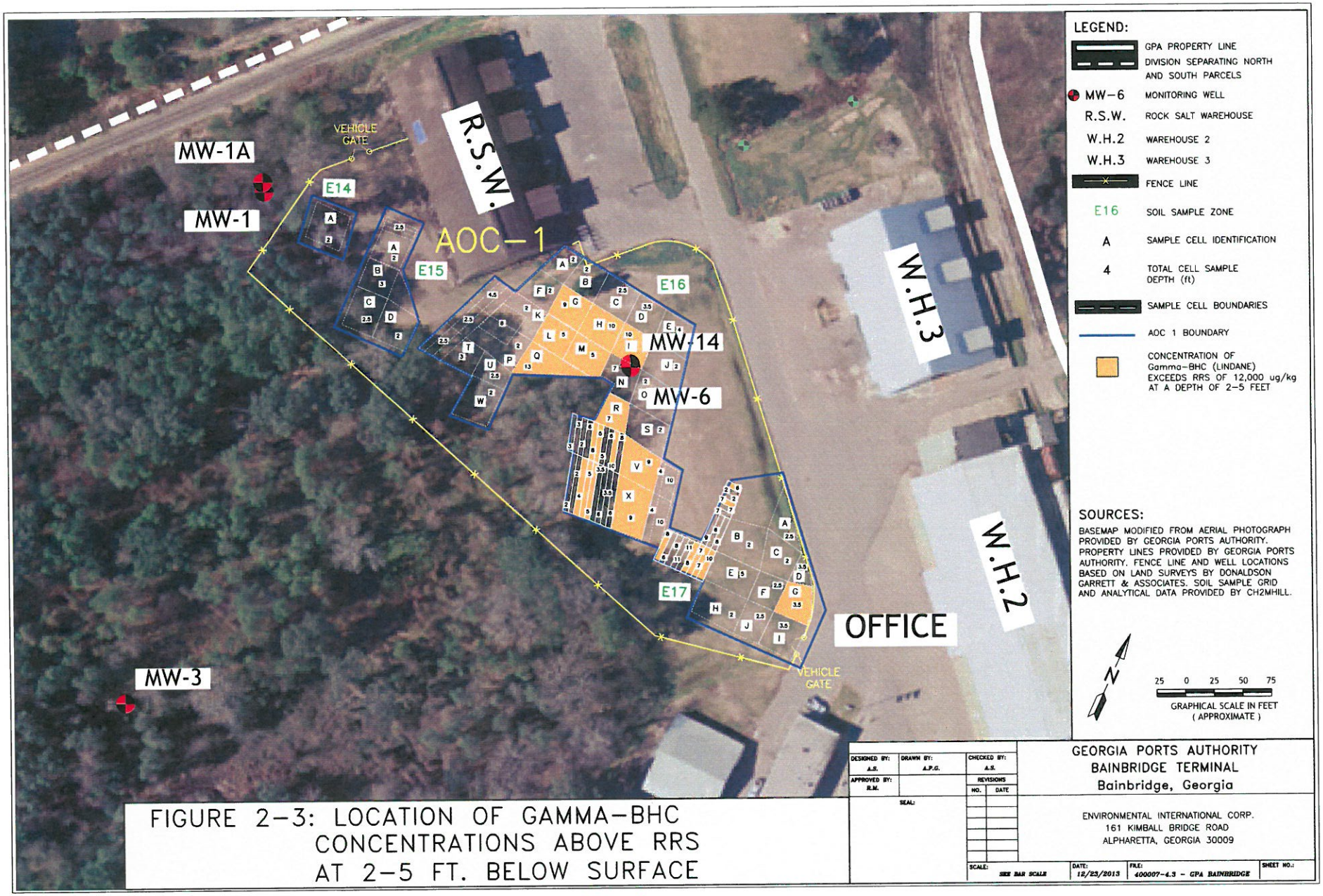


FIGURE 2-3: LOCATION OF GAMMA-BHC CONCENTRATIONS ABOVE RRS AT 2-5 FT. BELOW SURFACE

DESIGNED BY: A.S.	DRAWN BY: A.P.G.	CHECKED BY: A.S.
APPROVED BY: R.M.		REVISIONS NO. DATE

SEAL:

GEORGIA PORTS AUTHORITY
BAINBRIDGE TERMINAL
Bainbridge, Georgia

ENVIRONMENTAL INTERNATIONAL CORP.
161 KIMBALL BRIDGE ROAD
ALPHARETTA, GEORGIA 30009

SCALE: SEE BAR SCALE	DATE: 12/23/2013	FILE: 400007-4.3 - GPA BAINBRIDGE	SHEET NO.:

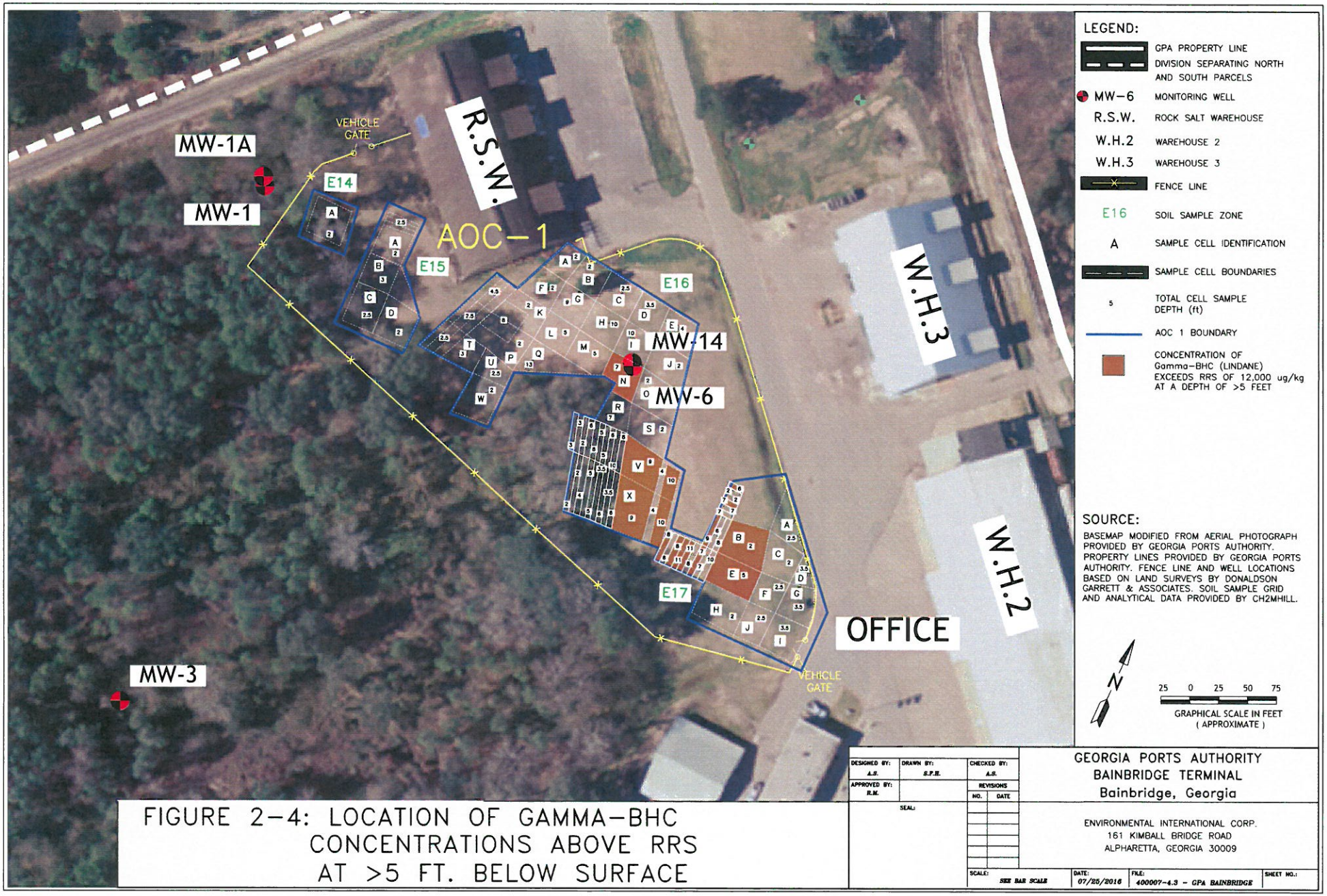
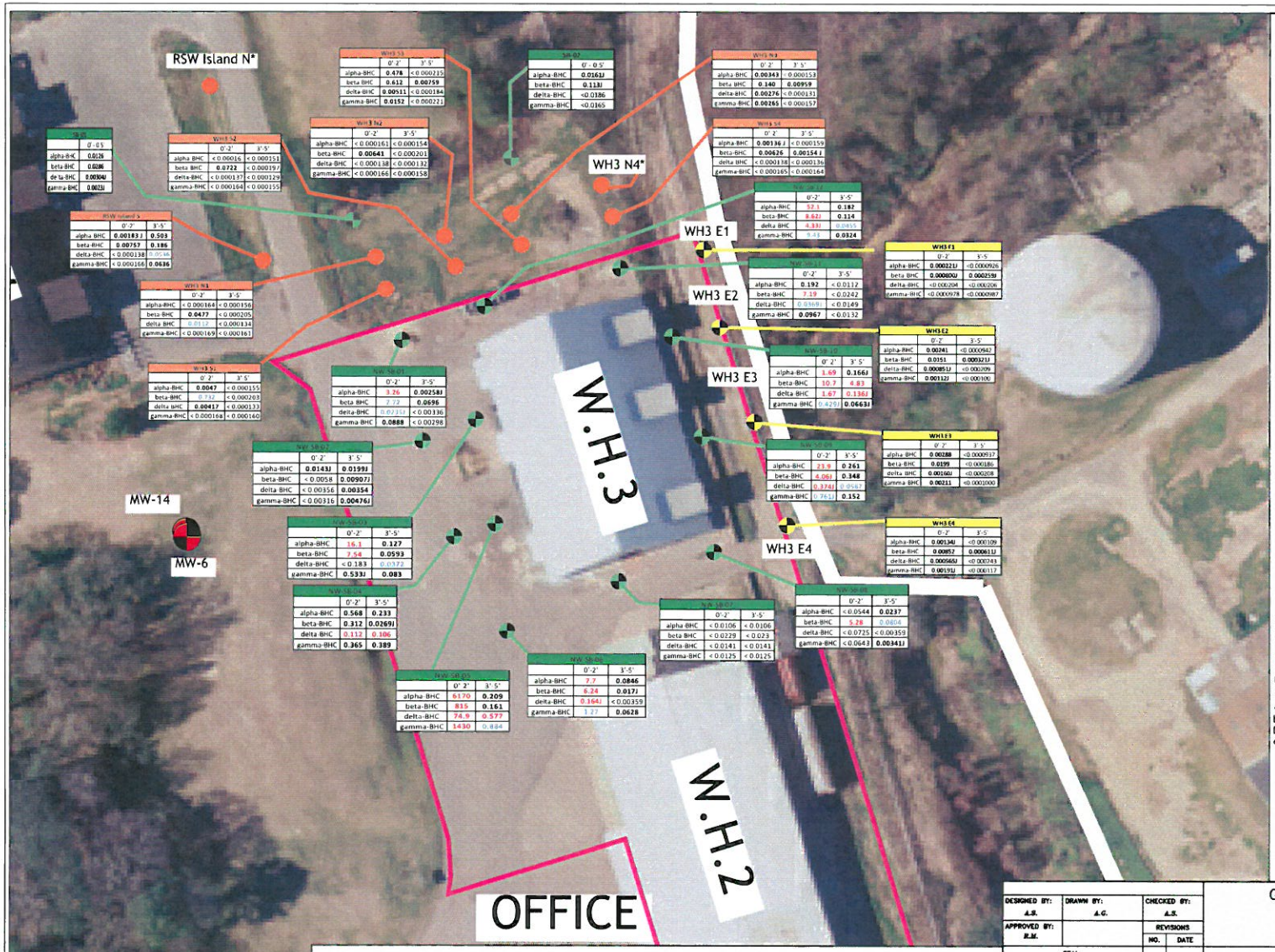


FIGURE 2-4: LOCATION OF GAMMA-BHC CONCENTRATIONS ABOVE RRS AT >5 FT. BELOW SURFACE

DESIGNED BY: A.S.	DRAWN BY: S.P.H.	CHECKED BY: A.S.	GEORGIA PORTS AUTHORITY BAINBRIDGE TERMINAL Bainbridge, Georgia
APPROVED BY: R.M.		REVISIONS NO. / DATE	
SEAL:			ENVIRONMENTAL INTERNATIONAL CORP. 161 KIMBALL BRIDGE ROAD ALPHARETTA, GEORGIA 30009
		SCALE: SEE BAR SCALE	DATE: 07/25/2016 FILE: 400007-4.3 - GPA BAINBRIDGE SHEET NO.:



LEGEND:

- GPA PROPERTY LINE
- R.S.W. — ROCK SALT WAREHOUSE
- W.H.3 — WAREHOUSE 3
- AOC-2 BOUNDARY
- EIC SOIL BORINGS, JUNE 2013
- PRE-VIRP SOIL BORINGS
- EIC SOIL BORINGS, DECEMBER 2014

NOTE: ALL CONCENTRATIONS REPORTED IN MILLIGRAMS PER KILOGRAM (mg/kg). VALUES IN BOLD INDICATE RESULTS ABOVE DETECTION LIMITS. ALL DECEMBER 2014 SOIL BORING LOCATIONS HAD SAMPLES TAKEN AT 0–2' and 3–5'.

* = SAMPLES NOT ANALYZED

J = COMPOUND WAS DETECTED, BUT BELOW QUANTIFICATION LIMIT. CONCENTRATION CONSIDERED ESTIMATE.

CONCENTRATION mg/kg

COC	DELINEATION	RRS
α BHC	0.66	0.66
β BHC	0.66	3.1
δ BHC	0.01	0.10
γ BHC	0.66	12

SOURCE:

Basemap modified from aerial photograph provided by Georgia Ports Authority. Property lines provided by Georgia Ports Authority. Pre-VIRP sample locations (approximate) from CH2M Hill report, 2/24/2012. Post-VIRP June 2013 sample locations based on survey by Donaldson Garret & Associates on 6/5/2013. December 2014 soil sample locations were based on December 2014 survey by DGA.

N

20 0 20 40 60 80

GRAPHICAL SCALE IN FEET
(APPROXIMATE)

FIGURE 3-1: AOC-2 SOIL SAMPLING RESULTS MAP

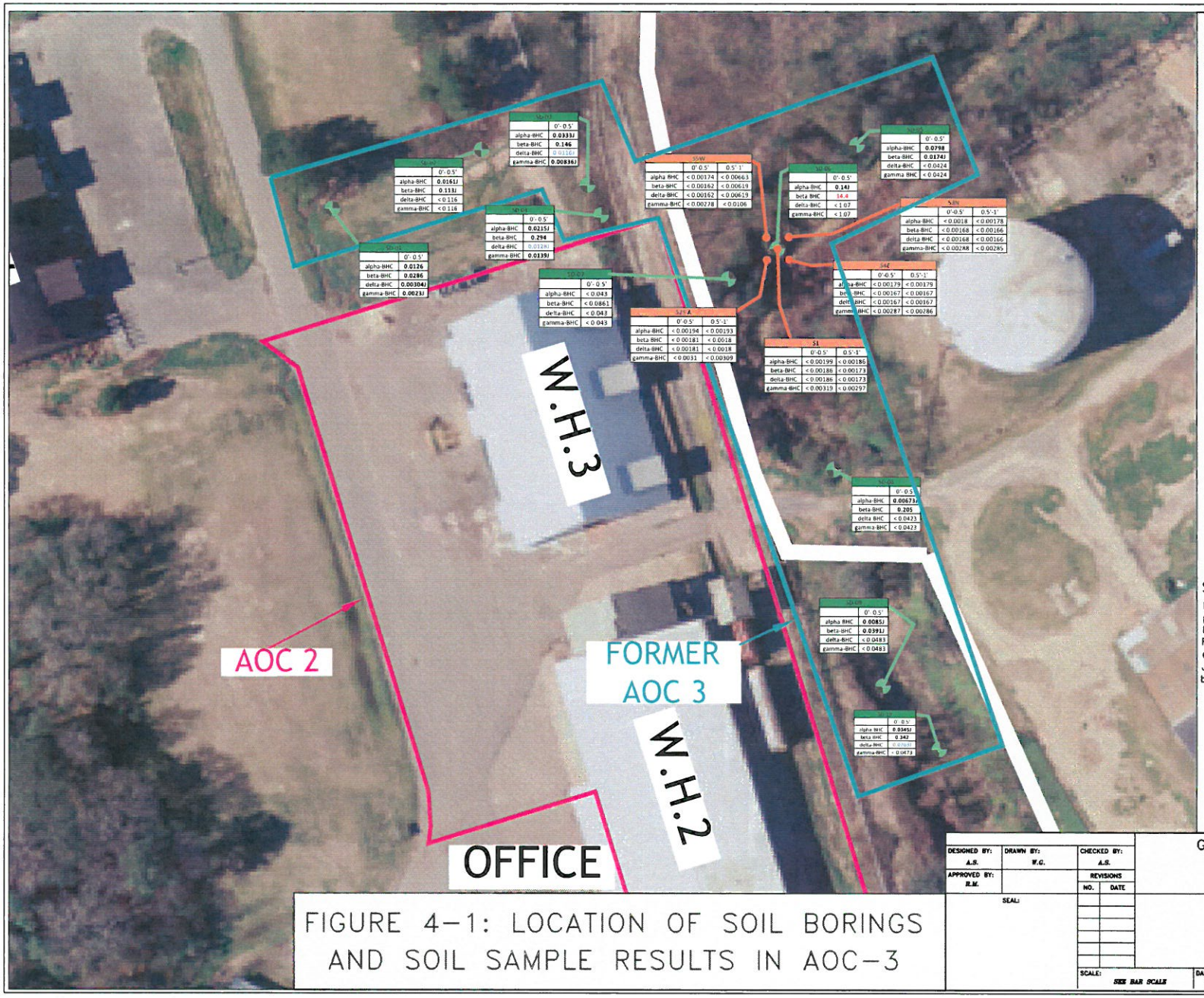
DESIGNED BY:	DRAWN BY:	CHECKED BY:
A.S.	A.G.	A.S.
APPROVED BY: R.M.		REVISIONS NO. / DATE

SEAL:

GEORGIA PORTS AUTHORITY
BAINBRIDGE TERMINAL
Bainbridge, Georgia

ENVIRONMENTAL INTERNATIONAL CORP.
161 KIMBALL BRIDGE ROAD
ALPHARETTA, GEORGIA 30009

SCALE:	DATE:	FILE:	SHEET NO.:
SEE BAR SCALE	6/14/16	400007-4.5 - GPA BAINBRIDGE	



LEGEND:

- GPA PROPERTY LINE
- R.S.W. ROCK SALT WAREHOUSE
- W.H.3 WAREHOUSE 3
- AOC-2
- AOC-3
- EIC SOIL BORINGS, JUNE 2013
- PRE-VIRP SOIL BORINGS

J = COMPOUND WAS DETECTED, BUT BELOW QUANTIFICATION LIMIT. CONCENTRATION CONSIDERED ESTIMATE.

CONCENTRATION mg/kg

COC	DELINEATION	RRS
α BHC	0.66	0.66
β BHC	0.66	3.1
δ BHC	0.01	0.10
γ BHC	0.66	12

SOURCE:

Basemap modified from aerial photograph provided by Georgia Ports Authority.
Property lines provided by Georgia Ports Authority.
Pre-VIRP sample locations (approximate) from CH2M Hill report, 2/24/2012. Post-VIRP June 2013 sample locations based on survey by Donaldson Garret & Associates on 6/5/2013.

N

20 0 20 40 60 80
GRAPHICAL SCALE IN FEET
(APPROXIMATE)

FIGURE 4-1: LOCATION OF SOIL BORINGS AND SOIL SAMPLE RESULTS IN AOC-3

DESIGNED BY:	DRAWN BY:	CHECKED BY:
A.S.	W.G.	A.S.

APPROVED BY: R.M.

SEAL:

REVISIONS NO.	DATE

GEORGIA PORTS AUTHORITY
BAINBRIDGE TERMINAL
Bainbridge, Georgia

ENVIRONMENTAL INTERNATIONAL CORP.
161 KIMBALL BRIDGE ROAD
ALPHARETTA, GEORGIA 30009

SCALE: SEE BAR SCALE | DATE: 08/27/16 | FILE: 400007-4.2 - GPA BAINBRIDGE | SHEET NO.:

MAINTENANCE AND MONITORING PLAN

ATTACHMENT C:
Annual Inspection Form

Evaluator(s) Initials:_____
Date:_____

Annual Inspection Report Form

Site Location: Georgia Ports Authority, Bainbridge Terminal, Bainbridge Decatur County, Georgia

Name of Evaluator(s):_____

Signature(s):_____

Date of Evaluation:_____

The following evaluation form is for the purpose of evaluating site conditions as they pertain to the environmental covenant set in place at the site. Additional information such as photos, figures, or tables, can be attached to this form as needed.

Section 1: Land Use

1. Does the Property meet the definition of non-residential property as defined in HSRA Rule 391-3-19-.02(2)?
   Circle one (Yes , No)
   "Non-residential property means any property or portion of a property not currently being used for human habitation or for other purposes with similar potential for human exposure, at which activities have been or are being conducted that can be categorized in one of the 1987 Standard Industrial Classification major group..."
   If not, provide a written explanation below.

_____

_____

_____

_____

2. Has the use of the property changed or has construction occurred on the property?
   Circle one (Yes , No)

   If yes, provide an explanation below.

_____

_____

_____

_____

Evaluator(s) Initials:_____
Date:_____

Annual Inspection Report Form

Section 2: Engineering Controls

3. Inspect all engineering controls and insure that they meet their intended purposes. Any deficiencies should be noted below. Utilize the standard condition definitions below to report the condition of each aspect of engineering controls.

Condition Definitions

- **Poor** – indicates that item is not meeting intended purpose and requires significant maintenance or repair to achieve its purpose
- **Fair** – indicates that item may not be meeting intended purpose and requires maintenance or repair to achieve its purpose
- **Acceptable** – indicates that item is meeting intended purpose and requires some maintenance or repair to insure that it continues to meet its purpose
- **Good** – indicates that item is meeting intended purpose and requires little to no maintenance or repair to insure that it continues to meet its purpose
- **Excellent** – indicates that item is meeting intended purpose and is in pristine condition, needing no maintenance or repair

3a. AOC-1 Fence line

Inspect the following elements of the fence line around AOC-1 and determine their condition.

Item	Condition				
	Poor	Fair	Acceptable	Good	Excellent
Bottom of Fence Line *(should be vertical and not deformed)*					
Ground Surface Near Fence Line *(bottom of chain link fence should be no greater than 2 inches above ground surface and void of erosion)*					
Body of Fence Line *(should be continuous and vertical, void of corrosion, deformation, holes, and vegetative growth)*					
Top of Fence Line *(chain link mesh should be vertical and not deformed)*					
Barbed Wire Tension *(barbed wire should be angled 45 degrees away from the fence body and be taut)*					

Evaluator(s) Initials:_____
Date:_____

Annual Inspection Report Form

Signs *(Signs should be visible, legible, conspicuous, and be placed at no less than 200 foot intervals along the fence line and at each gate)*					
Gate Hinges *(should operate with minimal force and hold the gate neatly in place without bending, sagging, or needing to force)*					
Gate Latches *(should operate with minimal force and hold gate firmly in place)*					
Locks *(should be located on the latches of the two access gates, void of corrosion, and easily operable)*					
Surroundings *(area surrounding fence line should be void of dead hanging limbs, dead trees, and other potential threats to the integrity of the fence line)*					

Notes:

_____

_____

_____

_____

_____

3b. AOC-2 Ground Cover

Inspect the following elements and determine their condition.

Item	Condition				
	Poor	Fair	Acceptable	Good	Excellent
Ground Cover *(should be either paved or have continuous grass cover, void of signs of erosion, digging, or exposed soil)*					

Notes:

_____

_____

_____

_____

Annual Inspection Report Form

4. Are all engineering controls at the site in good condition and serving their intended purpose of preventing exposure?
   Circle one (Yes , No)

   If not, provide an explanation below.

Section 3: Property Instruments and Permanent Monuments

5. Do all leases or other property instruments for the site have the applicable deed notice language inserted into them? (i.e. HSRA Rule 391-3-19-.08 and O.C.G.A. 44.5-48)
   Circle one (Yes , No)

   If not, provide a written explanation below.

Evaluator(s) Initials:_____
Date:_____

Annual Inspection Report Form

6. Are permanent markers in place at the site to provide notice that the site is subject to an environmental covenant and that the GA EPD or property owner should be contacted prior to digging or performing land disturbing activities?
   Circle one (Yes , No)

   If not, provide a written explanation below.

_____

_____

_____

_____

_____

Inspect the following elements and determine their condition.

Item	Condition				
	Poor	Fair	Acceptable	Good	Excellent
Monument *(should be visible, legible, and in a conspicuous location; void of surrounding tall vegetation; not deformed, cracked, or otherwise broken.*					
Surrounding Area *(should be neatly landscaped if in grass area, if in paved area, pavement should be level and without cracks or other holes*					

Annual Inspection Report Form

Section 4: Exposure Control

7. Overall, have there been any significant changes to the condition of the ground surface/cover at the site since the previous evaluation? (e.g. more or less paved area; leveling or construction activities)
   Circle one (Yes , No)

   If yes, provide a detailed description of the changes and include photographs or illustrations of the changes as needed.

Section 5: Additional Notes

8. Provide any additional notes regarding relevant site conditions not addressed above, which may adversely impact the effectiveness of engineering controls or exposure prevention.

Annual Inspection Report Form

HSI SITE 10071, GEORGIA PORTS AUTHORITY – BAINBRIDGE TERMINAL

MAINTENANCE AND MONITORING PLAN

ATTACHMENT D:
Fence Line Operations and Maintenance Manual

Fence Line Operations and Maintenance Manual

Updated: 4/10/14

Photo 1: AOC-1 Fence Line South Gate with Warning Sign

Introduction

In accordance with the Georgia Ports Authority (GPA) Bainbridge Terminal (site) Voluntary Investigation and Remediation Plan (VIRP), area of concern 1 (AOC-1), illustrated in Figure 1, requires management of contaminated soils utilizing a security fence.

Fence Line Specifications

The security fence for AOC-1 was constructed in January 2014 with the following specifications, illustrated in Figure 2. The fence height is comprised of 7 vertical feet of 2-inch mesh, 9-gauge chain link fabric from the ground surface along the fence boundary as illustrated in Figure 1. The chain-link fabric is supported by 2-inch diameter galvanized steel poles extending 8 feet from the ground surface and spaced 8 feet apart. Along the top of the chain-link fabric is 1 foot high 3 stranded barbed wire angled 45 degrees from the vertical body of the fence. The total perimeter length of the fence line is 1,320 feet with two 16 foot wide vehicle gates as illustrated in Figure 1.

Fence Line O & M Overview

Proper operation and maintenance of the fence surrounding AOC-1 should be conducted in order to prevent human exposure to the contaminated soil enclosed. This manual will outline routine fence line guidelines and inspections that will help to ensure the viability of the security fence as an exposure pathway control measure as well as to ensure the health and safety of port personnel and site visitors.

Index

Figure 1: Simple Fence Line Site Map

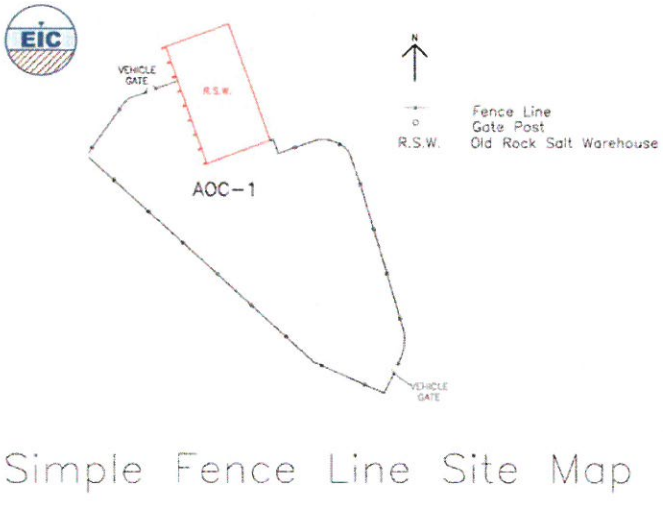
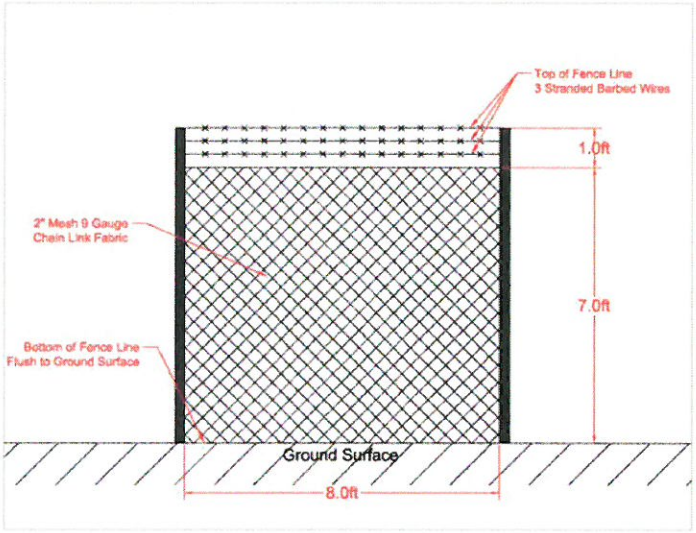


Figure 2: Fence Line Schematic Drawing



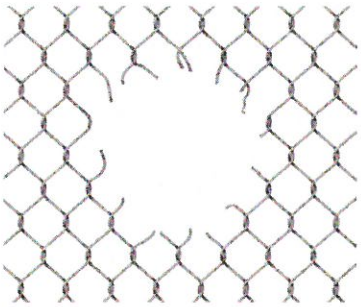


Photo 2: Fence Body Damage From Vandalism

Fence Line Inspections

Fence inspections are crucial to the health and safety of port personnel and site visitors. Inspections should be thorough and detail any damage, wear and tear, and other forms of malfunction throughout the fence line. Fence line inspections should be conducted bi-annually using the suggested points of interest (POI) provided in this document. Following is a suggested list of POI to inspect during fence line inspections.

- Bottom of Fence Line
- Top of Fence Line
- Barbed Wire Tension
- Gate Hinges
- Gate Latches
- Locks
- Ground Surface Near Fence Line
- Body of Fence
- Signs

All inspections should be well documented and any deficiencies or potential risks should be addressed for maintenance and repair as soon as possible. Regular maintenance of the fence line can prevent many breaches or deficiencies as well as costly repairs. Regular maintenance strategies are discussed further below and on page 3 & 4. Following is a detailed description of each POI.

Figure 3: POI Fence Line Schematic

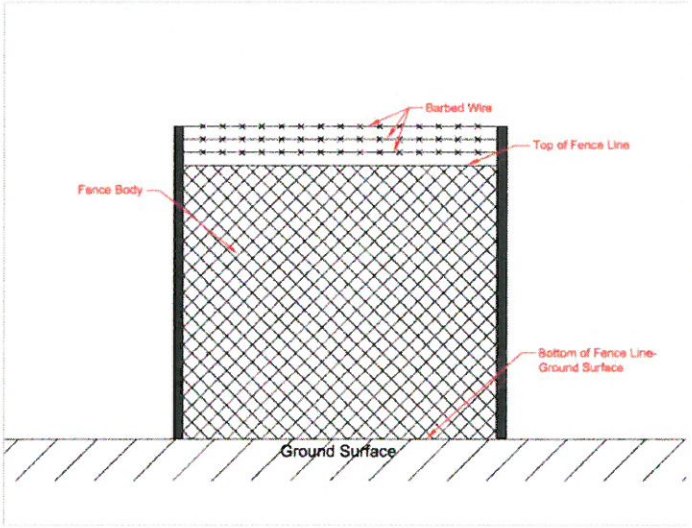
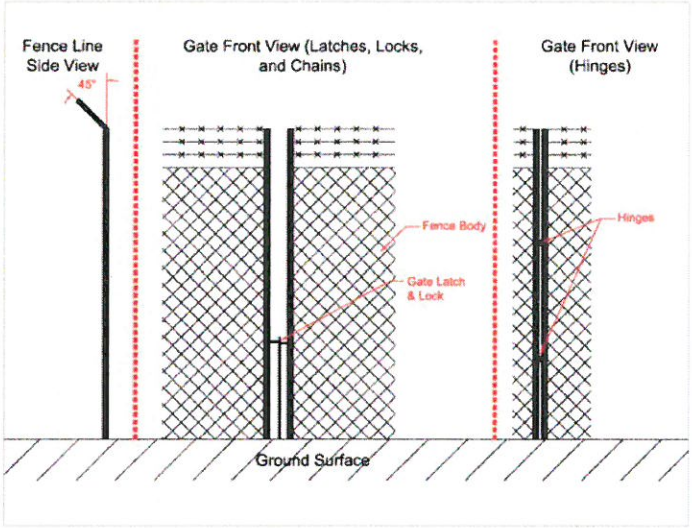


Figure 4: POI Gate Schematic and Fence Side View



Points of Interest

Figures 3 and 4 illustrate the points of interest described below. Any deficiencies in the points of interest listed below should be addressed as soon as possible either utilizing the suggested maintenance options listed on page 3 and 4 or by other conventional means.

Bottom of Fence Line and Ground Surface

The bottom edge of the fence line should be no greater than 2 inches above the ground surface, vertical, and undeformed. Erosion may occur near the fence line which could cause the ground surface to lower and allow unrestricted access to AOC-1. Animals may also burrow underneath the fence line, creating breaches. Any deformation at the bottom of the chain link fabric or deficiencies in the ground surface near the fence line should be noted.

Top of the Fence Line

Near the top of the fence line, the chain-link mesh should be vertical and the barbed wire should be angled at 45 degrees away from the fence body as illustrated in Figure 4. Fallen trees or tree limbs and other vegetation may damage the top of the security fence.

Barbed Wire Tension

The barbed wire at the top of the security fence should be taut and void of any deformations, breaks, or significant corrosion.

Gate Hinges and Latches

The two gates of the security fence should be the only access point for AOC-1 and, as such, they are an important point of

Points of Interest Continued

interest in the inspection list. The gate's hinges should properly operate with minimal force and the latches for the gate should hold the gate neatly in place without bending, sagging, or needing to force. Gate latches and hinges should also be inspected for corrosion, deformation, or cracks.

Locks

Locks on the fence line should be located on the latches of the two gates and should be secured at all times unless site access is necessary. Any corrosion or other damage, as well as tampering that may have occurred, should be noted. Key logs for gate keys should be kept when they are leant out to contractors or temporarily authorized GPA employees.

Body of Fence Line

When inspecting the body of the security fence, any holes or cuts in the fence line which may indicate tampering, should be noted, see Photo 2. Additionally, any deformation inward or outward, should be noted. The body should remain vertical and taut. Any corrosion or natural wear and tear which may cause failures in the security fence, should be noted. The body of the fence line should also be free of any major vegetative growth such as vines and trees, see Photos 3-5.

Signs

Make sure signs are visible and conspicuous. Hazardous site signs should be placed at no less than 200 foot intervals along the fence line. Signs should additionally be present at each gate.

Surroundings

Inspecting the surroundings of the security fence line can prevent much of the aforementioned damage to the security fence. When inspecting the surroundings, any threats that may cause future damage to the fence line such as dead trees or dead overhanging limbs, should be noted. Maintenance is a key element to fence security. If the fence line loses its integrity, it will lose its purpose as both a soil management practice as well as a measure to keep site personnel safe.

Photo 3: Damage to Fence by Fallen Tree

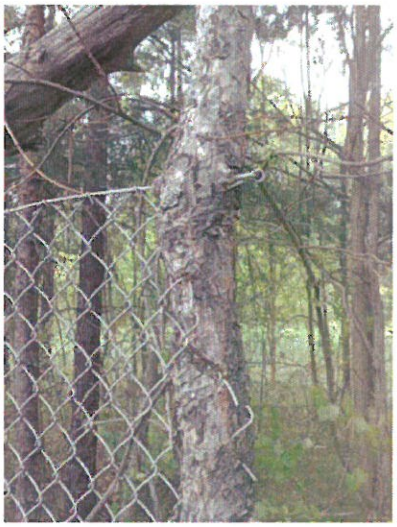


Photo 4: Tree growing through fence

Maintenance

Maintenance on the security fence should be conducted as soon as possible after a deficiency or potential threat is noted. Maintenance should not be postponed until the next inspection.

Following is a list of common maintenance issues that occur for security fences. Be aware that not all maintenance scenarios are presented in this manual and site personnel should use their own judgment on the most practical way to address security fence deficiencies and potential threats.

Preventative Maintenance

This section describes routine activities which may alleviate the fence line from potential threats, which may cause future damage. During and in between inspections if any dead trees or tree limbs that pose a threat to the fence line are noted, they should be removed as soon as possible. Removal of trees or tree limbs should be conducted by a professional and any large trees or tree limbs should be cut so as not to fall towards the security fence. It is suggested that preventative maintenance inspections, such as this, be conducted on a regular basis and additionally when inclement weather is approaching the site, such as hurricanes, tornados, or other storms with high wind speeds predicted.

Impact Damage

Impact damage describes any bending, breaking, deformation, or other deficiency occurring due to a blunt force such as a fallen tree or tree limb, ramming with a vehicle, vandalism, etc.

Impact damage should be addressed by the degree to which the fence line was

Photo 5: Vine Overgrowth on Fence Line Body

Maintenance Continued

damaged. Once all debris or other cause of the incident has been cleared, the degree of damage to the body, top of fence line, fence posts, and tension in the barbed wire, should be noted.

If any such damage causes a failure to meet the purpose and objective of the security fence, as discussed on page 1, then repairs on this area should be scheduled as soon as possible. Repairs should then be made to restore the fence to its original condition. In the interim, temporary measures should be made to secure AOC-1 to the extent possible.

Corrosion

Corrosion may occur throughout all areas of the fence line and can undermine the objectives of key elements for both soil management and personnel safety. Key areas to focus on regarding corrosion include the gate hinges and latches, locks, barbed wire, the body of the fence and signs.

The hinges and latches of the gates compose the few moving parts of the security fence line. Because of this, it is important that their range of motion not impeded by rust or other types of corrosion.

Hinges, latches, and locks should be well maintained with lubricants and replaced when they fail to meet project objectives. If any portion of the body of the fence line should become corroded to the point of undermining its structural integrity, that portion should be replaced as soon as possible. Minor corrosion of the body of the fence should be noted but may not require replacing parts of the fence line. Signs may also fade over time and should be replaced as soon as possible when they become illegible.

Overgrowth

When the security fence was constructed, parts of the nearby vegetation were cut back from the fence, however, regrowth is to be expected to reach the fence line in the form of vines, tree saplings, and shrubs.

In order to prevent overgrowth, routine maintenance in between bi-annual inspections should be conducted to remove any overgrowth that may undermine the integrity of the fence line. The most common area for over growth to take place is the body of the fence line. Tree saplings may uproot fence posts and rip apart the chain link fabric. Vines may also grow on the chain link body that can exacerbate or hide areas of corrosion or other damage which may be missed during inspection.

Tree saplings and shrubs should be uprooted, not cut, in order to remove them from the fence line. Vines should be cut away from the fence in a manner that does not damage the fence and then uprooted to prevent regrowth.

If any damage or excessive covering of the fence body occurs due to overgrowth, remove the overgrowth from the area of the fence line and replace any sections of the fence line that do not meet the goals and objectives of the security fence.

Fence Cutting and Vandalism

If any areas of the fence have cut marks that appear to be caused by wire cutters or bolt cutters, this may indicate a security breach at the site and should be reported to the site administrator as soon as possible. Any holes in the fence line should be repaired as soon as possible while attempts should be made to prevent any unauthorized personnel from entering AOC-1.

Vandalism may also occur in the form of defacement such as spray paint or posting signs and flyers. Any form of vandalism should be removed from the fence line by site personnel as soon as possible.

Erosion or Burrowing

The ground surface near the bottom of the fence line can be susceptible to erosion if adequate vegetative ground coverage is not available. It is important that any form of predictable erosion near the fence line be remediated before a deficiency is reached at the fence line. This may be done by placing properly engineered soils and planting small erosion preventing plants such as grass near the fence line. Any deficiencies in the ground surface near the fence line should be addressed as soon as possible with engineered back fill or other ground cover methods.

Animals may also burrow underneath the fence line and create breaches. These areas must be addressed with surface cover as well and future preventative measures such as placing mesh wiring just below ground surface near previously burrowed areas may be necessary.

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Prepared for:

GEORGIA PORTS AUTHORITY
PO Box 2406
Savannah, Georgia 31402

MAINTENANCE AND MONITORING PLAN

ATTACHMENT E:
Maintenance Evaluation Form

Contractor Initials:_____
Date:_____
Approved By:_____

Environmental Covenant Compliance
Maintenance Evaluation Form

Site Location: Georgia Ports Authority, Bainbridge Terminal, Bainbridge Decatur County, Georgia

Name of Contractor(s) Performing Maintenance:_____

Name of Person(s) Performing Maintenance:_____

Date(s) of Maintenance:_____to_____

Background and Purpose

The Georgia Ports Authority (GPA) Bainbridge Terminal (site) is contaminated with pesticides in both soil and groundwater. Contaminated soil at the site has been delineated within two areas of concern (AOCs), AOC-1 and AOC-2. Groundwater contamination in the subsurface has been delineated within the site property boundaries, with exception to the northern boundary of the property past Spring Creek Road. The attached Site Map (Figure 1-1) illustrates the locations of the AOCs at the site and the latest extent of groundwater contamination at the site. As source removal of the contamination has been determined to be impractical, the GPA has elected to manage the contaminated soil and groundwater with engineering and institutional controls under an environmental covenant.

The primary purpose of the following Environmental Covenant Compliance Maintenance Evaluation Form is to evaluate and document the maintenance performed at the site as it relates to the restrictions set in place by the executed environmental covenant.

Notification to GPA and EPD

Any maintenance that is conducted at the site, especially on or near the established AOCs, must be reviewed and approved by a competent GPA employee or qualified environmental consultant. In general, removal of soil or groundwater from these areas is prohibited until the Georgia EPD and site owners are contacted and provide approval. Additional information such as photographs, figures, or tables, can be attached to this form as needed to describe the maintenance activities to be performed.

Health and Safety

To further prevent exposure from contaminated soil and groundwater at the site, Environmental International Corporation (EIC) has developed a Contractor Health and Safety Awareness Plan (CHASAP) for the GPA Bainbridge Terminal. All maintenance performed at the site within the established AOCs and/or in the areas of groundwater contamination must be conducted in accordance with the CHASAP. Additionally, prior to performing work in these areas, contractors are required to have attended a health and safety briefing conducted by EIC within at least one calendar year of the work to be performed.

Contractor Initials:_____
Date:_____
Approved By:_____

Environmental Covenant Compliance
Maintenance Evaluation Form

1) **Provide a description of how and when the issue requiring maintenance was identified.**

_____

_____

_____

2) **Provide a description of the maintenance to be conducted and location.** *(Indicate on the attached map, the approximate location of maintenance to be conducted)*

_____

_____

_____

_____

_____

_____

3) **Does the maintenance to be performed include the following?**

Item	Yes	No
Removal or disturbance of soil within the established AOCs		
Removal or disturbance of surface cover (e.g. grass or pavement) within AOCs		
Removal or disturbance of soil below the saturation point in the soil (i.e. to groundwater)		
Breach of fence line surrounding AOC-1		
Removal or disturbance of groundwater (e.g. pumping from pits or wells)		
Removal or disturbance of permanent engraved granite monuments for either AOC		

If the answer is yes to any of the above, provide the following information as required: cubic yards of soil or surface cover to be removed or disturbed; gallons of groundwater to be removed; planned treatment or disposal methods for removed soil or groundwater; depth, area, and location of soil or groundwater disturbance; duration of time that fence line would need to be breached; and duration of time that permanent monument would remain disturbed.

_____

_____

_____

Contractor Initials:_____
Date:_____
Approved By:_____

Environmental Covenant Compliance
Maintenance Evaluation Form

4) **Provide additional notes for any concerns which may affect UEC compliance that is not addressed above.**

Contractor Initials:_____
Date:_____
Approved By:_____

Environmental Covenant Compliance
Maintenance Evaluation Form

5) **Following the completion of work to be performed, provide any notes below regarding deviations from the planned activities stated on pages 1 through 3. This includes any changes to the information provided in line item 3 of this form.**

HSI SITE 10071, GEORGIA PORTS AUTHORITY – BAINBRIDGE TERMINAL

MAINTENANCE AND MONITORING PLAN

ATTACHMENT F: Contractor Health and Safety Plan

HSI SITE 10071, GEORGIA PORTS AUTHORITY-BAINBRIDGE TERMINAL

CONTRACTOR HEALTH AND SAFETY AWARENESS PLAN

January 3, 2017

Prepared for:

GEORGIA PORTS AUTHORITY

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ATTACHMENTS

1.0 INTRODUCTION

1.1 Purpose

The Georgia Ports Authority (GPA) has retained Environmental International Corporation (EIC) to develop the following Contractor Health and Safety Awareness Plan (CHASAP) for their Bainbridge Terminal. Due to the presence of constituents of concern (COCs) above risk reduction standards (RRS), the site is subject to a Uniform Environmental Covenant (UEC), signed <date>, which restricts access to soil and groundwater at the site (GPA, 2016). All work conducted on site must be in compliance with the restrictions of the UEC. Prior to performing assigned tasks at the site, contractor must, at a minimum, be prepared to conduct all proposed tasks in accordance with this CHASAP and must participate in a site orientation program conducted by EIC. Contractors must have attended the health and safety briefing provided by EIC within one calendar year before performing the assigned tasks.

This CHASAP only provides awareness level guidance of the potential hazards related to the constituents of concern (COCs) defined at the site. Accordingly, each contractor has the sole responsibility to obtain for themselves the required safety training, supplies, and authorization for the safe completion of their respective tasks.

1.2 Site Description

The GPA Bainbridge Terminal (Site) is a railroad and truck terminal located at 1321 Spring Creek Road, Bainbridge, Georgia that is owned and operated by GPA. The site consists of an approximately 65-acre parcel lying between Spring Creek Road and the Flint River. A railroad within the property, that runs parallel to the Spring Creek Road, divides the site into North and South parcels. Currently, the terminal handles various bulk solid agricultural products. The Georgia Environmental Protection Division (EPD) Hazardous Site Inventory (HSI) number for the site is 10071. Figure 1-1 illustrates the site and surrounding properties.

2.0 CONSTITUENTS OF CONCERN

The primary constituents of concern (COCs) at the GPA site are pesticides. The predominant pesticide COC is benzenehexachloride (BHC), also known as hexachlorocyclohexane (HCH), which is composed of the following isomers: α-BHC, β-BHC, δ-BHC, and γ-BHC (Lindane). In addition to the predominant pesticide COCs at the site, COCs to a lesser extent have been identified at the site under a Voluntary Investigation and Remediation Plan (VIRP) monitoring program authorized by the EPD. These constituents include dichlorodiphenyldichloroethane (DDD), dichlorodiphenyldichloroethylene (DDE), dichlorodiphenyltrichloroethane (DDT), Aldrin, and Toxaphene.

2.1 Media Containing COCs

2.1.1 Soil

Concentrations of COCs in soil have been detected above established risk reduction standards (RRS) at several locations throughout the site. The locations have been grouped into two areas of concern (AOCs), as depicted in Figure 1-1.

2.1.2 Groundwater

Concentrations of BHC isomers in groundwater have been detected above established RRS across a large area of the site based on the analyses of groundwater samples collected on a semi-annual basis from monitoring wells. Figure 1-1 depicts the maximum extents of groundwater COCs above RRS in March and September 2015, as reported in the 5th and 6th VIRP Semi-annual Progress Reports, respectively (EIC, 2015a and 2015b).

2.2 Chemical Hazards

The prevailing pesticide COCs at the site present an environmental hazard to GPA's contractors conducting activities which disturb or remove soil cover (such as pavement), soils within the current AOCs, or result in contact with groundwater in areas of the site with COCs in groundwater. Therefore, to keep GPA's contractors aware of the associated environmental hazards, this CHASAP has identified the following exposure routes and symptoms for each COC. Additionally, Table 2-1 lists the exposure limits for the COCs identified at the site. Safety Data Sheets (SDSs) are included for each COC, as Attachment 2-1.

2.2.1 Exposure Routes

Based on the referenced activities, the potential exposure pathways at the Site are:

- Outdoor air inhalation (particulate matter)
- Soil exposure ingestion
- Soil dermal contact

- Groundwater ingestion
- Groundwater dermal contact

2.2.2 Exposure Symptoms

The following are exposure symptoms for each COC identified at the site in pure product form (CDC, 2007):

- **γ-BHC (Lindane):**
  - Eye, skin, nose, throat irritation; headaches; nausea; clonic convulsions; difficulty breathing; aplastic anemia; muscle spasms
- **α-BHC:**
  - None Established
- **β-BHC:**
  - None Established
- **δ-BHC:**
  - None Established
- **Aldrin:**
  - Headache; dizziness; nausea; vomiting; malaise; mild erythema of skin; impairment of memory; emotional disturbances; tremors; hyper-excitability; myoclonic jerks of limbs; clonic-tonic convulsions; coma; respiratory failure. Is also carcinogenic.
- **Dichlorodiphenyldichloroethane (DDD):**
  - None established
- **Dichlorodiphenyldichloroethylene (DDE):**
  - None established
- **Dichlorodiphenyltrichloroethane (DDT):**
  - Eye, skin irritation; paresthesia of tongue lips face; tremors; anxiety; dizziness; confusion; fatigue; headaches; vomiting. Is also carcinogenic
- **Toxaphene:**
  - None established
- **Particulate Matter**
  - Eye, skin, throat, upper respiratory irritation

3.0 JOB SAFETY ANALYSIS (JSA)

This Section of the CHASAP describes the safety and health hazards associated with working within the established AOCs and in areas where COCs occur in groundwater at the site. Accordingly, appropriate control measures to effectively control identified risks are suggested. This information should be used in conjunction with all current and applicable federal and state regulations and health and safety guidelines to develop a complete health and safety protocol for tasks performed where COC exposure is likely. A general definition of surface and subsurface, as well as groundwater disturbance activities is presented in Sections 3.1 and 3.2 respectively. As this is an awareness level CHASAP, each contractor is responsible for completing their own site-specific health and safety plan (HASP) which includes a task-specific job safety analysis (JSA).

3.1 Activities Affecting Surface and Subsurface

Any intrusive activities or other site work that may impact the existing security fence around and grass cover over AOC-1 and/or the protective surface cover at AOC-2, including grass, pavement, and building foundations ("intrusive activities"), must be conducted in accordance with the established site UEC and Maintenance and Monitoring Plan (M&MP)(EIC, 2016). Intrusive activities include, but are not limited to, drilling; digging; placement of any objects or use of any equipment which deforms or stresses the surface beyond its load-bearing capacity; piercing/penetrating the surface with a rod, spike or similar item; bulldozing; grading; or any earthwork in general.

3.2 Activities Affecting Groundwater

Groundwater activities include, but are not limited to, pumping groundwater from wells or open pits or the removal of saturated soil below the depth of the water table and bringing it to the surface. Any of these activities must comply with the restrictions put in place by the UEC.

3.3 General JSA

Attachment 3-1 is a general JSA for surface, subsurface, and groundwater disturbance activities with relation strictly to COC exposure pathways. This document does not address general safety concerns, such as heavy equipment operation, noise, and slip/trip/fall hazards, since these are expected to be addressed on a task-specific basis by the contractor in their HASP.

3.3.1 CHASAP and JSA Modification

Modification of or addition to this CHASAP may be required based on the type and extent of the activities to be performed and evolving site information and conditions. This CHASAP may only be modified by GPA or a qualified environmental health and safety contractor. In general, modification to the CHASAP should occur when:

- New chemical hazards are discovered and identified, and

- Exposure data indicate changes in the concentration and/or likelihood of exposure.

Below is a list of circumstances to consider when modifying the general JSA:

- New methods of performing site tasks are selected,
- Performing site tasks results in the discovery of additional hazards not previously considered, and
- New/different control measures are selected.

3.4 Notification of Hazards

The information provided in the attached JSA (Attachment 3-1) and SDSs (Attachment 2-1) will be made available to all contractors and subcontractors. Modifications to this CHASAP, the attached JSA, and the accompanying SDS will be communicated during the pre-job safety briefing held by GPA.

3.4 Control Measures

Based on the above referenced information, the appropriate control methods to minimize the identified risks, or to effectively control them to be made by the contractor are:

- Before starting work at any of the environmental AOCs or contacting groundwater, contact the Georgia Environmental Protection Division and the Georgia Ports Authority.
- Start an Exposure Monitoring Program (EMP) when working within the site AOCs or areas of COCs in groundwater.
- Use the appropriate personal protective equipment (PPE) when working within the site AOCs.
- Engineering and institutional control measures should be utilized to limit the mobility of COCs.

3.5.1 Exposure Monitoring

An exposure monitoring plan in accordance with the applicable Occupational Safety and Health Administration (OSHA) standards should be established when working within the site AOCs or when contacting groundwater at the site. This plan should include personnel monitoring and field screening as applicable. For large projects, specific environmental consultation with EPD, GPA or both may be necessary.

3.5.2 PPE

Appropriate PPE ensembles to limit all applicable exposure pathways, noted in Section 2.2.1, should be selected in accordance with OSHA guidelines. The levels of PPE necessary, as described in Appendix B of §1910.120 of the Code of Federal Regulations (CFR) (CFR, 2013), are expected to be Level C and Level D, but should be fully evaluated for applicability for each project.

3.5.3 Engineering and Institutional Controls

Appropriate engineering and institutional controls, such as dust management or splash protection, should be applied to limit the mobility of COCs during soil disturbance or groundwater contact activities.

4.0 REFERENCES

Centers for Disease Control and Prevention (CDC), 2007. *NIOSH Pocket Guide to Chemical Hazards. DHHS (NIOSH) Publication No. 2005-149.* Atlanta, Georgia, September 2007.

Code of Federal Regulations (CFR), 2013. *Code of Federal Regulations, Title 29, Subtitle B, Chapter XVII , Part 1910, Subpart H, Appendix B to §1910.120—General Description and Discussion of the Levels of Protection and Protective Gear.* Washington D.C., February 8, 2013.

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EIC, 2015a. *Fifth VIRP Semi-annual Progress Report, Georgia Ports Authority – Bainbridge Terminal, HIS Site No. 10071, 1321 Spring Creek Road, Land Lot 373, Parcels: 20, 21A, and portion of Parcel 19, Bainbridge, Decatur County, Georgia.* Alpharetta, Georgia, May 4, 2015.

EIC, 2015b. *Sixth VIRP Semi-annual Progress Report, Georgia Ports Authority – Bainbridge Terminal, HIS Site No. 10071, 1321 Spring Creek Road, Land Lot 373, Parcels: 20, 21A, and portion of Parcel 19, Bainbridge, Decatur County, Georgia.* Alpharetta, Georgia. November 2, 2015.

EIC, 2016. *Maintenance and Monitoring Plan, HSI Site 10071, Georgia Ports Authority-Bainbridge Terminal.* Alpharetta, Georgia, August 2016.

CONTRACTOR HEALTH AND SAFETY AWARENESS PLAN

TABLES

Table 2-1: COC Toxicity Information

No.	Chemical Identification		Source		Control Measures			Exposure Limits	
	Chemical Name	CAS Number	Soil	Groundwater	Engineering Controls	Exposure Monitoring	PPE	OSHA PEL and NIOSH REL (ppm)*	IDLH (ppm)
1	γ-BHC (Lindane)	58-89-9	X		X	X	X	0.0005	0.05
2	α-BHC	319-84-6	X	X	X	X	X	Not Established	Not Established
3	β-BHC	319-85-7	X	X	X	X	X	Not Established	Not Established
4	δ-BHC	319-86-8	X	X	X	X	X	Not Established	Not Established
5	Aldrin	309-00-2	X		X	X	X	0.00025	0.025 (Ca)
6	dichlorodiphenyldichloroethane (DDD)	72-54-8	X		X	X	X	Not Established	Not Established
7	dichlorodiphenyldichloroethylene (DDE)	72-55-9	X		X	X	X	Not Established	Not Established
8	dichlorodiphenyltrichloroethane (DDT)	50-29-3	X		X	X	X	0.0005 (NIOSH) 0.001 (OSHA)	0.5
9	Toxaphene	8001-35-2	X		X	X	X	0.0005	0.05 (Ca)
10	Particulate Matter	NA	X			X	X	0.015 (total) (NIOSH) 0.005 (respiratory)	Not Established

Notes:

Table was derived from information provided in NIOSH Pocket Guide to Chemical Hazards (NIOSH, 2007)

* = unless otherwise stated OSHA PEL and NIOSH REL are the same

*[2] =toxicity information is derived from Agency for Toxic Substance & Disease Registry (ATSDR, 2015)

Ca = denotes potential occupational carcinogens

NA = Not Available

CONTRACTOR HEALTH AND SAFETY AWARENESS PLAN

FIGURES

Legend

- MONITORING WELL
- STILLING WELL
- MW-18 MONITORING WELL ID
- N.L. NOT LOCATED

SITE FEATURES

- BULKHEAD
- NORTH AND SOUTH PARCEL DIVISION
- BAINBRIDGE PARCEL LINES
- PIER

AREAS OF CONCERN (AOC)

CURRENT AOC EXTENTS

- AOC-1 FENCE LINE
- AOC-1 BOUNDARY
- AOC-2 BOUNDARY
- GROUNDWATER RRS EXTENTS

NOTES:

AERIAL PHOTO WAS PROVIDED BY GPA. ABOVE GROUND STORAGE TANKS ON GPA NORTH PARCEL AND ON AGRIUM PROPERTY, AS WELL AS THE WAREHOUSE AND OTHER BUILDINGS ON AGRIUM PROPERTY HAVE SINCE BEEN DEMOLISHED.

PROPERTY LINES PROVIDED BY GEORGIA PORTS AUTHORITY. WELL LOCATIONS PLOTTED FROM MULTIPLE SURVEYS AT SITE. AOC-2 BOUNDARY ARE PLOTTED FROM A SURVEY CONDUCTED BY MOCK SURVEYING INC. ON FEBRUARY 16, 2016.

GROUNDWATER RRS EXTENTS ARE DERIVED FROM THE MAXIMUM RRS EXTENTS OBSERVED FOR BETA AND DELTA BHC IN MARCH AND SEPTEMBER 2015

W.H. = WAREHOUSE
R.S.W. = FORMER ROCK SALT WAREHOUSE
T-SHED = TRANSPORT SHED

N

400 200 0 400 Feet

DESIGNED BY: A.G.	REVISIONS NO.	REVISIONS DATE	DATE: 8/2/2016
DRAWN BY: A.G.			SCALE: SEE BAR SCALE
CHECKED BY: A.S.			SHEET NO.: 1 OF 1
APPROVED BY: R.M.			

FIGURE 1-1: SITE LAYOUT

GEORGIA PORTS AUTHORITY
BAINBRIDGE TERMINAL
BAINBRIDGE, GEORGIA

ENVIRONMENTAL INTERNATIONAL CORP.
161 KIMBALL BRIDGE RD.
ALPHARETTA, GEORGIA 30009

CONTRACTOR HEALTH AND SAFETY AWARENESS PLAN

ATTACHMENT 2-1:
Safety Data Sheets

SAFETY DATA SHEET

Version 5.5
Revision Date 06/02/2016
Print Date 07/07/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : α-HCH

Product Number : 33856
Brand : Sigma-Aldrich
Index-No. : 602-042-00-0

CAS-No. : 319-84-6

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

Identified uses : Laboratory chemicals, Synthesis 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 3), H301
Acute toxicity, Dermal (Category 4), H312
Carcinogenicity (Category 2), H351
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

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)
H301 Toxic if swallowed.
H312 Harmful in contact with skin.
H351 Suspected of causing cancer.
H410 Very toxic 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.

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.
P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER/doctor.
P302 + P352 IF ON SKIN: Wash with plenty of soap and water.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P322 Specific measures (see supplemental first aid instructions on this label).
P330 Rinse mouth.
P363 Wash contaminated clothing before reuse.
P391 Collect spillage.
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 : (1a,2a,3b,4a,5b,6b)-1,2,3,4,5,6-Hexachlorocyclohexane

Formula : $C_6H_6Cl_6$
Molecular weight : 290.83 g/mol
CAS-No. : 319-84-6
EC-No. : 206-270-8
Index-No. : 602-042-00-0

Hazardous components

Component	Classification	Concentration
(1α,2α,3β,4α,5β,6β)-1,2,3,4,5,6-Hexachlorocyclohexane		
	Acute Tox. 3; Acute Tox. 4; Carc. 2; Aquatic Acute 1; Aquatic Chronic 1; H301, H312, H351, H410	<= 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. 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.

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 firefighting 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 dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
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
Pick up and arrange disposal without creating dust. Sweep up and shovel. 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 formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.
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.

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
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: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (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.

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 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).

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: solid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	156.0 - 161.0 °C (312.8 - 321.8 °F)
f)	Initial boiling point and boiling range	No data available
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	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	log Pow: 3.80

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

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas
Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas
Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas
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 - 177.0 mg/kg

Inhalation: No data available

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 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:	2B - Group 2B: Possibly carcinogenic to humans ((1α,2α,3β,4α,5β,6β)-1,2,3,4,5,6-Hexachlorocyclohexane)
IARC:	2B - Group 2B: Possibly carcinogenic to humans ((1α,2α,3β,4α,5β,6β)-1,2,3,4,5,6-Hexachlorocyclohexane)
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:	Reasonably anticipated to be a human carcinogen ((1α,2α,3β,4α,5β,6β)-1,2,3,4,5,6-Hexachlorocyclohexane)
NTP:	Reasonably anticipated to be a human carcinogen ((1α,2α,3β,4α,5β,6β)-1,2,3,4,5,6-Hexachlorocyclohexane)
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.
	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: GV3500000

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 - Carassius auratus (goldfish) - 0.12 mg/l - 48.0 h
	LC50 - Cyprinus carpio (Carp) - 0.2 mg/l - 48.0 h
	LC50 - other fish - 1.49 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 0.20 - 1.70 mg/l - 48 h
Toxicity to algae	EC50 - No information available. - > 100.00 mg/l - 48 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
Bioaccumulation other fish - 96 h
- 0.8 mg/l

Bioconcentration factor (BCF): 250

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.
Very toxic 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. 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: 2811 Class: 6.1 Packing group: III
Proper shipping name: Toxic solids, organic, n.o.s. ((1α,2α,3β,4α,5β,6β)-1,2,3,4,5,6-Hexachlorocyclohexane)
Reportable Quantity (RQ): 10 lbs
Marine pollutant: yes
Poison Inhalation Hazard: No

IMDG
UN number: 2811 Class: 6.1 Packing group: III EMS-No: F-A, S-A
Proper shipping name: TOXIC SOLID, ORGANIC, N.O.S. ((1α,2α,3β,4α,5β,6β)-1,2,3,4,5,6-Hexachlorocyclohexane)

IATA
UN number: 2811 Class: 6.1 Packing group: III
Proper shipping name: Toxic solid, organic, n.o.s. ((1α,2α,3β,4α,5β,6β)-1,2,3,4,5,6-Hexachlorocyclohexane)

15. REGULATORY INFORMATION

SARA 302 Components
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
(1α,2α,3β,4α,5β,6β)-1,2,3,4,5,6-Hexachlorocyclohexane	319-84-6	2007-07-01

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
(1α,2α,3β,4α,5β,6β)-1,2,3,4,5,6-Hexachlorocyclohexane	319-84-6	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
(1α,2α,3β,4α,5β,6β)-1,2,3,4,5,6-Hexachlorocyclohexane	319-84-6	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
(1α,2α,3β,4α,5β,6β)-1,2,3,4,5,6-Hexachlorocyclohexane	319-84-6	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. (1α,2α,3β,4α,5β,6β)-1,2,3,4,5,6-Hexachlorocyclohexane	319-84-6	2009-02-01

WARNING! This product contains a chemical known to the State of California to cause cancer. (1α,2α,3β,4α,5β,6β)-1,2,3,4,5,6-Hexachlorocyclohexane | CAS-No. 319-84-6 | Revision Date 2009-02-01

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
H301	Toxic if swallowed.
H312	Harmful in contact with skin.
H351	Suspected of causing cancer.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

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

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: 5.5 Revision Date: 06/02/2016 Print Date: 07/07/2016

SAFETY DATA SHEET

Version 5.6
Revision Date 05/23/2016
Print Date 07/07/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : β-BHC

Product Number : 48494
Brand : Supelco
Index-No. : 602-042-00-0

CAS-No. : 319-85-7

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

Identified uses : Laboratory chemicals, Synthesis 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 3), H301
Acute toxicity, Dermal (Category 4), H312
Carcinogenicity (Category 2), H351
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

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)
H301 Toxic if swallowed.
H312 Harmful in contact with skin.
H351 Suspected of causing cancer.
H410 Very toxic 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.

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.
P281 Use personal protective equipment as required.
P301 + P310 + P330 IF SWALLOWED: Immediately call a POISON CENTER/doctor. Rinse mouth.
P302 + P352 + P312 IF ON SKIN: Wash with plenty of soap and water. Call a POISON CENTER or doctor/ physician if you feel unwell.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P363 Wash contaminated clothing before reuse.
P391 Collect spillage.
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 : β-1,2,3,4,5,6-Hexachlorocyclohexane

Formula : $C_6H_6Cl_6$
Molecular weight : 290.83 g/mol
CAS-No. : 319-85-7
EC-No. : 206-271-3
Index-No. : 602-042-00-0

Hazardous components

Component	Classification	Concentration
(1α,2β,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane		
	Acute Tox. 3; Acute Tox. 4; Carc. 2; Aquatic Acute 1; Aquatic Chronic 1; H301, H312, H351, H410	<= 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. 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.

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 firefighting 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 dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
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
Pick up and arrange disposal without creating dust. Sweep up and shovel. 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 formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
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.
Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

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
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: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (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.

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 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).

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: solid Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	> 300.0 °C (> 572.0 °F)
f)	Initial boiling point and boiling range	No data available
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	No data available
n)	Water solubility	insoluble
o)	Partition coefficient: n-octanol/water	log Pow: 3.78
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

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas
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 - 6,000 mg/kg

Inhalation: No data available

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 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:	2B - Group 2B: Possibly carcinogenic to humans ((1α,2β,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane)
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:	Reasonably anticipated to be a human carcinogen ((1α,2β,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane)
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: GV4375000

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

Blood -

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Poecilia reticulata (guppy) - 1.6 mg/l - 96.0 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential

Bioaccumulation	Cyprinus carpio (Carp) - 35 d - 0.05 mg/l
	Bioconcentration factor (BCF): 500

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.
Very toxic 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. 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: 2811 Class: 6.1 Packing group: III
Proper shipping name: Toxic solids, organic, n.o.s. ((1α,2β,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane)
Reportable Quantity (RQ): 1 lbs
Marine pollutant: yes
Poison Inhalation Hazard: No

IMDG
UN number: 2811 Class: 6.1 Packing group: III EMS-No: F-A, S-A
Proper shipping name: TOXIC SOLID, ORGANIC, N.O.S. ((1α,2β,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane)

IATA
UN number: 2811 Class: 6.1 Packing group: III
Proper shipping name: Toxic solid, organic, n.o.s. ((1α,2β,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane)

15. REGULATORY INFORMATION

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

SARA 313 Components
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

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer. (1α,2β,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane	CAS-No. 319-85-7	Revision Date 2009-02-01

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
H301	Toxic if swallowed.
H312	Harmful in contact with skin.
H351	Suspected of causing cancer.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

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

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: 5.6 Revision Date: 05/23/2016 Print Date: 07/07/2016

SAFETY DATA SHEET

Version 5.5
Revision Date 06/02/2016
Print Date 07/07/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : δ-BHC

Product Number : 48495
Brand : Supelco
Index-No. : 602-042-00-0

CAS-No. : 319-86-8

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

Identified uses : Laboratory chemicals, Synthesis 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 3), H301
Acute toxicity, Dermal (Category 4), H312
Carcinogenicity (Category 2), H351
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

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)
H301 Toxic if swallowed.
H312 Harmful in contact with skin.
H351 Suspected of causing cancer.
H410 Very toxic 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.

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 + P310 + P330 IF SWALLOWED: Immediately call a POISON CENTER/doctor. Rinse mouth.
P302 + P352 + P312 IF ON SKIN: Wash with plenty of water.Call a POISON CENTER/doctor if you feel unwell.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P363 Wash contaminated clothing before reuse.
P391 Collect spillage.
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 : δ-1,2,3,4,5,6-Hexachlorocyclohexane

Formula : C6H6Cl6
Molecular weight : 290.8 g/mol
CAS-No. : 319-86-8
EC-No. : 206-272-9
Index-No. : 602-042-00-0

Hazardous components

Component	Classification	Concentration
1α,2α,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane		
	Acute Tox. 3; Acute Tox. 4; Carc. 2; Aquatic Acute 1; Aquatic Chronic 1; H301, H312, H351, H410	<= 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. 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.

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 firefighting 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 dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
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
Pick up and arrange disposal without creating dust. Sweep up and shovel. 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 formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
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.

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.
Hazardous components without workplace control parameters

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: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (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.

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 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).

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: solid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	No data available
f)	Initial boiling point and boiling range	No data available
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	No data available

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 oxidizing agents

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas
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 - 1,000 mg/kg

Inhalation: 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 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:	2B - Group 2B: Possibly carcinogenic to humans (1α,2α,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane)
NTP:	Reasonably anticipated to be a human carcinogen (1α,2α,3α,4β,5α,6β)-1,2,3.4,5,6-Hexachlorocyclohexane)
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: GV4550000

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

Central nervous system -

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - other fish - 2.83 mg/l - 96.0 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential

Bioaccumulation	other fish - 33 d - 0.955 mg/l
	Bioconcentration factor (BCF): 326

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.
Very toxic 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. 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. (1α,2α,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane)
Reportable Quantity (RQ): 1 lbs

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. (1α,2α,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane)
Marine pollutant:yes

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (1α,2α,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane)

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

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

SARA 313 Components
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
1α,2α,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane	319-86-8	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
1α,2α,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane	319-86-8	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
1α,2α,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane	319-86-8	1993-04-24

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer. 1α,2α,3α,4β,5α,6β)-1,2,3,4,5,6-Hexachlorocyclohexane	319-86-8	2015-08-14

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
H301	Toxic if swallowed.
H312	Harmful in contact with skin.
H351	Suspected of causing cancer.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

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

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: 5.5 Revision Date: 06/02/2016 Print Date: 07/07/2016

SAFETY DATA SHEET

Version 5.6
Revision Date 05/27/2015
Print Date 06/21/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : γ-BHC

Product Number : 49049
Brand : Supelco
Index-No. : 602-043-00-6

CAS-No. : 58-89-9

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 3), H301
Acute toxicity, Inhalation (Category 4), H332
Acute toxicity, Dermal (Category 4), H312
Carcinogenicity (Category 2), H351
Effects on or via lactation, H362
Specific target organ toxicity - repeated exposure (Category 2), H373
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

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)

H301	Toxic if swallowed.
H312 + H332	Harmful in contact with skin or if inhaled
H351	Suspected of causing cancer.
H362	May cause harm to breast-fed children.
H373	May cause 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.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P263	Avoid contact during pregnancy/ while nursing.
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/ eye protection/ face protection.
P301 + P310 + P330	IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician. Rinse mouth.
P302 + P352 + P312	IF ON SKIN: Wash with plenty of soap and water. Call a POISON CENTER or doctor/ physician if you feel unwell.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P363	Wash contaminated clothing before reuse.
P391	Collect spillage.
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 : 1α,2α,3β,4α,5α,6β-Hexachlorocyclohexane
γ-BHC
Lindane

Formula : C6H6Cl6
Molecular weight : 290.83 g/mol
CAS-No. : 58-89-9
EC-No. : 200-401-2
Index-No. : 602-043-00-6

Hazardous components

Component	Classification	Concentration
γ-1,2,3,4,5,6-Hexachlorocyclohexane		
	Acute Tox. 3; Acute Tox. 4; Carc. 2; Lact. ; STOT RE 2; Aquatic Acute 1; Aquatic Chronic 1; H301, H312 + H332, H351, H362, H373, H410	<= 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. 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.

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 firefighting 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 dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
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
Pick up and arrange disposal without creating dust. Sweep up and shovel. 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 formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
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.
Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

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
γ-1,2,3,4,5,6-Hexachlorocyclohexane	58-89-9	TWA	0.500000 mg/m3	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	0.500000 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential for dermal absorption		
		TWA	0.500000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		Skin designation		

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: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (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.

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 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).

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: solid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 113 - 115 °C (235 - 239 °F) - lit.
f)	Initial boiling point and boiling range	No data available
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	1.85 g/cm3
n)	Water solubility	8.35 g/l at 25 °C (77 °F)
o)	Partition coefficient: n-octanol/water	Pow: 3.5 at 22 °C (72 °F)
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

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 - 88.0 mg/kg

LC50 Inhalation - Rat - 4 h - 1,560 mg/m3

Dermal: No data available

No data available

Skin corrosion/irritation
Skin - Rabbit
Result: No skin irritation

Serious eye damage/eye irritation
Eyes - Rabbit
Result: No eye irritation

Respiratory or skin sensitisation
Will not occur

Germ cell mutagenicity
No data available

Carcinogenicity

IARC:	2B - Group 2B: Possibly carcinogenic to humans (γ-1,2,3,4,5,6-Hexachlorocyclohexane)
NTP:	Reasonably anticipated to be a human carcinogenThe reference note has been added by TD based on the background information of the NTP. (γ-1,2,3,4,5,6-Hexachlorocyclohexane)
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
Effects on or via lactation

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: Not available

Neurotoxic effects., Cyanosis, Headache, Nausea, Incoordination., Tremors, Vomiting, Dizziness, Seizures., Unconsciousness

Reproductive system. - Irregularities - Based on Human Evidence
Reproductive system. - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Cyprinus carpio (Carp) - 0.2 mg/l - 96.0 h
	LC50 - Cyprinodon variegatus (sheepshead minnow) - 0.9 - 1.3 mg/l - 96.0 h
	LC50 - Oncorhynchus mykiss (rainbow trout) - 0.03 - 0.28 mg/l - 48.0 h
	NOEC - Oncorhynchus mykiss (rainbow trout) - 0.056 mg/l - 3.0 d
	LC50 - Oncorhynchus mykiss (rainbow trout) - 0.038 mg/l - 96.0 h

	LOEC - Oncorhynchus mykiss (rainbow trout) - 0.1 mg/l - 3.0 d
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 0.80 - 6.50 mg/l - 48 h
	LOEC - Daphnia (water flea) - 0.021 mg/l - 7 d
Toxicity to algae	EC50 - Algae - 4.00 mg/l - 72 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential

Bioaccumulation	Pimephales promelas (fathead minnow) - 304 d - 0.0091 mg/l
	Bioconcentration factor (BCF): 674

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

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: 2811 Class: 6.1 Packing group: III
Proper shipping name: Toxic solids, organic, n.o.s. (γ-1,2,3,4,5,6-Hexachlorocyclohexane)
Reportable Quantity (RQ): 1 lbs
Marine pollutant:yes
Poison Inhalation Hazard: No

IMDG
UN number: 2811 Class: 6.1 Packing group: III EMS-No: F-A, S-A
Proper shipping name: TOXIC SOLID, ORGANIC, N.O.S. (γ-1,2,3,4,5,6-Hexachlorocyclohexane)
Marine pollutant:yes

IATA
UN number: 2811 Class: 6.1 Packing group: III
Proper shipping name: Toxic solid, organic, n.o.s. (γ-1,2,3,4,5,6-Hexachlorocyclohexane)

15. REGULATORY INFORMATION

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

	CAS-No.	Revision Date
γ-1,2,3,4,5,6-Hexachlorocyclohexane	58-89-9	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
γ-1,2,3,4,5,6-Hexachlorocyclohexane	58-89-9	2007-07-01

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
γ-1,2,3,4,5,6-Hexachlorocyclohexane	58-89-9	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
γ-1,2,3,4,5,6-Hexachlorocyclohexane	58-89-9	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
γ-1,2,3,4,5,6-Hexachlorocyclohexane	58-89-9	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. γ-1,2,3,4,5,6-Hexachlorocyclohexane	58-89-9	2009-02-01

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
H301	Toxic if swallowed.
H312	Harmful in contact with skin.
H312 + H332	Harmful in contact with skin or if inhaled
H332	Harmful if inhaled.
H351	Suspected of causing cancer.
H362	May cause harm to breast-fed children.
H373	May cause damage to organs through prolonged or repeated 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

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: 5.6 Revision Date: 05/27/2015 Print Date: 06/21/2016

SAFETY DATA SHEET

Version 5.5
Revision Date 06/02/2016
Print Date 07/07/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Aldrin

Product Number : 36666
Brand : Sigma-Aldrich
Index-No. : 602-048-00-3

CAS-No. : 309-00-2

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

Identified uses : Laboratory chemicals, Synthesis 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 2), H300
Acute toxicity, Dermal (Category 1), H310
Carcinogenicity (Category 2), H351
Specific target organ toxicity - repeated exposure (Category 1), H372
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

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)
H300 + H310 Fatal if swallowed or in contact with skin
H351 Suspected of causing cancer.
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.
P202 Do not handle until all safety precautions have been read and

understood.

P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P262	Do not get in eyes, on skin, or on clothing.
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.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER/doctor.
P302 + P350	IF ON SKIN: Gently wash with plenty of soap and water.
P310	Immediately call a POISON CENTER/doctor.
P322	Specific measures (see supplemental first aid instructions on this label).
P330	Rinse mouth.
P361	Remove/Take off immediately all contaminated clothing.
P363	Wash contaminated clothing before reuse.
P391	Collect spillage.
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	:	$C_{12}H_8Cl_6$
Molecular weight	:	364.91 g/mol
CAS-No.	:	309-00-2
EC-No.	:	206-215-8
Index-No.	:	602-048-00-3

Hazardous components

Component	Classification	Concentration
Aldrin		
	Acute Tox. 2; Acute Tox. 1; Carc. 2; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H300 + H310, H351, H372, H410	<= 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. 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.

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 firefighting 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 dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
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
Pick up and arrange disposal without creating dust. Sweep up and shovel. 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 formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.
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.

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
Aldrin	309-00-2	TWA	0.050000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Central Nervous System impairment Liver damage Kidney damage Confirmed animal carcinogen with unknown relevance to humans Danger of cutaneous absorption		
		TWA	0.250000 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A Potential for dermal absorption		

		TWA	0.250000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		Skin designation		
		TWA	0.05 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Central Nervous System impairment Liver damage Kidney damage Confirmed animal carcinogen with unknown relevance to humans Danger of cutaneous absorption		
		TWA	0.25 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A Potential for dermal absorption		
		TWA	0.25 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		Skin designation		
		PEL	0.25 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		Skin		

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: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (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.

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 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).

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: solid 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 - 98.0 °C (204.8 - 208.4 °F)
f)	Initial boiling point and boiling range	No data available
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	1.60 g/cm3 at 20.00 °C (68.00 °F)
n)	Water solubility	insoluble
o)	Partition coefficient: n-octanol/water	log Pow: 6.50
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

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas
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 - 39.0 mg/kg

Inhalation: No data available

LD50 Dermal - Rabbit - 15.0 mg/kg
Remarks: Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Olfaction:Other changes. Behavioral:Convulsions or effect on seizure threshold. Behavioral:Excitement.

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 has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

Limited evidence of carcinogenicity in animal studies

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

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard
No data available

Additional Information
RTECS: IO2100000

Nausea, Vomiting, Headache, Tremors, Incoordination., Dizziness, Cyanosis, Seizures., Unconsciousness

Kidney -

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Oncorhynchus mykiss (rainbow trout) - 0.01 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 0.03 mg/l - 48 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
Bioaccumulation: Leuciscus idus (Golden orfe) - 3 d - 0.002 mg/l

Bioconcentration factor (BCF): 3,700

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

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: 2811 Class: 6.1 Packing group: I
Proper shipping name: Toxic solids, organic, n.o.s. (Aldrin)
Reportable Quantity (RQ): 1 lbs
Marine pollutant:yes
Poison Inhalation Hazard: No

IMDG
UN number: 2811 Class: 6.1 Packing group: I EMS-No: F-A, S-A
Proper shipping name: TOXIC SOLID, ORGANIC, N.O.S. (Aldrin)
Marine pollutant:yes

IATA
UN number: 2811 Class: 6.1 Packing group: I
Proper shipping name: Toxic solid, organic, n.o.s. (Aldrin)

15. REGULATORY INFORMATION

SARA 302 Components

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

	CAS-No.	Revision Date
Aldrin	309-00-2	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
Aldrin	309-00-2	2007-07-01

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Aldrin	309-00-2	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Aldrin	309-00-2	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Aldrin	309-00-2	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. Aldrin	309-00-2	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
H300	Fatal if swallowed.
H300 + H310	Fatal if swallowed or in contact with skin
H310	Fatal in contact with skin.
H351	Suspected of causing cancer.
H372	Causes damage to organs through prolonged or repeated exposure.

HMIS Rating

Health hazard:	4
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	4
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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: 5.5 Revision Date: 06/02/2016 Print Date: 07/07/2016

SAFETY DATA SHEET

Version 5.1
Revision Date 06/26/2014
Print Date 07/07/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : 4,4'-DDD

Product Number : 35486
Brand : Sigma-Aldrich

CAS-No. : 72-54-8

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)
Acute toxicity, Oral (Category 3), H301
Acute toxicity, Dermal (Category 4), H312
Carcinogenicity (Category 2), H351
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

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)
H301 Toxic if swallowed.
H312 Harmful in contact with skin.
H351 Suspected of causing cancer.
H410 Very toxic 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.
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.
P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P302 + P352 IF ON SKIN: Wash with plenty of soap and water.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P322 Specific measures (see supplemental first aid instructions on this label).
P330 Rinse mouth.
P363 Wash contaminated clothing before reuse.
P391 Collect spillage.
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 : 1,1-Dichloro-2,2-bis(4-chlorophenyl)ethane
TDE

Formula : $C_{14}H_{10}Cl_4$
Molecular Weight : 320.04 g/mol
CAS-No. : 72-54-8
EC-No. : 200-783-0

Hazardous components

Component	Classification	Concentration
2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane		
	Acute Tox. 3; Acute Tox. 4; Carc. 2; Aquatic Acute 1; Aquatic Chronic 1; H301, H312, H351, H410	-

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
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.

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
Nature of decomposition products not known.

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 dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
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
Pick up and arrange disposal without creating dust. Sweep up and shovel. 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 formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.Normal measures for preventive fire protection.
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.

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
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.

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 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).

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: solid
b)	Odour	no data available
c)	Odour Threshold	no data available
d)	pH	no data available
e)	Melting point/freezing point	94.0 - 96.0 °C (201.2 - 204.8 °F)
f)	Initial boiling point and boiling range	193.0 °C (379.4 °F) at 1.3 hPa (1.0 mmHg)
g)	Flash point	no data available
h)	Evapouration rate	no data available
i)	Flammability (solid, gas)	no data available
j)	Upper/lower flammability or explosive limits	no data available
k)	Vapour pressure	< 0.00001 hPa (< 0.00001 mmHg) at 25.0 °C (77.0 °F)
l)	Vapour density	no data available
m)	Relative density	1.38 g/cm3
n)	Water solubility	no data available
o)	Partition coefficient: n-octanol/water	log Pow: 6.02
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

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 - Hamster - > 5,000 mg/kg

TDLo Oral - Human - 428.5 mg/kg
Remarks: Endocrine:Adrenal cortex hypoplasia.

TDLo Oral - rat - 6,000 mg/kg
Remarks: Cardiac:Other changes. Gastrointestinal:Other changes. Kidney, Ureter, Bladder:Changes in both tubules and glomeruli.

TDLo Oral - rat - 14 mg/kg
Remarks: Liver:Changes in liver weight. Endocrine:Estrogenic. Musculoskeletal:Other changes.

TDLo Oral - rat - 2,100 mg/kg
Remarks: Behavioral:Altered sleep time (including change in righting reflex).

Inhalation: no data available

LD50 Dermal - rabbit - 1,200 mg/kg
Remarks: Behavioral:Excitement. Behavioral:Convulsions or effect on seizure threshold. Skin irritation

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 has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

Limited evidence of carcinogenicity in animal studies

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: KI0700000

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 - other fish - 1.18 - 9 mg/l - 96.0 h
	LC50 - Lepomis macrochirus (Bluegill) - 0.04 - 0.05 mg/l - 96.0 h
	LC50 - Oncorhynchus mykiss (rainbow trout) - 0.06 - 0.09 mg/l - 96.0 h
	LC50 - Pimephales promelas (fathead minnow) - 3.47 - 5.58 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia pulex (Water flea) - 0.01 mg/l - 48 h

12.2 Persistence and degradability
no data available

12.3 Bioaccumulative potential
Indication of bioaccumulation.

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.
Very toxic 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: 2811 Class: 6.1 Packing group: III
Proper shipping name: Toxic solids, organic, n.o.s. (2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane)
Reportable Quantity (RQ): 1 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG
UN number: 2811 Class: 6.1 Packing group: III EMS-No: F-A, S-A
Proper shipping name: TOXIC SOLID, ORGANIC, N.O.S. (2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane)
Marine pollutant: No

IATA
UN number: 2811 Class: 6.1 Packing group: III
Proper shipping name: Toxic solid, organic, n.o.s. (2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane)

15. REGULATORY INFORMATION

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

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
2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane	72-54-8	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane	72-54-8	1993-04-24

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer. 2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane	72-54-8	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
H301	Toxic if swallowed.
H312	Harmful in contact with skin.
H351	Suspected of causing cancer.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

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

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: 5.1 Revision Date: 06/26/2014 Print Date: 07/07/2016

SAFETY DATA SHEET

Version 5.3
Revision Date 01/02/2015
Print Date 07/07/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : 4,4'-DDE

Product Number : 35487
Brand : Sigma-Aldrich

CAS-No. : 72-55-9

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
Carcinogenicity (Category 2), H351
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

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 Harmful if swallowed.
H351 Suspected of causing cancer.
H410 Very toxic 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.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P273 Avoid release to the environment.
P281 Use personal protective equipment as required.

P301 + P312 IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P330 Rinse mouth.
P391 Collect spillage.
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 : 1,1-Dichloro-2,2-bis(4-chlorophenyl)ethene

Formula : $C_{14}H_8Cl_4$
Molecular weight : 318.03 g/mol
CAS-No. : 72-55-9
EC-No. : 200-784-6

Hazardous components

Component	Classification	Concentration
2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene		
	Acute Tox. 4; Carc. 2; Aquatic Acute 1; Aquatic Chronic 1; H302, H351, H410	<= 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
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 firefighting 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 dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
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
Pick up and arrange disposal without creating dust. Sweep up and shovel. 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 formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.Normal measures for preventive fire protection.
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.

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
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 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.

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 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).

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: solid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	88.0 - 90.0 °C (190.4 - 194.0 °F)
f)	Initial boiling point and boiling range	No data available
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	< 0.00001 hPa (< 0.00001 mmHg)
l)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	log Pow: 6.51
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 - 880.0 mg/kg

Inhalation: No data available

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 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:	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: Not available

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) - 0.2 - 0.3 mg/l - 96.0 h
	LC50 - Oncorhynchus mykiss (rainbow trout) - 0.03 - 0.04 mg/l - 96.0 h
	LC50 - Salmo salar (Atlantic salmon) - 0.05 - 0.18 mg/l - 96.0 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential

Bioaccumulation	Gambusia affinis (Mosquito fish) - 33 d - 3.84 µg/l
	Bioconcentration factor (BCF): 12,037

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.
Very toxic 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: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene)
Reportable Quantity (RQ): 1 lbs
Marine pollutant:yes
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. (2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene)
Marine pollutant:yes

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene)

15. REGULATORY INFORMATION

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

SARA 313 Components

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
2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene	72-55-9	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene	72-55-9	1993-04-24

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer. 2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene	CAS-No. 72-55-9	Revision Date 2010-06-11
WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. 2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene	CAS-No. 72-55-9	Revision Date 2010-06-11

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.
H351	Suspected of causing cancer.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

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

NFPA Rating

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

Further information

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: 5.3 Revision Date: 01/02/2015 Print Date: 07/07/2016

SAFETY DATA SHEET

Version 5.4
Revision Date 02/28/2015
Print Date 07/07/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : 4,4'-DDT

Product Number : 31041
Brand : Sigma-Aldrich
Index-No. : 602-045-00-7

CAS-No. : 50-29-3

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 3), H301
Acute toxicity, Dermal (Category 3), H311
Carcinogenicity (Category 2), H351
Specific target organ toxicity - repeated exposure, Oral (Category 1), H372
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

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)

H301 + H311	Toxic if swallowed or in contact with skin
H351	Suspected of causing cancer.
H372	Causes damage to organs through prolonged or repeated exposure if swallowed.
H410	Very toxic 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.
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.
P281	Use personal protective equipment as required.
P301 + P310 + P330	IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician. Rinse mouth.
P302 + P352 + P312	IF ON SKIN: Wash with plenty of soap and water. Call a POISON CENTER or doctor/ physician if you feel unwell.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P361	Remove/Take off immediately all contaminated clothing.
P363	Wash contaminated clothing before reuse.
P391	Collect spillage.
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 : 1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane
1,1-Bis(4-chlorophenyl)-2,2,2-trichloroethane

Formula : $C_{14}H_9Cl_5$
Molecular weight : 354.49 g/mol
CAS-No. : 50-29-3
EC-No. : 200-024-3
Index-No. : 602-045-00-7

Hazardous components

Component	Classification	Concentration
1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane		
	Acute Tox. 3; Carc. 2; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H301 + H311, H351, H372, H410	<= 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. 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.

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 firefighting 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 dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
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
Pick up and arrange disposal without creating dust. Sweep up and shovel. 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 formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
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.
Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

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
1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane	50-29-3	TWA	1.000000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Liver damage Confirmed animal carcinogen with unknown relevance to humans		
		TWA	0.500000 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A		
		TWA	1.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		Skin designation		

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: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (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.

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 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).

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: solid
b)	Odour	No data available
c)	Odour Threshold	No data available

d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 107 - 110 °C (225 - 230 °F) - lit.
f)	Initial boiling point and boiling range	260.0 °C (500.0 °F)
g)	Flash point	72.0 - 77.0 °C (161.6 - 170.6 °F)
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	0.0000021 hPa (0.0000016 mmHg) at 20.0 °C (68.0 °F)
l)	Vapour density	No data available
m)	Relative density	0.99 g/cm3
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	log Pow: 6.91
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
Oxidizing agents, Iron and iron 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 - 87.0 mg/kg

Inhalation: No data available

LD50 Dermal - Rabbit - 300.0 mg/kg
Remarks: Behavioral:Tremor. Behavioral:Muscle weakness. Behavioral:Ataxia.

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

Limited evidence of carcinogenicity in animal studies

IARC:	2B - Group 2B: Possibly carcinogenic to humans (1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane)
NTP:	Reasonably anticipated to be a human carcinogen (1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane)
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
Ingestion - Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard
No data available

Additional Information
RTECS: KJ3325000

CNS stimulation.

Pancreas. -

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 0.01 mg/l - 96.0 h
	LC50 - Lepomis macrochirus (Bluegill) - 0.01 mg/l - 96.0 h
	LC50 - Oncorhynchus mykiss (rainbow trout) - 0.003400 mg/l - 96.0 h
	LOEC - Oncorhynchus mykiss (rainbow trout) - 150 mg/l - 3.0 d
	NOEC - Oncorhynchus mykiss (rainbow trout) - 113 mg/l - 3.0 d
Toxicity to daphnia and other aquatic invertebrates	Immobilization EC50 - Daphnia magna (Water flea) - 0.00108 mg/l - 48 h
Toxicity to algae	LC100 - Scenedesmus quadricauda (Green algae) - > 20 mg/l - 7 d

12.2 Persistence and degradability

12.3 Bioaccumulative potential

Bioaccumulation — Oncorhynchus mykiss (rainbow trout) - 20 d - 0.001 mg/l

Bioconcentration factor (BCF): 46,670

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.
Very toxic 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. 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: 2811 Class: 6.1 Packing group: III
Proper shipping name: Toxic solids, organic, n.o.s. (1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane)
Reportable Quantity (RQ): 1 lbs
Marine pollutant:yes
Poison Inhalation Hazard: No

IMDG

UN number: 2811 Class: 6.1 Packing group: III EMS-No: F-A, S-A
Proper shipping name: TOXIC SOLID, ORGANIC, N.O.S. (1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane)
Marine pollutant:yes

IATA

UN number: 2811 Class: 6.1 Packing group: III
Proper shipping name: Toxic solid, organic, n.o.s. (1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane)

15. REGULATORY INFORMATION

SARA 302 Components

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

SARA 313 Components

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.

Massachusetts Right To Know Components

	CAS-No.	Revision Date
1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane	50-29-3	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane	50-29-3	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane	50-29-3	1993-04-24

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer. 1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane	CAS-No. 50-29-3	Revision Date 2008-06-17
WARNING. This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. 1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane	CAS-No. 50-29-3	Revision Date 2008-06-17

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
H301	Toxic if swallowed.
H301 + H311	Toxic if swallowed or in contact with skin
H311	Toxic in contact with skin.
H351	Suspected of causing cancer.
H372	Causes damage to organs through prolonged or repeated exposure if swallowed.

HMIS Rating

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

NFPA Rating

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

Further information

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: 5.4 Revision Date: 02/28/2015 Print Date: 07/07/2016

SAFETY DATA SHEET

Version 5.2
Revision Date 06/13/2016
Print Date 06/21/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Toxaphene

Product Number : N13586
Brand : Supelco
Index-No. : 602-044-00-1

CAS-No. : 8001-35-2

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

Identified uses : Laboratory chemicals, Synthesis 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 2), H300
Acute toxicity, Dermal (Category 4), H312
Skin irritation (Category 2), H315
Carcinogenicity (Category 2), H351
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

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)

H300	Fatal if swallowed.
H312	Harmful in contact with skin.
H315	Causes skin irritation.
H335	May cause respiratory irritation.
H351	Suspected of causing cancer.
H410	Very toxic 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/ eye protection/ face protection.
P301 + P310 + P330	IF SWALLOWED: Immediately call a POISON CENTER/doctor. Rinse mouth.
P302 + P352 + P312	IF ON SKIN: Wash with plenty of water.Call a POISON CENTER/doctor if you feel unwell.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/doctor if you feel unwell.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P391	Collect spillage.
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

Formula : C10H10Cl8
Molecular weight : 413.81 g/mol
CAS-No. : 8001-35-2
EC-No. : 232-283-3
Index-No. : 602-044-00-1

Hazardous components

Component	Classification	Concentration
Toxaphene		
	Acute Tox. 2; Acute Tox. 4; Skin Irrit. 2; Carc. 2; STOT SE 3; Aquatic Acute 1; Aquatic Chronic 1; H300, H312, H315, H335, H351, H410	<= 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. 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.

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 firefighting 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 dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
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
Pick up and arrange disposal without creating dust. Sweep up and shovel. 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 formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
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.

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
Toxaphene	8001-35-2	TWA	0.5 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Liver damage Central Nervous System convulsion		

		Confirmed animal carcinogen with unknown relevance to humans Danger of cutaneous absorption		
		TWA	0.500000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Liver damage Central Nervous System convulsion Confirmed animal carcinogen with unknown relevance to humans Danger of cutaneous absorption		
		STEL	1 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Liver damage Central Nervous System convulsion Confirmed animal carcinogen with unknown relevance to humans Danger of cutaneous absorption		
		STEL	1.000000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Liver damage Central Nervous System convulsion Confirmed animal carcinogen with unknown relevance to humans Danger of cutaneous absorption		
		TWA	0.500000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		Skin designation		
		TWA	0.5 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		Skin designation		
		Potential Occupational Carcinogen See Appendix A Potential for dermal absorption		
		PEL	0.5 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		Skin		
		STEL	1 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		Skin		

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.

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 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).

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: solid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 65 - 90 °C (149 - 194 °F)
f)	Initial boiling point and boiling range	No data available
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	1.650 g/cm3 at 20 °C (68 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	log Pow: 5.9
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
Avoid moisture.

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas
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 - 50 mg/kg

Inhalation: No data available

LD50 Dermal - Rabbit - 1,025 mg/kg
Remarks: Behavioral:Excitement. Behavioral:Food intake (animal). Vascular:Regional or general arteriolar or venous dilation.

No data available

Skin corrosion/irritation
Skin - Mammal
Result: Skin irritation

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 has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Limited evidence of carcinogenicity in animal studies

IARC:	2B - Group 2B: Possibly carcinogenic to humans (Toxaphene)
NTP:	Reasonably anticipated to be a human carcinogen (Toxaphene)
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
No data available

Additional Information
RTECS: Not available

Nausea, Headache, Incoordination., Convulsions, Central nervous system depression, Tremors, Coma., 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	mortality LOEC - Pimephales promelas (fathead minnow) - 0.005 mg/l - 7.0 d
	LC50 - Lepomis macrochirus (Bluegill) - 0.024 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 0.01 mg/l - 48 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential

Bioaccumulation	Lepomis macrochirus - 32 d - 0.277 µg/l
	Bioconcentration factor (BCF): 8,100

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.
Very toxic to aquatic life with long lasting effects.

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: 2811 Class: 6.1 Packing group: II
Proper shipping name: Toxic solids, organic, n.o.s. (Toxaphene)
Reportable Quantity (RQ): 1 lbs
Marine pollutant:yes
Poison Inhalation Hazard: No

IMDG
UN number: 2811 Class: 6.1 Packing group: II EMS-No: F-A, S-A
Proper shipping name: TOXIC SOLID, ORGANIC, N.O.S. (Toxaphene)
Marine pollutant:yes

IATA
UN number: 2811 Class: 6.1 Packing group: II
Proper shipping name: Toxic solid, organic, n.o.s. (Toxaphene)

15. REGULATORY INFORMATION

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

	CAS-No.	Revision Date
Toxaphene	8001-35-2	1993-04-24

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

	CAS-No.	Revision Date
Toxaphene	8001-35-2	1993-04-24

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Toxaphene	8001-35-2	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Toxaphene	8001-35-2	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
Toxaphene	8001-35-2	1993-04-24

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer. Toxaphene	8001-35-2	1989-12-31

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
H300	Fatal if swallowed.
H312	Harmful in contact with skin.
H315	Causes skin irritation.
H335	May cause respiratory irritation.
H351	Suspected of causing cancer.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	4
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

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

Further information

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

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CONTRACTOR HEALTH AND SAFETY AWARENESS PLAN

ATTACHMENT 3-1:
General JSA

General Job Safety Analysis				
Job Title: Soil/Groundwater Disturbing Activities		**Location:** Georgia Ports Authority Bainbridge Terminal		**Company Conducting Analysis:** Enivrionmental International Corporation
Target Audience: Site Contractors		**Supervising Entity:** Georgia Ports Authority		**Date Analysis Conducted:** 8/2/2016
Task No.	**Task Description**	**Potential Hazard**	**Who/What might be harmed?**	**Suggested Control/Response Measures**
1	Any intrusive activities within AOC-1 and AOC-2*	Inhilation of dust, Dermal exposure to COC containing soil, Accidental ingestion of COC containing soil	Onsite Workers	Exposure Monitoring Plan, Appropriate PPE, Dust control measures, proper personal and equiptment decontamination
2	Any groundwater contacting activities**	Dermal exposure to COC containing groundwater, Accidental ingestion of COC containing groundwater	Onsite Workers	Appropriate PPE, Proper personal and equiptment Decontamination

Notes:

This General Job Safety Analysis is intended as an awareness level analysis only. It is limited strictly to COC exposure hazards and does not consider other task or site specific hazards.

AOC = Area of Concern

COC = Constituents of Concern

* Intrusive activities include, but are not limited to, drilling; digging; placement of any objects or use of any equipment which deforms or stresses the surface beyond its load-bearing capacity; piercing the surface with a rod, spike or similar item; bulldozing; or earthwork.

** Groundwater activities include, but are not limited to, pumping from wells or open pits; injection of any material into the subsurface; and removal of soil to the depth of the water table such that it is open to air.