Maryland
Department of
the Environment

Maryland Department of the Environment
in collaboration with
Maryland Department of Transportation
Maryland Port Administration

Innovative Reuse and Beneficial Use of Dredged Material Guidance Document

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EXECUTIVE SUMMARY

This Technical Guidance Document (hereafter "this Document" or "the Document") has been prepared by the Maryland Department of the Environment ("MDE" or "the Department") to describe the policies and procedures for reviewing proposed beneficial use and innovative reuse projects utilizing dredged material as authorized by The Dredged Material Management Act of 2001, Maryland Code Annotated, Environment Article §§ 5-1101 through 5-1108 and other laws and regulations applicable to specific uses (*See* Appendix A1). This Document was developed by request of the State's Dredged Material Management Program's (DMMP) Executive Committee (see Appendix A4) and in consideration of a legislative directive (see Appendix A1) prioritizing beneficial uses and innovative reuse of dredged material in Maryland.

The Department considers dredged material a resource with a variety of potential applications, including fill, that can be used safely and in a manner protective of human health and the environment. The purpose of the Document is to guide scientists, engineers, and other technical professionals in how the Department makes approvals and related determinations to beneficially use or innovatively reuse dredged material. In so doing, those seeking Departmental approvals will better understand what information is required, leading to increased transparency and efficiency in the approval process. This document is also a living document that will be updated, as necessary, with new policies and procedures as other innovative reuse and beneficial uses are piloted.

Currently, the Document (Section IV) addresses Departmental considerations for several in-water beneficial uses (beach nourishment, marsh creation, island restoration, and other in-water beneficial uses) and innovative reuse applications on land (Brownfield clean up, landfill daily cover, engineered fill/soil). For some uses, like beach nourishment and marsh creation, existing Departmental regulations are prescriptive and clearly describe permitting requirements. For other uses, such as engineered fill, existing laws and regulations generally require protection of public health and the environment, are less prescriptive, and approvals are made on a case-by-case basis. In such cases, this Document describes current policies used to make those determinations. These policies use a rigorous risk-based framework that considers chemical concentrations, exposed populations, exposure duration and pathway(s).

This Document also serves as a comprehensive guidance framework for beneficial use and innovative reuse requirements across environmental media - air, land and water. Links to permit applications and programmatic contacts are included to clarify what permits are required and who to contact for assistance. Compiling this information in a comprehensive document helps provide certainty to the regulated community. The Department considers dredged material a valuable resource for achieving our mission to protect and restore the environment for the health and well-being of all Marylanders. Whether through projects that protect shorelines from erosion, create wetlands that improve water quality and provide aquatic habitat, or restore contaminated sites to safe and productive use, dredged material has a proven track record of environmental success. This Document aims to build on and accelerate those successes to achieve Maryland's ambitious environmental and public health goals.

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Glossary of Terms

Term	***Definition***
Background Level	The level of a substance occurring naturally at the site prior to any manmade spill or release, as defined by § 7-501 of the Environmental Article, Annotated Code of Maryland.
Baltimore Harbor	The waterway which consists of the tidal portions of the Patapsco River and its tributaries lying westward of a line extending from Rock Point in Anne Arundel County to North Point in Baltimore County. Environment Article, § 5-1101.
Beach nourishment	The placement of dredged material on the beaches or in the water starting at or above the ordinary high water line for the purpose of adding to, replenishing, or preventing the erosion of, beach material.
Beneficial Use	Any of the following uses of dredged material from the Chesapeake Bay and its tributaries placed into waters or onto bottomland of the Chesapeake Bay or its tidal tributaries, including Baltimore Harbor: (i) the restoration of underwater grasses; (ii) the restoration of islands; (iii) the stabilization of eroding shorelines; (iv) the creation or restoration of wetlands; and (v) the creation, restoration, or enhancement of fish or shellfish habitats. Environment Article, §5-1101(a) (3).
Clay	The fraction of soil or dredged material whose grain-size distribution is less than 0.002 millimeters, generally referred to as very fine-grained sediment. Clays are generally slippery when wet, are often of very low natural permeability to water, and can be used to make low-permeability liners that can retard water leakage from an impoundment.
Construction	Land clearing, grubbing, topsoil stripping, soil movement, grading, cutting and filling, transporting, or otherwise disturbing land for any purpose. "Construction" includes land disturbing activities for the purpose of: 1) constructing buildings; 2) mining materials; 3) developing golf courses; and 4) constructing roads and installing utilities. Environment Article, § 4-105(a).
Dewatering	Use of trenches or other engineering techniques to expedite removal of water from dredged material at a dredged material containment facility.
Discharge of dredged material	See 40 CFR §232.2.

Disposal facility	A facility permitted to accept solid wastes by the State of Maryland or other State. In Maryland, such facilities must be permitted in accordance with Title 9 of the Environment Article and the regulations promulgated in COMAR 26.04 or COMAR 26.10.13.
Dredged material	Sediment excavated or dredged from the waters of the State.
Dredged material containment facility	An artificial confinement structure, site or area used for the separation of dredged material solids from the interstitial or carriage water.
Dredging	The removal or displacement by any means of soil, sand, gravel, shells, or other material, whether or not of intrinsic value, from any waters of this State.
Fill material (construction)	Soil or dewatered dredged material used as foundation material for construction of a structure, such as roads and buildings, or to reclaim land lost to erosion, such as gullies or mines, to raise the grade on a property, or to provide final cover material for a property. Final use of fill material is dependent upon the screening level category of the material (from the *Fill Material and Soil Management Fact Sheet*).
Fill material (Section 404)	Any material placed in jurisdictional waters of the U.S. and/or adjacent wetlands.
Grain size analysis	A method to determine dredged material and placement site sediment particle size distribution.
Habitat development	Refers to utilization of dredged sediments as a resource material for habitat development or the incidental or subsequent creation of fish and wildlife habitat on currently or formerly used dredged material placement sites.
Harbor	Any protected water area affording a place of safety for vessels.
Hazardous Substance	Any substance that is defined as a hazardous substance under § 101(14) of the federal act (the Comprehensive Environmental Response, Compensation and Liability Act or CERCLA); or is identified as a controlled hazardous substance by the Department under COMAR 26.14.01.02.
Innovative Reuse	The use of dredged material in the development or manufacturing of commercial, industrial, horticultural, agricultural, or other products. Environment Article, §5-1101(a) (6).
Interstitial water or pore water	Water contained in the interstices or voids of soil or rock.
Land use controls	Any restriction or control that serves to protect human health and the environment by limiting use of or exposure to any portion of the property, including water resources.
Leaching	The process whereby water from precipitation or other sources infiltrates into the ground and extracts by solution, and other mechanisms, elements such as metals and compounds from the

	soil. The liquid produced by this process can result in the mass transfer over time of extracted chemicals into subsurface layers and the groundwater flow regime.
Maintenance dredging	Cyclic dredging of the same area over a period of time to remove accumulating sediments and to maintain safe and efficient ship, barge and boat traffic.
Monitoring	The process of collecting (before, during, or after placement) physical, chemical and environmental data to determine potential impacts of a particular dredging and dredged material placement or disposal option.
Navigable Waters of the United States	See 33 CFR Part 329. This term should not be confused with the term *waters of the United States*.
New work dredging	Dredging in an area that has not previously been dredged; often includes sand, clay bottom, or bedrock material. Is distinct from maintenance dredging of the Port's federal navigation channels.
Permeability	The ease with which water can move or pass through a soil, dredged material, or other material.
pH	A standard measure of 0.0 to 14.0 of acidity and alkalinity of soil, water and other liquids. The number derives from the inverse negative log in base 10 of the hydrogen ion concentration in moles per liter (*mol/l*), e.g., a hydrogen concentration of $1x10^{-7}$ *mol/l* in water produces a pH of 7; of $1x10^{-5}$ *mol/l* produces a pH of 5, etc.
Probable Effects Level (PEL)	The concentration of a constituent above which adverse effects are frequently expected.
Salinity	The measure of soluble salts in soil or water (or dredged material) that makes it suitable or unsuitable for particular beneficial uses.
Sand	The fraction of soil or dredged material whose grain size distribution is 2.0 to 0.05 millimeters, generally referred to as coarse-grained.
Sediment	Material such as sand, silt, or clay suspended in or settled on the bottom of a water body.
Silt	The fraction of soil or dredged material whose grain-size distribution is 0.05 to 0.002 millimeters, generally referred to as fine-grained. Unconsolidated geologic and organic materials overlying bedrock, if present.
Soil	
Soil amendment	A fertilizer, lime, mulch, compost, dredged material, or other blend or product added to soil or to improve its quality. Soil amendments may also include soil conditioners as defined in COMAR 15.18.03.01.
Sulfide, Sulfate	Sulfides are naturally occurring minerals or compounds containing sulfur in an un-oxidized form, for example, the mineral pyrite is iron disulfide (FeS_2). Sulfates are minerals or compounds that contain sulfur combined with oxygen. When estuarine dredged sediments, which contain sulfides, are brought to the surface and

	exposed to air, the sulfide minerals are oxidized, and acidity (lower pH) is produced, which can increase the solubility of other elements, such as iron, as well.
Threshold Effects Level (TEL)	Represents the concentration of constituents below which adverse effects are expected to rarely occur.
Upland placement	The placement of dredged materials landward from the ordinary high-water level of a waterway or water body.
Waters of this State	As defined in Maryland, includes (1) Both surface and underground waters within the boundaries of this State subject to its jurisdiction, including that part of the Atlantic Ocean within the boundaries of this State, the Chesapeake Bay and its tributaries, and all ponds, lakes, rivers, streams, public ditches, tax ditches, and public drainage systems within this State, other than those designed and used to collect, convey, or dispose of sanitary sewage; and (2) The flood plain of free-flowing waters determined by the Department of Natural Resources on the basis of the 100-year flood frequency. Environment Article, §9-101(1).
Waters of the United States	See 33 CFR Part 328. This term is broader than the term *Navigable waters of the United States.*
Wetlands	See definition of nontidal wetlands in COMAR 26.23.01.01B (62) and definition of tidal wetlands in COMAR 26.24.01.02B (57).

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List of Abbreviations

ASTM	American Society for Testing and Materials
AVS	Acid Volatile Sulfides
BPW	Maryland Board of Public Works
CAD	Confined Aquatic Disposal
C&D	Chesapeake and Delaware
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHS	Controlled Hazardous Substances
COMAR	Code of Maryland Regulations
CZCC	Coastal Zone Consistency Concurrence
CZMA	Coastal Zone Management Act
DMCF(s)	Dredged Material Containment Facility
DMMP	Dredged Material Management Plan
DMMA	Dredged Material Management Act of 2001
DNR	The Maryland Department of Natural Resources
GIS	Geographic Information System
ESA	Endangered Species Act
HQ	Hazard Quotient
LMA	Land and Materials Administration
LRP	Land Restoration Program
LUC(s)	Land Use Controls(s)
mcy	million cubic yards
MDA	Maryland Department of Agriculture
MDE	Maryland Department of the Environment
MDOT	Maryland Department of Transportation
MDSPGP-5	Maryland State Programmatic General Permit-5
MES	Maryland Environmental Service
MGS	Maryland Geological Survey
MHT	Maryland Historic Trust
MPA	Maryland Port Administration
MSA	Magnuson-Stevens Fisheries Conservation and Management Act
NMFS	National Marine Fisheries Service
NEPA	National Environmental Policy Act
PAHs	Polycyclic aromatic hydrocarbons
PEL(s)	Probable Effects Level(s)
PCBs	Polychlorinated biphenyls
RAP	Response Action Plan
RCRA	Resource Conservation and Recovery Act
RSL(s)	Regional Screening Level(s)
SEM	Simultaneously Extracted Metals
SHA	State Highway Administration
SIP	State Implementation Plan
SQGs	Sediment Quality Guidelines
SVOCs	Semivolatile Organic Compounds

TCLP	Toxicity Characteristic Leaching Procedure
TEL(s)	Threshold Effects Level(s)
TPH-DRO	Total Petroleum Hydrocarbon-Diesel Range Organics
TPH-GRO	Total Petroleum Hydrocarbon-Gasoline Range Organics
UECA	Uniform Environmental Covenants Act
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USFWS	United States Fish & Wildlife Service
VCP	Voluntary Cleanup Program
VOCs	Volatile Organic Compounds
WQC	Water Quality Certification

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I. Purpose

In 2001, the Maryland General Assembly enacted the Dredged Material Management Act of 2001 (DMMA), establishing the Dredged Material Management Program (DMMP) and the DMMP Executive Committee to provide oversight and guidance over the Port of Baltimore's dredging needs through a rolling 20-year capacity and placement plan. Further, the DMMA prioritizes beneficial use and innovative reuse alternatives over other traditional dredged material placement methods.[1] This Guidance Document (hereafter "this Document" or "the Document") outlines policies and procedures for the innovative reuse and beneficial use of dredged material in the State of Maryland, as a safe and effective alternative to disposal. This document has been prepared by the Maryland Department of the Environment ("MDE" or "the Department") in response to the State's DMMP Executive Committee directive and recommendations issued in the Innovative and Beneficial Use Interagency Regulatory Workgroup Final Report (June 2016). That report was a collaborative effort among members of the workgroup including representatives from MDE, the U.S. Army Corps of Engineers, Baltimore District (USACE), the U.S. Environmental Protection Agency, Region 3 (EPA), the Maryland Department of Natural Resources (DNR), the Maryland Geological Survey (MGS), the Maryland Environmental Service (MES), and the Maryland Department of Transportation (MDOT) State Highway Administration (SHA) and Maryland Port Administration (MPA).

The innovative reuse and beneficial use of dredged material may be subject to various laws and regulations, and this Document is intended to assist prospective end users in identifying and applying requirements across MDE programs, laws and regulations. The objectives of this Document are to:

- Provide clear, consistent and understandable permit application and approval processes for the proposed end uses of dredged material, such as fill for brownfield redevelopment, construction and roadways, landfill daily cover, aquatic habitat restoration and/or creation, manufactured topsoil, and other purposes.
- Provide general guidance and risk-based screening criteria for the sampling and testing of dredged material and dredged material blends/mixtures for identified proposed use options.
- Provide a framework for the long-term management of innovative reuse and beneficial use of dredged material that protects public health and the environment and complies with state and federal regulations. This may include implementation of land use controls (LUCs) at a site receiving dredged material. The LUCs may require a

[1] Environment Article, § 5-1104.2, Annotated Code of Maryland.

recorded environmental covenant that complies with the Maryland Uniform Environmental Covenants Act (UECA).

Chapter II of this Document provides an introductory overview to the issues associated with dredging and dredged material management within Maryland. Chapter III of this Document outlines the regulatory requirements for dredging activities and dredged material management in Maryland. Chapter IV of this Document discusses the innovative reuse and beneficial use of dredged material, including fill for brownfield redevelopments, construction projects, roadway construction, landfill daily cover, aquatic habitat restoration and/or creation, and manufactured topsoil, as well as the testing program for the dredged material or dredged material blends or admixtures.

While this Document provides an overview of current dredging and dredged material placement and disposal processes in Maryland, the scope of the Document is intended to clarify the regulatory processes and approvals needed for innovative reuse and beneficial end uses of dredged material. This Document is guidance and is not a substitute for any applicable law or regulation[2].

It is acknowledged that there may be new or existing technologies that provide an opportunity to innovatively reuse or beneficially use dredged material in addition to the uses discussed within this Document. Current guidance is provided for uses that have MDE procedural protocols for permits and approvals. MDE intends this guidance to be a living document that will be updated periodically as new processes and policies are investigated and established.

II. Introduction

A general definition of dredging is to "*bring up or clear (something) from a river, harbor, or other area of water with a dredge.*" Under Maryland law[3], dredging means "the removal or displacement by any means of soil, sand, gravel, shells, or other material, whether or not of intrinsic value, from any waters of this State." As used throughout this Document, "dredging" generally refers to the removal or displacement of materials such as sediments from the bottom of bays, lakes, ponds, rivers, harbors, wetlands and other water bodies within the State of Maryland, and "dredged material" refers broadly to sediments and other materials excavated from within such waters.

[2] This document provides guidance on how MDE generally intends to plan, implement, maintain, and enforce the innovative reuse and beneficial use of dredged materials in Maryland. This document does not, however, substitute for MDE regulations, nor is it a regulation itself. It does not impose legally binding requirements on State agencies or the regulated community, and may not apply to a particular situation based upon the circumstances. MDE retains the discretion to adopt approaches on a case-by-case basis that differ from this guidance where appropriate. Any decisions regarding a particular site will be made based on the applicable statutes and regulations.

[3] Environment Article, §16-101(e), Annotated Code of Maryland.

Dredging is routinely performed to provide deeper water for navigation, such as for commercial shipping channels, other public and private boat channels, marinas, boat basins and the like. It may also be performed for the installation of subaqueous utilities, removal of contaminated sediments, environmental enhancement or restoration, underwater archaeological or salvage operations, or other purposes. Sources of dredged material vary as widely as the purpose and scope of dredging projects. However, within Maryland, the vast majority of dredged materials requiring disposal results from State and Federal navigational access projects, and the disposition of those materials is the primary impetus for this Document. Most dredged material derived from navigational access projects consists of naturally-occurring particulates derived from the natural erosion of rocks and soil, transported by runoff into lakes and streams, and ultimately deposited as sediment in the Chesapeake Bay and its tributaries[4].

The federal government and many states recognize that some dredged material is a valuable resource, rather than a waste or byproduct that must be disposed of in a landfill or disposal facility. There is growing recognition that this material can often be put to beneficial use or innovative reuse rather than discarded, and that certain uses of this material can be fully protective of public health and the environment, as well as being economically beneficial. The Department strongly supports the use of dredged material as a resource, recognizing the goals set forth by the DMMA of 2001 to prioritize beneficial use and innovative reuse options over traditional dredged material placement methods.

The technical guidance for the innovative reuse and beneficial use of dredged material set forth in this Document is based on the following:

- The source(s) of the dredged material (e.g. Baltimore Harbor Channel, Chesapeake Bay and the Chesapeake and Delaware (C&D) Approach Channel, reservoirs, ponds, etc.).
- "Unprocessed" (raw, wet) dredged material vs. "processed" (dried, amended, or blended with other product) dredged material.
- The intended end use of the dredged material and characteristics of the receiving site.

[4] As the eroded materials in the Chesapeake Bay and Baltimore Harbor form sediment, they are affected by sulfate from the estuarine water. The dissolved sulfate in the water is chemically reduced to sulfide, which reacts with iron oxides in the sediments to form iron sulfides. These sediments, if placed under aerobic conditions, may acidify to a pH of 4.0 or lower, however, some materials contain natural calcium carbonate and although they contain iron sulfides, may not acidify to pH's of 4.0 or less.

III. Dredging and Dredged Material Management Regulations in Maryland

A. Navigational Dredging by the Army Corps of Engineers

A primary civil works mission[5] of the USACE is to maintain safe and efficient navigation for the purposes of international and interstate commerce. This includes projects involving the dredging and maintenance of marked, federal navigation channels associated with deep-water ports, major waterways and similar navigational projects. These projects, as well as the funds to construct and maintain them, are subject to prior authorization by the U.S. Congress.[6] The USACE Baltimore District is responsible for maintaining[7] over 290 miles of navigation channels within the Chesapeake and Coastal Bays and the Susquehanna River basin, including nearly all tidal waters within the State of Maryland.[8]

When performing dredging activities in this capacity[9] the USACE is generally not subject to typical state or local permitting requirements. However, such federal projects are still required to obtain a Maryland State Water Quality Certification (WQC) in accordance with Section 401 of the Clean Water Act if any discharge associated with the dredging activity will occur into waters of the United States, as well as a Coastal Zone Consistency Concurrence (CZCC) in accordance with the Coastal Zone Management Act (CZMA). These federal projects may not proceed without the state's WQC and CZCC, or the state's waiver thereof.[10] For many dredging projects, USACE partners with a state, local or municipal entity as the "local sponsor" who assumes responsibility for the management and disposal of dredged materials generated by the federal navigational dredging project. Local sponsors are generally subject to all applicable federal, state and local permitting requirements, as discussed under the "Dredged Material Management" section (Section III.D).

Dredging and other civil works projects conducted (or funded) by the USACE are not required to obtain a regulatory authorization from the USACE – essentially, the USACE does not directly regulate itself. Federal navigation projects remain subject to numerous other applicable federal laws and regulations, including but not limited to the CZMA, National Environmental Policy Act (NEPA), Endangered Species Act (ESA), and Magnuson-Stevens Fisheries Conservation and Management Act (MSA).

[5] Navigation was the first civil works mission of USACE, as was established by federal law in the 1820s.
[6] Generally, USACE navigation projects are approved through "Water Resources Development Acts" (WRDAs), approved by Congress. Funding for USACE projects is generally provided by Congressional appropriations acts.
[7] The USCG is responsible for ensuring that federal channels are adequately marked, and that aids to navigation are maintained.
[8] The C&D Canal, in Cecil County, is operated and maintained by the USACE – Philadelphia District.
[9] Sometimes referred to as "the navigational servitude".
[10] States may waive WQC or CZCC, including by failing to respond to a request within a specified timeframe.

As defined in the Code of Maryland Regulations (COMAR) 26.13.02.04-6, dredged material is not a hazardous waste if it: (1) is subject to the requirements of a permit issued by (a) the USACE or an approved state under Section 404 of the Federal Water Pollution Control Act (33 U.S.C. 1344) or (b) the USACE under Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413); or (2) is "generated in connection with a USACE civil work project" and is subject to the requirements of a USACE issued permit under Section 404 of the Federal Water Pollution Control Act or under Section 103 of Marine Protection, Research and Sanctuaries Act of 1972, or "subject to the administrative equivalent" of the above referenced permits, "as provided for in the regulations of the U.S. Army Corps of Engineers, such as 33 Code of Federal Regulation (CFR) §336.1, 33 CFR §336.2 and 33 CFR §337.6." Additionally, dredged material is generally not considered a solid waste in Maryland, unless it contains solid waste[11]. There may be areas where solid waste or hazardous waste was released into the environment, such that solid or hazardous waste may be present in the sediment. Where material is dredged from an area in which hazardous waste has been released, it is appropriate to analyze the dredged materials using the TCLP (Toxicity Characteristic Leaching Procedure) to determine whether the material exhibits a characteristic of hazardous waste under COMAR 26.13.02.08.

B. Other Dredging

With the notable exception of federal navigational dredging projects as described above, the dredging and placement of dredged materials within Maryland generally requires approval by both MDE and the USACE. Such activities often require additional state and local approvals as well. However, there are smaller projects within state tidal wetlands that do not require individual approvals from both agencies.

For questions or more details on dredging permitting requirements listed below, please contact Denise Keehner of the Wetlands and Waterways Program at 410-537-3751 or denise.keehner@maryland.gov.

1. Maryland Permits

MDE has the authority to regulate proposed dredging activities and the management of dredged material under the following (*See also* Appendix A1):

- Environment Article Title 5, Subtitle 5-901 through 5-911; Annotated Code of Maryland; COMAR 26.23; (Nontidal Wetlands).
- Environment Article Title 5, Subtitle 5-501 through 5-514; COMAR 26.17.04; (Waterway Construction).
- Environment Article Title 16; COMAR 26.24; (Tidal Wetlands)
- Clean Water Act, Section 401 (Water Quality Certification).
- Coastal Zone Management Act, Section 307 Federal Consistency Requirements

Depending on the location and scope of a particular dredging project, Maryland authorizations required may include an individual Tidal Wetlands License (for projects

[11] As defined in Environment Article, §9-101(j), Annotated Code of Maryland.

located on state-owned[12] tidal wetlands) approved by the Maryland Board of Public Works[13] (BPW) on recommendation from MDE, individual Tidal Wetlands Permit (for projects on private tidal wetlands) and/or individual Non-tidal Wetlands and Waterways Permit. The WQC, if required, is issued by MDE either as a separate authorization (for Tidal Wetlands Licenses issued by BPW), or incorporated into the MDE authorization (for Tidal Wetlands General Licenses and for Tidal or Nontidal Wetlands and Waterways Permits). Small "maintenance dredging" projects within state tidal wetlands that fall below certain thresholds[14] can be approved under a Tidal Wetlands General License issued by MDE.

2. Federal USACE Permits

The USACE regulates discharges of dredged or fill material into waters of the United States and structures or work in navigable waters of the United States under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899. The type of USACE permit required depends upon factors such as the location and type of work, whether it affects "Section 404" and/or "Section 10" waters, etc. Types of USACE permits include Individual, Nationwide and General Permits. Nationwide and General Permits are created for routine activities that would cause no more than minimal adverse environmental effects, individually and cumulatively, and such permits are issued as a federal action, subject to state WQC and CZCC approvals, and must be renewed every five years.

A State Programmatic General Permit (SPGP) is a type of General Permit, which upon issuance, enables a state or state agency to review applications and verify *federal* approval for certain types of projects, without requiring a separate application directly to USACE. The Maryland State Programmatic General Permit-5 (MDSPGP-5)[15] was issued by the USACE Baltimore District to streamline the authorization of certain categories of work within waters of the United States, located within the state of Maryland and the Baltimore District's jurisdiction. The MDSPGP-5 authorizes certain categories of maintenance dredging and "minor" dredging within tidal waters. The MDSPGP-5 does not generally authorize discharges of dredged material within waters of the U.S., although it does authorize limited placement of fill materials (which might include certain dredged materials) for the purposes of beach nourishment, marsh creation or other specific purposes.

3. Maryland and USACE Joint Application Process

To implement the MDSPGP-5 and to streamline the overall state and federal permitting process within Maryland, MDE and USACE have developed a joint permitting process, which is implemented in accordance with the MDSPGP-5 and an interagency "Standard

[12] The vast majority of tidal waters, including wetlands, lying waterward of the mean high water line and located within the boundaries of the State of Maryland are considered "state tidal wetlands".
[13] Consisting of the Governor, Comptroller and Treasurer of the State of Maryland.
[14] Not more than 1,500 square feet and 100 cubic yards of dredged material removed.
[15] Effective October 1, 2016; Refer to: http://www.nab.usace.army.mil/Missions/Regulatory/Permit-Types-and-Process/

Operating Procedure" document. This process allows the majority of applicants proposing activities that impact state- and federally-regulated wetlands and waters to submit a single application to MDE, which is then able to review applications and, in many cases ("Category A" projects), issue both state and federal approvals. Projects that do not qualify under Category A ("Category B", "Alternate" or "Enforcement" projects) are transmitted directly to USACE for separate federal action.

This joint permit application process includes an interagency coordination and review between the USACE and MDE, as well as other applicable state and federal agencies responsible for the management of protected resources, including DNR, Maryland Historic Trust (MHT), National Marine Fisheries Service (NMFS), United States Fish and Wildlife Service (USFWS), United States Coast Guard (USCG), etc. To apply for dredging activity permits, applicants must submit to MDE a completed Joint Federal/State Application for the Alteration of Any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland[16]. The joint permit application requires the applicant to provide information on how and where dredging is proposed to be conducted and information on the intended disposition of the dredged material. Upon receipt of an application, MDE categorizes the application for qualification under the MDSPGP-5. This includes an initial "screening" of the application using geospatial data in a Geographic Information System (GIS) to determine whether the proposed project has the potential to adversely affect certain resources (e.g. federal navigation channels or other projects, historic or archaeological resources, submerged aquatic vegetation, protected species or their habitats, etc.). If MDE determines that the project, due to the type, scope or location of the activity, or due to the presence of protected resources, does not qualify under Category A, then an application is forwarded to the USACE for federal action, MDE takes no further action under the MDSPGP-5, although it continues to review the application for any applicable *state* permit or license.

C. Additional Regulatory Considerations

Air Quality Permits to Construct are required before an air pollution source is constructed or modified. The purpose of the permit to construct is to ensure that a proposed project will comply with applicable air quality control laws which exist to protect public health and the environment. In general, dredging would not trigger the requirement to obtain an air quality permit to construct unless the dredged material is being processed in a manner that generates air emissions, e.g. processing dredged material in a kiln to produce lightweight aggregate.

In some dredging situations, a federal Clean Air Act requirement, called general conformity, will apply. The General Conformity Rule, established under Clean Air Act Section 176(c)(4), applies to federally funded or permitted projects in a nonattainment area that are not subject to transportation conformity. A federal agency must demonstrate that every action it undertakes or supports will conform to the appropriate state

[16] Refer to:
http://www.mde.state.md.us/programs/Water/WetlandsandWaterways/PermitsandApplications/Documents/www.mde.state.md.us/assets/document/permit/alter.pdf

implementation plan (SIP) and will not interfere with a state's plans to attain and maintain national standards for air quality. General conformity always applies to dredging projects that increase the depth or width of a channel as well as any other dredging activity that is not a part of routine maintenance. It must be demonstrated that direct and indirect emissions from the dredging project are below the de minimis levels established in the Clean Air Act (shown here: https://www.epa.gov/general-conformity/de-minimis-emission-levels).

For questions or more details on air permitting requirements, please contact Karen Irons of the Air Quality Permits program at 410-537-3256 or karen.irons@maryland.gov.

D. Dredged Material Management

Prior to MDE approval of a request for any federal, state, local, or private dredging activities, and the issuance of an authorization to proceed, an applicant must identify a placement or disposal site for the dredged material. This placement or disposal location is specifically addressed either in the MDE permit or in the WQC issued by MDE and includes the following dredged material management options: upland containment or disposal[17], beach nourishment/marsh creation, and other beneficial use[18], or innovative reuse[19]. Exemptions to the general requirements for upland disposal of dredged material are listed in COMAR 26.24.03.03A[20].

In determining the acceptability of dredged material for innovative reuse and beneficial use, MDE considers chemical and physical characteristics of the dredged material. Additionally, MDE considers the source of the dredged material, whether material is unprocessed or processed, and the end use receiving site/project as discussed in the following section.

1. Dredged Material Sources

Generally, dredged material sources in Maryland can be categorized as federal navigation channel material (from within Baltimore Harbor specifically or outside of the Harbor in Chesapeake Bay channels) and other material (reservoirs, lakes, ponds, etc.). The most significant source of dredged material in Maryland is accumulated sediment excavated annually from federal navigation channels to maintain a depth that enables safe navigation for cargo vessels in the Chesapeake Bay and into the Port of Baltimore; a process called maintenance dredging. On average, 5 million cubic yards (mcy) of

[17] As regulated in COMAR 26.24.03.03.
[18] As regulated in COMAR 26.24.03.05.
[19] The specific innovative reuse need not be identified, finalized or approved by MDE at the time the dredging occurs. The dredged material may be placed at an approved containment facility and the innovative reuse project may be implemented at a later point in time post-dredging. However, the permits and approvals described for specific end uses in Section IV of the guidance document would apply even when the proposed beneficial use or innovative reuse does not occur immediately subsequent to the dredging.
[20] Upon meeting applicable criteria and with MDE consultation, upland disposal exemptions for general upland disposal requirements include: (1) previously approved disposal facility, (2) landfills, and (3) nonforested upland fields.

maintenance material is dredged annually from Maryland navigation channels in the Chesapeake Bay, with 1.5 mcy of that maintenance material dredged from within the Baltimore Harbor.

The USACE and MDOT/MPA work together to conduct dredging of the federal channels and to identify placement sites for the maintenance material removed from the Baltimore Harbor and its approach channels. Material dredged from the Baltimore Harbor channels is currently placed in one of two MDOT/MPA-owned Dredged Material Containment Facilities (DMCFs), Cox Creek DMCF and Masonville DMCF, and has been placed in a pilot Confined Aquatic Disposal (CAD) cell located within Baltimore Harbor. Sediment characterization efforts focusing on the Baltimore Harbor maintenance channel material (i.e., the material currently being removed during maintenance dredging) have shown potential for this source of dredged material to be considered for innovative reuse and beneficial uses. Generally, Baltimore Harbor dredged material from outside of the regularly maintained navigation channels may require more rigorous chemical characterization due to a possibility of legacy industrial contamination. Dredged material from outside of Baltimore Harbor and in areas not subject to legacy industrial contamination will require relatively less characterization. MDE approval and testing requirements for innovative reuse and beneficial uses will also consider whether estuarine dredged material will be used in an oxidized environment where it is likely to acidify.

Maintenance material from the Chesapeake Bay channels is currently placed as a beneficial use for island habitat restoration at the Poplar Island Ecosystem Restoration Project. The USACE also provides maintenance dredging for the Chesapeake & Delaware Canal Approach Channels, and this material would be placed at USACE-owned facilities, such as Pearce Creek DMCF located in Cecil County, Maryland.

Other dredged material sources in Maryland may include sediment from the maintenance and removal of dams, in-water construction activities, and maintenance of marinas, piers, and other recreational boating areas, as well as access channels to these boating areas. These projects can be initiated by local government or private entities and may occur in freshwater, estuarine, or saltwater locations.

This guidance does not alter the established permitting process for dredging or current practices for managing sediment from stormwater management ponds. Current dredged material placement/disposal options for stormwater management pond sediment are not affected. All questions concerning Maryland's stormwater management program should be addressed to the Sediment, Stormwater, and Dam Safety Program at (410) 537-3543.

2. Unprocessed or Processed Dredged Material

Dredged material can be used directly from a dredging site or DMCF without any processing or alteration if it meets applicable testing and criteria as listed in Appendix A3 for a particular end use. This type of material is referred to in this Document as unprocessed dredged material, and has been used typically for beneficial use options such as aquatic and wetland habitat development or beach nourishment.

Dredged material that requires some degree of drying or other processing, amending, or blending to make it suitable for innovative reuse and beneficial use is referred to as processed dredged material. Minimal processing may consist of dewatering the material to reduce the moisture content of the dredged material to meet an end use requirement. Substantial processing may consist of blending or amending the dredged material to meet structural and geotechnical engineering requirements. If the source of the dredged material is from saline waters, blending and amending may be necessary to address salinity or pH issues[21]. Some examples of additional materials that dredged material could be blended or amended with include, but are not limited to, lime, cement-based additives such as Portland cement, or biosolids. The presence of a contaminant(s) does not preclude the possibility of an innovative reuse and beneficial use of dredged material. Some sediment from some areas that were subject to runoff from historic industrial activities can be stabilized by amending or blending techniques to make the material suitable for use, and in some cases, lower the leaching potential of the dredged material.

If dredged material requires transportation from the source location to the site of the innovative reuse or beneficial use project or to the end user via land on public roadways or by rail, MDE recommends dewatering the dredged material prior to transportation. For road transportation, dredged material (processed or unprocessed) should pass a paint filter liquids test utilizing EPA Method 9095B[22] to prevent spills and leaks. Dredged material that is considered to contain free liquids, based on the paint filter test, should be transported in trucks with water-tight tailgates, liners, or other methods to prevent leakage. In-water transportation of dredged material for innovative reuse and beneficial use should take precautions to ensure the transporting vessel is either below or only filled to a capacity that will allow safe transport without losing any material and minimize spillage, erosion, or other discharge to waters of the State.

3. Management and Regulation of Processing Operations

Processing activities can potentially have negative environmental impacts such as water pollution, the development of significant health nuisances such as odor or dust. Therefore, these activities may be regulated by one or more State agencies, depending on what type of materials are being blended, where and how they are being blended, and what is being done with the finished product.

a) *Industrial Stormwater Permit*

[21] Salt accumulations in soil can decrease nutrient availability and inhibit growth of many plants. Additionally, pH affects the chemical properties of dredged material. The pH level can indicate what type of amending is required as a corrective action to ensure dredged material can be beneficially or innovatively used (i.e. low pH (<4.0) indicates free acids present (sulfates) and lime could be used as an amendment).

[22] This method is used to determine the presence of free liquids in a representative sample. Material is placed in a paint filter (fine mesh size number 60 +/- 5%). If any portion of the material passes through and drops from the filter within the 5-minute test period, the material is considered to contain free liquids.

The purpose of this section is to set the expectations, site design parameters, and regulatory requirements of soil processing operations involving dredged materials in order to prevent or minimize exposure of hazardous materials to stormwater and to prevent untreated discharges of stormwater. Soil blending operations include dredged materials, in addition to native soils, sand or gravel, compost or nutrient addition, its byproducts, storage and staging areas, active mixing areas, and finished product storage areas.

Since soil blending operations have the potential to create hotspots of sediment, nutrients or other pollutants in stormwater, they are subject to State and federal water pollution control laws. OSHA has no clear SIC Code for soil blending; however, the code most frequently used is 2875, which includes the mixing of potting soil. The specific trigger is that facilities that primarily blend soils are considered to be engaged in industrial activity and must have a National Pollutant Discharge Elimination System ("NPDES") permit for industrial stormwater. In other cases, where other operations on-site necessitate an NPDES permit for stormwater discharges, such as composting or mulching, the blending operations must be considered as a secondary operation and also considered for permit coverage.

Industrial Stormwater discharges may be permitted under the General Permit for Stormwater Discharges Associated with Industrial Activity, or the Department may, at its discretion, require an individual discharge permit for the facility. A facility that has no exposure of potential pollutants to stormwater (for example, all blending operations are conducted in a building) may file a No Exposure Certification with the Department.

The industrial stormwater permit requires operators to identify and then select appropriate controls for pollutants and to minimize or prevent exposure of specific categories of materials associated with soil blending to stormwater. This will typically be accomplished via segregating stockpiles, the development of a site specific storm water pollution prevention plan, and applying sediment and erosion controls. The permit also has benchmark requirements identified for specific pollutants, as listed in Table 1. These are appropriate for blending Category 1 or Category 2 dredged materials.

Table 1. Metals Benchmark Values for Stormwater Runoff at Dredged Material Blending or Processing Facilities.

Table - Subsector C1 Benchmarks

PARAMETER	Benchmark	Units	Frequency	Sample Type
Nitrate plus Nitrite Nitrogen	0.68	mg/L	1/quarter	Grab
Total Lead[1]	0.082	mg/L	1/quarter	Grab
Total Iron	1.0	mg/L	1/quarter	Grab
Total Zinc[1]	0.12	mg/L	1/quarter	Grab
Phosphorus	2.0	mg/L	1/quarter	Grab

[1] The benchmark values of some metals are dependent on water hardness. For these parameters, you must determine the hardness of the receiving water per Appendix C.

If the facility chooses to process Category 3 or Category 4 materials, a site specific discharge permit is required, with limits protective of the specific receiving stream, unless those materials can be segregated with no potential to be exposed to stormwater or all contact water is collected and hauled to a WWTP. Land application of those treated leachate and discharge via an on-site disposal system are other alternatives that may be authorized under a site specific State groundwater discharge permit.

(1) Other Permits:

In addition, a state discharge permit is required for discharges of pollutants or wastewater from the operations to surface or groundwater, such as vehicle wash water. If the dredge material is being mixed with materials that are or would otherwise be considered to be a waste, such as treated sewage sludge or an industrial waste, MDE may require other permits that the Department considers to be applicable.

(2) Contacts:

For stormwater and other discharges to surface waters, contact Paul Hlavinka of the Industrial and General Permits Division at 410-537-3323. For discharges to ground waters, contact Mike Eisner of the Groundwater Permits Division at 410-537-3778. Also, see MDE's website for more information concerning discharge permits: http://www.mde.state.md.us/PROGRAMS/PERMITS/WATERMANAGEMENTPERMITS/Pages/Permits/WaterManagementPermits/index.aspx

IV. Beneficial Use and Innovative Reuse of Dredged Material

The State's DMMP is managed by committees that oversee, advise, and guide the Port's strategic, long-term 20-year management plan. The program benefits from the broad participation of citizens, scientific experts, regulatory agencies, and business partners. An extensive advisory committee structure (Appendix A4) helps ensure the success of this complex and multi-faceted planning and operations process.

The DMMP uses a mix of strategies for guiding sufficient placement capacity for the Port's dredging needs and ensuring that the federal navigation channels remain safe and efficient for maritime commerce. To date the DMMP has included such methods as upland placement, construction of carefully engineered containment facilities, aquatic beneficial uses, and pilot-scale demonstration innovative reuse projects. As required under the DMMA, the DMMP Executive Committee annually reports to the General Assembly on the strategic long-term management plans for dredged materials.

This section describes the current processes and associated requirements for MDE to determine whether a specific beneficial use or innovative reuse of dredged material is acceptable.MDE provides approvals or permits to dredge and place or use dredged material based on various considerations, including the proposed use of the dredged material, exposure pathways, and associated human health or environmental risks. There are a range of innovative reuses and beneficial uses of dredged material depending on physical and chemical characteristics, the grain size and level of chemical concentrations, and end use location.

Acceptable end uses that have an existing approval process in place include aquatic habitat creation or restoration, landfill cover, and structural and non-structural fill or soil (brownfield reclamation, use as a soil amendment, manufactured topsoil). Other acceptable end uses may include building materials/aggregate, mine and quarry reclamation, or other upland uses[23].

The planned innovative reuse or beneficial use location is an important factor in determining acceptability/approval of an end use. A planned end use location could be in a residential, commercial, or industrial location as defined in MDE's Cleanup Standards for Soil and Groundwater, June 2008: Interim Final Guidance (Update No. 2.1). Additionally, there may be existing engineered or institutional LUCs (such as groundwater use restrictions, cap maintenance, etc.) in place at the receiving site location to protect human health and the environment, which may assist in MDE granting approval for a particular innovative reuse or beneficial use of dredged material. These LUCs are typically required to be included on property deeds, and the environmental covenants created under UECA are recorded in local land records to help ensure that

[23] Guidance regarding innovative reuse and beneficial uses is currently in the formulation stages of development for these listed ends uses and will be based upon the specific use. Upon assessment and monitoring, approval will be on a case-by-case basis.

these LUCs are enforced over time. If needed, MDE may determine there are further requirements than those listed in this Document for each innovative reuse or beneficial end use based on the site specific factors.

A. Beneficial Uses

1. Background

"Beneficial use of dredged material" is defined in §5-1101(a)(3) of the Environment Article as a range of any of the following uses of dredged material from the Chesapeake Bay and its tributary waters placed into waters or onto bottomland of the Chesapeake Bay or its tidal tributaries, including Baltimore Harbor: (1) the restoration of underwater grasses; (2) the restoration of islands; (3) the stabilization of eroding shorelines; (4) the creation or restoration of wetlands; and (5) the creation, restoration, or enhancement of fish or shellfish habitats. Although this statutory language specifically calls out material from the Chesapeake Bay and its tidal tributaries, the beneficial use definition in regards to aquatic habitat terms could be used as a guide for dredging projects throughout Maryland.

Beneficial uses of dredged material are considered in consultation with MDE on a case-by-case basis, and may require detailed project investigation, planning, and study. Design guideline requirements for certain beneficial uses of dredged material are listed in COMAR 26.24.03.05.

Case Studies: Poplar Island and Hart-Miller Island are case studies for beneficial use of dredged material for aquatic habitat creation and island habitat restoration. Pleasure Island in Baltimore County is a case study for beneficial use of dredged material for shoreline stabilization, and use of sandy dredged material is a common practice for repairing or replacing beach material along Maryland's coastal bays.

2. Authorized uses

Authorized beneficial uses of dredged material include: restoration of underwater grasses; restoration of islands; stabilization of eroding shorelines; replenishment of beach areas; creation or restoration of wetlands; and creation, restoration, or enhancement of fish or shellfish habitats. Environment Article, § 5-1101(a) (3).

Baltimore Harbor Channel Dredged Material

As stated previously in this Document, dredging and dredged material from Baltimore Harbor is governed by Title 5, Subtitle 11, of the Environmental Article. Section 5-1101(2) defines Baltimore Harbor as the tidal portions of the Patapsco River lying west of a line extending from Rock Point in Anne Arundel County to North Point in Baltimore County. Section 5-1102(a) and (c) require that dredged material from Baltimore Harbor either be placed in contained areas, inside or outside of the Harbor only, or for beneficial use projects as defined in 5-1101(a)(3). At present, there are two active dredged material containment facilities (DMCF) approved for this purpose: Cox Creek DMCF and Masonville DMCF. Currently there are no beneficial use projects in the Harbor utilizing Baltimore Harbor dredged material. The DMMA contemplates that dredged material

from the Baltimore Harbor may be innovatively reused in accordance with the DMMP's recommendations to the Governor, as set forth in this Document. Environment Article, § 5-1105(d)(3).

3. Regulating Authorization

a) *Regulating Agency and Authorization*

The MDE Wetlands & Waterways Program under the Water and Science Administration regulates the in-water beneficial use of dredged material with authority from WQC provisions of the Clean Water Act, Section 401, if dredged material comes from waters of the United States. Depending on project location, authority may also be pursuant to Section 404 of the Clean Water Act and the Coastal Zone Management Act.

- Program Contact Information: MDE, Wetlands & Waterways Program, Water and Science Administration, Phone: 410-537-3745

b) *Permit/Approval Requirements*

To utilize dredged material in beneficial use projects the following permits/approvals may be required:

- State Tidal Wetlands License
- Non-tidal Wetlands Permit
- Waterway Construction Permit
- Section 401 Water Quality Certification
- State Discharge permit to authorize point source discharge, if applicable

c) *Application Process*

The *Joint Federal/State Application for the Alteration of Any Floodplain, Waterway, Tidal or Nontidal Wetland in Maryland* application must be submitted to MDE to utilize dredged material in an aquatic habitat creation, restoration or enhancement project. Refer to the following MDE Permit Guides located on the MDE website (http://www.mde.maryland.gov) for full application process and fees:
3.18 Tidal Wetland Licenses and Permits
3.19 Non-tidal Wetlands
3.20 Waterway and 100-year Floodplain

4. Sampling and Analysis Considerations

In addition to project plans and specifications required as part of the permit application process, the Department generally requires monitoring and maintenance plans for beneficial use projects to ensure there are no adverse impacts to aquatic resources and that the project continues to function as designed. This section outlines some testing considerations when using dredged material for beneficial uses. Depending on the project details, other sampling, analysis and reporting may be required as a special permit condition for the project.

d) *Number and Location of Samples*

MDE recommends that analysis be conducted on representative samples of the dredged material, activities at the project site, and in consideration of past testing results, where

available. The number of samples collected at a proposed dredge site shall follow the MDE guidance based on project size (cubic yards of material or acres covered) and characteristics, as well as aquatic receptors. Sampling should include appropriate quality assurance and quality control measures, including collection of blind duplicate samples, matrix spikes, field blanks, rinsate/equipment blanks, and trip blanks. Upon review of the data submitted, MDE may require additional sampling prior to permit issuance or general permit coverage.

Table 2 provides general recommendations for the number of initial samples, based on the volume of proposed dredging for beneficial use. Sampling frequency may differ on a site-specific basis. MDE recommends that the locations and depth of the samples be designed to properly characterize the dredged sediment. Refer to guidance from the EPA/USACE Inland Testing Manual[24] when developing a detailed sampling plan. In the case of routine maintenance work, data from prior samplings may be available and the field samples may be reduced.

Table 2. Guidance for Number of Samples - Aquatic habitat restoration, creation, or enhancement. Sample numbers for projects less than 5,000 cy and greater than 500,000 cy determined on a case-by-case basis by MDE.

Volume of Dredged Material (CY)	Number of Sample Stations	Number of Composites Analyzed
< 5,000	Determined on a case-by-case basis by MDE.	
5,000 – 20,000	4	1
20,000 – 100,000	8	2
100,000 – 200,000	12	3
200,000 – 300,000	16	4
300,000 – 400,000	20	5
400,000 – 500,000	24	6
> 500,000	Determined on a case-by-case basis by MDE.	

e) *Screening Criteria*

Chemical and physical characteristics of dredged material are important when determining material suitability for beneficial use. A key Departmental consideration in determining sediment characterization requirements for beneficial uses is the source of the dredged material. Dredged material from inside the legally defined Baltimore Harbor will generally require more rigorous sediment characterization, both physical and chemical, and associated monitoring in order to approve beneficial use. Furthermore, Baltimore Harbor dredged material from outside of the regularly maintained navigation channels may require other special characterization and monitoring requirements as a result of proximity to legacy industrial activities. The Department will also consider whether estuarine dredged material will be beneficially used in an environment where it is likely to acidify and produce leachate.

[24] https://www.epa.gov/cwa-404/inland-testing-manual

Table 3 includes a broad suite of parameters that are typically tested to identify suitable sources of dredged material for beneficial use (*See also* Appendix A2). Testing should be performed based on the specific beneficial use below, but not all analyses may be applicable in all cases.

For Beach Nourishment and Marsh Creation Projects – Current regulations (COMAR 26.24.03.05 and 26.24.03.06D) require grain size analyses for both the dredged material and placement site. The dredged material must be equal to or larger in grain size and character than the existing beach material, or determined otherwise to be compatible with existing site conditions acceptable to MDE. The dredged material may not contain more than 10 percent silts and clays, or control measures such as breakwaters, groins or similar structures should be used to control movement.

These regulations also require that the dredged material must be relatively free of organic material, floating debris, or other objects and not cause adverse impacts to existing navigation channels, longshore currents, adjacent properties, and fish spawning, nursery or migration patterns. Any adverse impacts to commercial and sport fishing shall also be minimized.

Table 3. Beneficial Use - Aquatic habitat restoration, creation, or enhancement, typical dredged material sampling

Typical Sampling Analyses	**Suggested Analytical Method***
Physical Analyses	
Grain Size	ASTM D-422
Chemical & Nutrient Analyses	
Metals and Inorganic Analytes	
Priority Pollutant Metals	SW-846 EPA Method 6020
Mercury	SW-846 EPA Method 7471
Acid Volatile Sulfides/Simultaneously Extracted Metals (AVS/SEM)	EPA Method 821-R-100
Total Cyanide	SW-846 EPA Method 9014
Total Sulfides	SW-846 EPA Method 9030
Total Phosphorus	EPA Method 365.3/365.4
Ammonia-Nitrogen	EPA Method 350
Total Kjeldahl Nitrogen	EPA Method 351
Organic Analytes	
Total Organic Carbon	SW-846 EPA Method 5310B modified (Lloyd Khan)
Volatile Organic Compounds (VOCs) – TCL	SW-846 EPA Method 8260
Semivolatile Organic Compounds (SVOCs) - TCL, including Polycyclic Aromatic Hydrocarbons (PAHs)	SW-846 EPA Method 8270
Pesticides	SW-846 EPA Method 8081
Polychlorinated Biphenyls (PCBs) (Aroclors)	SW-846 EPA Method 8082
Dioxins/Furans	SW-846 EPA Methods 8280 & 8290
pH	EPA 9040
Total Sulfates	SW-846 EPA Method 9035 or other as is appropriate

*Use the most current version available for all analytical methods.

For Island Habitat Restoration Projects – Restoration of island habitats in the Chesapeake Bay and outside of Baltimore Harbor are regulated through the State's Tidal Wetlands License and WQC. Island restoration projects are designed to keep dredged material in place using containment dikes or similar controls to prevent movement of placed dredged materials. Accordingly, MDE focuses on regulating discharges from the island habitat restoration sites through special conditions in the Tidal Wetlands License or WQC to minimize turbidity, pH, and associated metals excursions. Current island habitat restoration projects are managed in real-time and cease discharging when water quality deviates outside of acceptable ranges established in the permit. Additionally, exterior community monitoring may be required to ensure that there are no adverse impacts to the exterior aquatic environment from these regulated discharges.

For Other Beneficial Use Projects - Based on project size and scope, environmental sensitivity of the beneficial use site, whether there are discharges back to waters of the State, the source of the dredged material or results of previous sediment data for the area, and potential adverse impacts to tidal wetlands, MDE may require chemical and physical analyses, elutriate testing, site-specific ecological risk assessments, discharge limits/monitoring, and/or bioassays. When rigorous sediment characterization is necessary, MDE may screen the sediment chemistry results using the Threshold Effects Level (TEL) and the Probable Effects Level (PEL) Sediment Quality Guidelines (SQGs), as published in the NOAA Screening Quick Reference Tables[25] (*See* Appendix A2).

SQGs provide scientifically-based screening concentrations to help meet regulatory requirements for protecting biological resources by predicting when adverse effects may occur. If the initial screening using established SQGs indicates there are no TEL exceedances, further chemical testing will not be necessary. When parameters exceed TELs and/or PELs, analysis may be conducted to determine the magnitude and number of exceedances, whether additional risk analysis, bio-availability assessment or site-specific controls, sediment encapsulation/fixing, or project redesign are necessary to ensure no adverse impacts to aquatic life. Because of factors including, but not limited to, natural or regionally high background levels of chemicals, the fact that SQGs were developed using data from west coast estuaries and in-situ sediment characteristics may render chemicals biologically inert, PELs and TELs are considered a guide used for reference purposes only. Accordingly, any final decisions regarding project plans, permits and approvals will often be made on a case-by-case basis.

f) *Maintenance Planning*

MDE typically requires pre-project baseline and post-project monitoring per an approved maintenance and monitoring plan, to ensure any beneficial use project continues to function as designed. For example, wetland restoration projects are typically monitored for 5-years post construction to ensure that areal wetland plant coverage in the restored area is 80% or greater and represents a stable wetland community. Similarly, other

[25] http://response.restoration.noaa.gov/sites/default/files/SQuiRTs.pdf

beneficial use projects may require follow-up monitoring to ensure project goals are achieved. MDE may support pooled monitoring approaches where rigorous monitoring is focused on a limited number of restoration sites or types throughout the State to minimize overall monitoring locations and costs while providing more robust information to evaluate project effectiveness. Therefore, any monitoring requirements and/or waivers thereto will be considered in the context of other similar completed or ongoing monitoring programs.

B. Innovative Reuses

1. Background

"Innovative reuse" is defined in §5-1101(a)(6) of the Environment Article as "the use of dredged material in the development or manufacturing of commercial, industrial, horticultural, agricultural, or other products." Innovative reuse includes use for daily, intermediate, or final cover as an alternative to traditional earthen material currently used at active landfills, as well as soil and fill materials in the reclamation of brownfields, engineered fill for roadway bed material, parking lot foundations, or embankments and manufactured soil or soil amendments that are discussed in the following sections. Other innovative reuse opportunities for soil and fill will be added to this Document as they are approved.

The MDOT/MPA continues to explore various methods for innovatively reusing dredged material removed from the Baltimore Harbor channels with extensive input and feedback from key stakeholders, including the State's DMMP advisory committees, such as the Innovative Reuse Committee and Innovative Reuse Technical Team.

a) *Authorized Uses*

Authorized innovative reuses of dredged material may include: landfill daily, intermediate, and final cover; landfill closure caps; or soil and fill material, including soil amendments. Dredged material could be innovatively reused on its own in place of a usable commercial product or blended, amended or incorporated into a manufactured product. Through its existing authorities under the Tidal Wetlands Act, the U.S. Clean Water Act Section 401 WQC and/or the Waterway Construction statute (non-tidal waterbodies), MDE can authorize the innovative reuse of dredged material removed from the Baltimore Harbor federally maintained channels, the federally-maintained channels outside of the Baltimore Harbor in the tidal areas of the Chesapeake and Atlantic Coastal bays, and all other proposed dredging projects (State, local, private)[26]. In addition,

[26] For the dredging and dredged material placement of federally-maintained channels within Baltimore Harbor by USACE, MDE regulates these activities through a Clean Water Act, Section 401 WQC and a State Discharge Permit for discharges from the Cox Creek DMCF and Masonville DMCF. The WQC, required by the Corps in accordance the CWA, defers to the State Discharge Permit for compliance with the State's water quality standards. The dredging of federally-maintained channels outside of Baltimore Harbor in the tidal areas of the Chesapeake and Atlantic coastal bays is regulated through the Section 401 WQC. All other proposed dredging projects, e.g. State, local,

depending on the proposed innovative reuse and in conjunction with a sediment characterization analysis compared to the Technical Screening Criteria (Appendix A3) and testing requirements (Appendix A2) issued through this Document, MDE could review and approve the innovative reuse at the time of initial dredging permit/approval request.

Note: *The sampling and characterization of the material that is being considered for innovative reuse projects may be done by the generator, processor, materials broker, user, or any other party, as long as the sampling protocol, selected analytes, and analytical methods are appropriate and adequate for the intended end use as listed in the following sections. Sampling of in-situ sediments may be performed by the agency conducting the dredging in order to plan efficient use of the material to be generated, but prior to implementing an end use the actual material proposed for use should be characterized from material stockpiles at the dredged material containment, processing, or brokerage facility.*

2. Landfill – Daily, Intermediate, and Final Cover, Closure Cap

a) *Background*

Suitable dredged material can be used as daily, intermediate, or final cover as an alternative to traditional earthen material that is currently used at active landfills. The purpose of landfill cover is to control vectors (i.e., rodents, flies, birds), odors, fires, and windblown litter. Additionally, dredged material may be used as part of the final closure cap if it meets applicable geotechnical criteria.

b) *Authorized uses*

Landfill cover requirements for sanitary landfills are addressed in COMAR 26.04.07, as well as in specific refuse disposal (landfill) permit requirements. The landfill cover requirements for an active landfill include daily, intermediate, and final cover, as listed in the minimum operating procedures for each sanitary landfill category, as well as the closure cap for a completed landfill as described in COMAR 26.04.07.21. Daily cover material is considered a uniform compacted layer of clean earth at least 6 inches in depth, or an approved cover material of a thickness specified by MDE, which shall be placed over exposed solid waste by the end of each day's operation, or more frequently as determined by MDE. Intermediate cover material is considered a uniform compacted layer of clean earth not less than 1 foot in depth, that is required to be placed over each portion of a lift (a layer of waste usually 8 feet thick filled sequentially across the top of the landfill) not later than 1 month following completion of that lift. Final cover material is considered a uniform compacted layer of earthen material not less than 2 feet in depth, that is required to be placed over the final lift of the landfill not later than 90 days following completion of that final lift. As part of the closure cap for a landfill, a minimum thickness of 2 feet of earthen material is required to be placed over the low

private, are regulated through a State Tidal Wetlands License and the associated WQC. Dredging activities in non-tidal waterways and water bodies are regulated under the State's Waterway Construction Statute.

permeability cap and the drainage layer no later than 36 months following completion of the final lift of the landfill.

For use as intermediate or final cover where interim or permanent vegetative stabilization is required, the material should be evaluated to ensure that oxidation of sulfide minerals will not produce long-term acidification that may interfere with plant growth, and monitored during use to determine if liming or other treatment becomes necessary.

c) *Regulating Authorization*

(1) Regulating Agency and Authorization

The MDE's Solid Waste Program under the Land and Materials Administration (LMA) regulates and permits landfill cover and cap material under Environment Article, §§9-204, 9-252, and 9-314, Annotated Code of Maryland, and COMAR 26.04.07 Solid Waste Management.

- Program Contact Information: MDE, Solid Waste Program, LMA, Phone: 410-537-3315

(2) Permit/Approval Requirements

MDE will evaluate the suitability of dredged material proposed for use as landfill cover material or a closure cap on a case-by-case basis. For a landfill to gain approval to utilize dredged material as daily cover, the landfill would be required to submit to MDE a request for use as an alternative daily cover, revised landfill operations manual, and the results of the physical and chemical characterization of the dredged material. In addition, for intermediate and final cover and closure cap approval, the request must demonstrate that the material can satisfactorily support vegetation for final stabilization, or include procedures to render the material capable of supporting vegetative stabilization. If accepted, the request would result in a minor permit modification to the landfill's existing refuse disposal permit. The final approval for uses at a landfill will be dependent upon the characterization of the material, and MDE may impose limitations on placement or stockpile areas of the material.

Dredged material will likely need to be dewatered prior to transportation to the landfill for daily, intermediate, or final cover and closure cap use, which may require applicable stormwater or surface water discharge permits to ensure any discharge meets water quality standards. Please contact MDE's Water and Science Administration for additional information.

(3) Application Process

A minor permit modification to the landfill's existing refuse disposal permit would be required. The generator of the dredged material would work with the operator of the proposed receiving landfill to make the request to MDE. In most instances involving the use of dredged materials as soil cover, the landfill permittee would submit a letter requesting the change, analytical data demonstrating the chemical constituency and leachability of the material (which may be supplied to the landfill operator by the generator or user of the dredged materials), drawings showing where the activity would

take place, and revised pages to the operations manual that relate to the storage and use of the material. MDE would review the supporting information requesting permit modifications prior to issuing a written determination. Other uses may require additional information. Refer to the following MDE Permit Guide on the MDE website (http://www.mde.maryland.gov) for additional information and contact information: 2.01 Refuse Disposal Permit.

d) *Sampling and Analysis Considerations*

This section outlines and provides guidance for the sampling and analysis for evaluating the use of dredged material for landfill cover and cap; additional sampling and analysis may be required under the site-specific refuse disposal permit, along with additional special permit conditions. If the dredged material is amended, blended, or otherwise processed prior to final end use and placement, the required bulk, leaching, and agronomic testing listed in Table 3 should be conducted on the final processed dredged material. The chemical and physical characteristics of dredged material are important when determining the suitability for landfill cover. Under COMAR 26.04.07.10D, daily cover material may not:

(1) Contain free liquids, putrescible, or toxic materials. Moisture which is present in the cover material solely as a result of precipitation is not free liquid.
(2) Create a dust or odor problem.
(3) Attract or harbor vectors.
(4) Impede compaction with standard landfill equipment.

Table 4 lists a broad suite of parameters that are typically sampled and analyzed to identify suitability of a source of dredged material or dredged material blend for landfill cover or closure cap (also provided as Table A2-2 in Appendix A2). Some of the analytes may not be applicable, and those necessary should be performed based on consultation with MDE.

Table 4. Innovative Reuse - Landfill cover and closure cap, typical dredged material sampling

Typical Sampling Analyses	Analytical Method*
Physical Analyses	
Grain Size	ASTM D-422
Specific gravity	ASTM D-854
Percent moisture	ASTM D-2216
Atterberg limits	ASTM D-4318
Unified Soil Classification System (USCS)	ASTM D-2487
Chemical & Nutrient Analyses	
Metals and Inorganic Analytes	
Toxicity Characteristic Leaching Procedure (TCLP) – Full Analysis	SW-846 EPA Method 1311
Priority Pollutant Metals	SW-846 EPA Method 6020
Mercury	SW-846 EPA Method 7471
Organic Analytes	
Total Organic Carbon	SW-846 EPA Method 5310B modified (Lloyd Khan)
Volatile Organics (VOCs) – TCL	SW-846 EPA Method 8260

Semivolatile Organic Compounds (SVOCs) - TCL, including Polycyclic Aromatic Hydrocarbons (PAHs)	SW-846 EPA Method 8270
Organochlorine Pesticides	SW-846 EPA Method 8081
Polychlorinated Biphenyls (PCBs) Aroclors	SW-846 EPA Method 8082
pH	EPA 9040
Total Sulfates, Sulfides	SW-846 EPA Method 9035 or other as is appropriate
For Final Cap Include:	
Soil Testing for Vegetation Growth - Phosphorus, Potassium, Magnesium, Calcium - Cation Exchange Capacity - Organic Matter - Soluble Salts	

*Use the most current version available for all analytical methods.

(1) Number and Location of Samples

MDE recommends that analysis be conducted on samples that are representative of the dredged material, historical activities proximal to the area being dredged, and results of past testing, if available. Sampling guidance is based on the typical volume that could be placed for landfill cover at an active landfill. If the dredged material is coming from an area with known past industrial use, MDE may recommend a multi-increment sampling approach to collect representative samples. Multi-increment samples are prepared by the collection and combination of a large number of small samples of soil from multiple locations within the area of concern, and reduce the variability of the data compared to past discrete sampling strategies.

Sampling should include appropriate quality assurance and quality control measures during the sampling program, including collection of blind duplicate samples, matrix spikes, field blanks, rinsate/equipment blanks, and trip blanks. Upon review of the data submitted, MDE may require additional sampling. MDE recommends that the locations and depth of the samples be designed to properly characterize the dredged sediment or the final processed dredged material.

Table 5. Suggested guidance for Number of Samples – Landfill Cover or Closure Cap.

Volume of Dredged Material (CY)	**Number of Sample Stations**	**Number of Composites Analyzed**
Up to 20,000	1 sample per 5,000 CY	4
20,000 – 100,000	10	5
100,000 – 200,000	20	10
200,000 – 300,000	30	15

(2) Screening Levels

For alternative daily, intermediate, or final cover, or for use in a closure cap for landfills, MDE may use the screening criteria based on exposure risk assessment processes, established specifically for the end use and final placement of dredged material fill for a construction worker. Screening criteria are presented in Appendix A3 and were calculated using the EPA Regional Screening Level (RSL) tool. Additionally, the TCLP

results of the dredged material shall be compared with EPA regulatory maximum concentration values listed in Table A3-3 of Appendix A3.[27] If no parameters exceed these criteria, the material may be suitable for landfill cover and closure cap.

3. Soil and Fill Material, including Soil Amendments and Use on Agricultural Lands

a) *Background*

MDE has established four categories for the management of dredged material to be used as soil and fill, including as a soil amendment. The categories are determined based on results from a full physical and chemical sediment characterization. Following characterization, the dredged material is categorized into one or more of the categories based on the risk-based screening criteria provided in Appendix A3.

The current focus of this section is on dredged material or dredged material blends used as soil and fill materials in the reclamation of brownfields, engineered fill for roadway bed material, parking lot foundations, or embankments, and manufactured soil or amendments. Other innovative reuse opportunities for soil and fill will be added to this Document as they are investigated and a process is established that is determined to be safe for human health and the environment.

b) *Authorized uses*

Brownfields Site Reclamation **-** The Small Business Liability Relief and Brownfields Revitalization Act of 2002 amended the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or Superfund) to define a brownfield as "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant," with actual presence of contaminants on the property determined by an environmental site assessment. Redevelopment of brownfield sites in Maryland is subject to oversight under the authority of the Controlled Hazardous Substance (CHS) Act (§7-222 of the Environmental Article), the CHS Response Plan (COMAR 26.14.02), and the Voluntary Cleanup Program (VCP) (§7-501 *et seq.* of the Environmental Article). The purpose of Maryland's brownfield program is to encourage the cleanup and redevelopment of former industrial or commercial sites throughout Maryland that pose or may pose a threat to public health or the environment. Generally, cleanup and redevelopment activities are conducted in tandem. In many cases, fill materials are imported onto a property or removed from a property as part of the redevelopment process. Processed dredged material may provide suitable imported fill material for these sites, with specific limitations and land use controls in place.

Engineered Fill **-** Engineered fill is placed to meet engineered project requirements or specifications for a specific use, such as roadway bed material, parking lot foundation, or embankment fill. Depending on the use, engineered fill requirements may include the type of material and gradation, plasticity, permeability, compaction, moisture content,

[27] 40 CFR §261.24(b), Table 1

and placement methods, which are often published on the engineering plans or in the specifications and are subject to third party testing and inspection. To meet the physical and geotechnical requirements for engineered fill, dredged material may need to be processed before use through dewatering, blending, or amending.

Manufactured Soil, Soil Amendment/Conditioner and Use on Agricultural Lands - Dredged material that meets appropriate screening criteria may be used as a manufactured soil directly after dewatering, or may require blending or amending with other media, such as wood chips, lime, gypsum, compost, or biosolids. The end product can then be used as topsoil, a soil conditioner for landscaping in public areas or on agricultural lands. Dredged material that is from the estuarine waters of the Bay will need to address salinity issues for vegetative growth in topsoil. Blending the dredged material with other media could address salinity and improve the quality of the product by minimizing its runoff and leaching potential. A manufactured soil or soil conditioner testing screen can be performed on the dredged material to determine which blends will produce the best soil.

The Maryland Departments of Agriculture (MDA) and Environment (MDE) agree that dredged material can be used on agricultural lands as long as it conforms to certain criteria listed below. Specifically, the dredged material:

- Does not exceed the Category 1 screening levels in MDE's Innovative Reuse and Beneficial Use guidance (IRBU, see http://mde.maryland.gov/programs/Marylander/Documents/Dredging/FINAL_IBR_GUIDANCE_8.30.2017_MDE.pdf); and
- Is placed on agricultural lands that have a current nutrient management plan developed by a certified consultant and where the dredged material application rate/quantity does not exceed plan recommendations.

MDE, in coordination with MDA, will review and assess the dredged material's chemistry to determine into which land use category the dredged material falls. If initial data review indicates the material does not meet category 1, further detailed risk assessment may be appropriate to qualify the material as category 1 material.

The Departments also recommend that when the dredged material is reused on agricultural lands it is necessary to monitor the chemical parameters detailed in the IRBU guidance, including analyzing for nitrogen, phosphorus and potassium concentrations in dredged sediments to determine whether nutrient management plan requirements for a particular farm will continue to be met with any dredged material application. Equally important is to conduct sediment grain size analysis to determine if dredged material application improves the agricultural soil's physical characteristics. Dredged material placed on agricultural lands in groundwater use areas will be evaluated on a case-by-case

basis and may be subject to additional evaluations and environmental measures to ensure placement does not adversely impact groundwater or surface water resources.

MDA and MDE also encourage entities using dredged material on farm lands to determine if any local ordinances or agricultural preservation/easement requirements apply that may restrict this use. MDE can assist with any permitting requirements and help develop a sediment sampling and analysis program to properly characterize dredged sediments. Local soil conservation districts can also often help with sediment and erosion control requirements. Once applicant's develop a detailed project scope/plan and have dredged material analytical results, a pre-application meeting should also be scheduled with MDE and the Corps to receive further regulatory guidance on the specific project.

In projects that use dredged material as a commercial fertilizer or soil conditioner, each brand and grade of commercial fertilizer or soil conditioner is required to be registered with MDA under COMAR 15.18.03.02 before it is distributed for sale.

c) *Regulating Authorization*

(3) Regulating Agency and Authorization

The innovative reuse of dredged material as fill material, including as a manufactured soil or amendment is subject to Environment Article, §7-222 and §7-503, Annotated Code of Maryland and COMAR 26.14.02.06. The Land Restoration Program (LRP) is located within MDE's LMA and is responsible for overseeing the assessment and cleanup of hazardous substances in Maryland. This applies to soil and fill material that is impacted or potentially impacted by substances such as petroleum or metals, which may apply to dredged material depending on the source.

- Program Contact Information: Land Restoration Program, LMA, Phone: 410-537-3493

Dredged material may be categorized into one or more of four categories based on results of a full sediment characterization and comparison to screening criteria listed in Appendix A3 and detailed in the *Fill Material and Soil Management Fact Sheet*:

- Category 1 – Residential Unrestricted Use Soil and Fill Material
- Category 2 – Non-Residential Restricted Use Soil and Fill Material
- Category 3 – Restricted Use Soil and Fill Material, Cap Required
- Category 4 – Ineligible for Soil and Fill Material

These categories and the screening criteria applicable to each are discussed further in Section IV.B.3.d(2) below. Multiple management categories may be applied to a receiving site depending on the project needs and the material characterization results. Dredged material can be separated into subsets that could be managed at the applicable

category level or managed at the most restrictive category if material separation is not feasible. Category screening and category determination shall be made on the final dredged material product being used, after any processing, amending, or blending.

(4) Permit/Registration/Approval Requirements

Approval of the use of dredged material as a soil or fill material is based on two factors: (1) the characterization of the dredged material and comparison to screening levels; and (2) the nature of the site on which it is proposed to be used. A person using the dredged material as fill material may be required to fully characterize the dredged material fill or provide a certification stating that the imported dredged material fill is not contaminated per the guidelines in the *VCP Clean Imported Fill* fact sheet available on the MDE website (http://www.mde.maryland.gov).

The use of dredged material on brownfield sites may be subject to LRP approval; in these cases, the CHS Enforcement Program or the VCP evaluate the suitability of dredged material proposed for use as imported fill material at a brownfield site. In addition to the sampling and screening criteria described in this Document for Categories 1 through 4, use of dredged material in construction or landscape applications, may be subject to additional specifications, such as the American Society for Testing and Materials Specification for Topsoil used for Landscaping Purposes, the MDE Construction Specifications for Environmental Site Design Practices, and the SHA Standard Specifications for Furnished Topsoil. LRP maintains enforcement authority over dredged material when it is used in a manner that creates a threat to human health or the environment, in accordance with Environment Article, §§ 7-201 *et seq*.

Dredged material use as soil or fill must comply with all applicable requirements governing the placement or use of material as fill, such as erosion and sediment control and stormwater management. Dredged material use consistent with the specifications and requirements referenced in this document is also intended to protect groundwater quality standards. However, in projects that use dredged material as soil or fill, this Document does not obviate requirements under COMAR 26.08.02.09 for a groundwater discharge permit if groundwater quality standards will be adversely impacted. Dredged material use as soil or fill must comply with all applicable requirements governing the placement or use of material as fill, such as erosion and sediment control and stormwater management.

(5) Application Process

Brownfields Sites **-** MDE provides two options for obtaining regulatory oversight when redeveloping brownfield sites.

> ***CHS Enforcement Program*** **-** The first option is to request that the CHS Enforcement Program oversee the assessment and cleanup of a brownfield property. To obtain oversight, the person submits a written request to the LRP. A CHS Enforcement Program project manager is assigned and provides technical review services for all environmental assessment and cleanup activities for the project.

This includes reviewing and approving the use of dredged material as fill material for the site.

Obtaining regulatory oversight for assessing and cleaning up properties under the CHS Response Plan is more streamlined than the VCP process described below. Once a person has requested CHS oversight and received confirmation that LRP will provide oversight for assessing and cleaning up a property under the authority of the CHS Response Plan, the person would develop an environmental management plan that details the steps to clean up the property. This plan would also include details regarding the use of dredged material as imported fill at the property.

VCP **-** The second option is to enroll the property in the VCP. An application package must be submitted to MDE for a site to be accepted for participation into the VCP. Refer to the VCP MDE Permit Guide on the MDE website (http://www.mde.maryland.gov) for full eligibility and application process and fees. If the property is eligible and accepted into the VCP, the participant may be required to submit a response action plan to MDE for approval. The response action plan must include detailed steps to clean up the property, and would include language for the use of dredged material as imported fill at the site.

Blending of Sewage Sludge and Dredged Material for Use as a Soil Conditioner **–** If dredged material is mixed with a Class A sewage sludge and applicable testing shows it does not cause undue harm to the environment or public health, safety, or welfare as determined by MDE, then MDE's Resources Management Program may provide written authorization for the use of the blend under COMAR 26.04.06.09C(8). If dredged material is mixed with a Class B sewage sludge, a person must apply for a sewage sludge utilization permit from MDE's Resource Management Program.

- Program Contact Information: MDE, Resource Management Program, LMA, Phone: 410-537-3314

Blending of Solid Waste and Dredged Material for Use as a Soil Conditioner **–** If dredged material is mixed or blended with a solid waste to improve sediment characterization, MDE's Solid Waste Program could approve the processed dredged material blend under COMAR 26.04.07.26 if the processed dredged material product is shown through testing to be protective of public health, natural resources, and the environment.

Sale or Distribution of a Soil Conditioner Containing Dredged Material **–** Each brand and grade of commercial fertilizer or soil conditioner is required to be registered under MDA before it is distributed for sale. MDA may require submission of sampling data prior to registering the product, and may consult with MDE. A registration application is available at MDA's State Chemist website: Registration of Soil Conditioner/Compost.

d) *Sampling and Analysis Considerations*

Table 6 and Appendix A2 include a broad suite of parameters that are typically sampled and analyzed to identify dredged material suitability for soil or fill material. The following sampling and analysis considerations for evaluating the use of dredged material as soil or fill material are provided as guidance only. Sampling and analysis plans will be approved by MDE depending on the intended land use of the property, existing LUCs already at the site, and the source of the dredged material.

Table 6. Innovative Reuse - Soil or Fill, including Soil Conditioner, typical dredged material sampling

Typical Sampling Analyses	Analytical Method*
Physical Analyses	
Grain Size	ASTM D-422
Specific gravity	ASTM D-854
Percent moisture	ASTM D-2216
Atterberg limits	ASTM D-4318
Chemical & Nutrient Analyses	
Priority Pollutant Metals	SW-846 EPA Method 6020
Mercury	SW-846 EPA Method 7471
Chromium, Hexavalent	SW-846 EPA Method 3060
Free and Total Cyanide	SW-846 EPA Method 9014
Volatiles (VOCs)	SW-846 EPA Method 8260
Semivolatile Organic Compounds (SVOCs), including Polycyclic Aromatic Hydrocarbons (PAHs)	SW-846 EPA Method 8270
Organochlorine Pesticides	SW-846 EPA Method 8081
Polychlorinated Biphenyls (PCBs) Total and Aroclors	SW-846 EPA Method 8082
Dioxins	SW-846 EPA Method 8280
Furans	SW-846 EPA Method 8090
TPH-DRO/GRO	SW-846 EPA Method 8015
Total Organic Carbon	SW-846 EPA Method 5310B modified (Lloyd Khan)
pH	EPA 9040
Lime Loading Rate	
Nutrient Content	Mehlich-3
Soluble Salts	EC1:2 (V:V)
Total Sulfates	SW-846 EPA Method 9035 or other as is appropriate

*Use the most current version available for all analytical methods.

(1) Number and Location of Samples

MDE recommends that analysis be conducted on samples that are representative of the dredged material volume used, as well as the exposure unit of the end use. Based on the *VCP Clean Imported Fill* fact sheet, Table 7 provides a guideline for the minimum samples for dredged material characterization based on volume of dredged material. If the dredged material source is an area with known past industrial use, MDE may recommend a multi-incremental sampling approach to collect representative samples.

MDE recommends that the locations and depth of the samples be designed to properly characterize the dredged sediment.

Table 7. Typical Guidance for Number of Samples – Soil and Fill Material

Volume of Borrow Area Stockpile	Samples per Volume
Up to 1,000 cubic yards	1 sample per 250 cubic yards
1,000 to 5,000 cubic yards	4 samples for first 1000 cubic yards +1 sample per each additional 500 cubic yards
Greater than 5,000 cubic yards	12 samples for first 5,000 cubic yards + 1 sample per each additional 1,000 cubic yards

Sampling should include appropriate quality assurance and quality control measures during the sampling program, including collection of blind duplicate samples, matrix spikes, field blanks, rinsate/equipment blanks, and trip blanks, if required. Upon review of the data submitted, MDE may require additional sampling prior to issuing approval.

(2) Screening Levels

The screening criteria for use of dredged material as soil and fill material were calculated using the EPA RSL tool based on specific exposure rates and assumptions detailed in the EPA RSL User's Guide (https://www.epa.gov/risk/regional-screening-levels-rsls). Additional details regarding use categories are available in the *Fill Material and Soil Management Fact Sheet*. Approval of the use of the dredged material is dependent upon the source of dredged material and the sediment characterization, the use category of the dredged material, existing or potential LUCs in place, and whether the receiving site is located in a non-groundwater use area. Dredged material considered for placement in groundwater use areas will be evaluated on a case-by-case basis and may be subject to additional evaluations and environmental measures to ensure placement does not adversely impact groundwater or surface water resources. Use category determinations shall be based on chemical concentrations of the end product to be used, after any blending of dredged materials with other amendments. Full screening criteria for innovative reuse and beneficial use of dredged material are included in Appendix A3. Each of the categories is discussed in more detail below.

Category 1 – Residential Unrestricted Use Soil and Fill Material

Category 1 – "Residential Unrestricted Use Soil and Fill Material" means a soil or fill material that is impacted by a hazardous substance or oil at concentrations less than or equal to the current residential EPA soil RSLs (residential soil, https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017) for non-carcinogens set at a hazard quotient (HQ) of 0.1 and carcinogens at a lifetime cancer risk of $1x10^{-6}$. If the soil or fill material background level contains naturally occurring substances at concentrations not exceeding the concentrations of such substances occurring naturally in the environment and in which all other substances are less than or equal to the residential standards, such soils and fill material are considered "Residential Unrestricted Use Soil and Fill Material." Category 1 – Residential Unrestricted Use Soil and Fill Material screening levels incorporate the most common human exposure pathways (ingestion, dermal contact, and inhalation of contaminants from soil in outdoor

air) using generic exposure assumptions and are protective of acute and chronic health effects for residential populations, including young children. For dredged materials used as soil and fill materials, the Category 1 screening limits are the most restrictive. A person may send soil or fill material that meets the Category 1 – Residential Unrestricted Use Soil and Fill Material definition to any offsite location for use as soil or fill material.

If potential contaminant concentrations in dredged material used for soil or fill material exceed Category 1 screening criteria, then a more detailed residential risk assessment may be performed that meets a HQ of 1 for non-carcinogens and a lifetime cancer risk of $1x10^{-5}$ for carcinogens. When a residential risk assessment on soil or fill material is performed and meets a HQ of 1 for non-carcinogens and a lifetime cancer risk of $1x10^{-5}$ for carcinogens, then the soil or fill material may be innovatively reused at all sites without soil exposure restrictions and will be considered a Category 1 soil and fill material.

The generator of the dredged material soil, fill or soil amendment should contact LMA staff for additional information on regulatory requirements for Category 1 material. The receiving site may be required to submit written acknowledgement regarding the volume and nature of such soil or fill material to the LMA prior to transporting the material to the receiving location. The LMA program regulating the receiving site may require additional documentation from a person who places or transports Category 1 – Residential Unrestricted Use Soil and Fill Material.

Category 2 – Non-Residential Restricted Use Soil and Fill Material

Category 2 – Non-Residential Restricted Use Soil and Fill Material means a soil or fill material that is impacted by a hazardous substance or oil at concentrations less than or equal to the current industrial EPA soil RSLs for non-carcinogens set at a HQ of 0.1 and carcinogens at a lifetime cancer risk of $1x10^{-6}$. If the soil or fill material background level contains naturally occurring substances at concentrations not exceeding the concentrations of such substances occurring naturally in the environment and in which all other substances are less than or equal to the non-residential standards (industrial soil, https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017), such soils and fill material are considered "Non-Residential Restricted Use Soil and Fill Material." Category 2 -- Non-Residential Restricted Use Soil and Fill Material screening levels incorporate the most common human exposure pathways (ingestion, dermal contact, and inhalation of contaminants from soil in outdoor air) using generic exposure assumptions and are protective of acute and chronic health effects for commercial and industrial populations. A person may send dredged material that meets the Category 2 – Non-Residential Restricted Use Soil and Fill Material definition to a non-residential and non-recreational offsite location for innovative reuse.

If potential contaminant concentrations in the soil or fill material exceed Category 2 screening criteria, then a more detailed non-residential risk assessment may be performed that meets a HQ of 1 for non-carcinogens and a lifetime cancer risk of $1x10^{-5}$ for carcinogens. When a non-residential risk assessment is performed that meets a HQ of 1 for non-carcinogens and a lifetime cancer risk of $1x10^{-5}$ for carcinogens, then the soil or

fill material is considered a Category 2 material and may be innovatively reused at non-residential and non-recreational sites.

A receiving site may be required to submit written acknowledgement regarding the volume and nature of such soil or fill material to the LMA prior to the transporting of the material to the receiving location. The LMA program regulating the receiving site may require additional documentation from a person who places or transports Category 2 – Non-Residential Restricted Use Soil and Fill Material.

The receiving site may also be required to encumber the property with LUCs to ensure that exposure to the soil or fill material meeting the Non-Residential Restricted Use Soil and Fill Material definition is appropriately managed. The LUCs shall include a recorded environmental covenant that complies with the Maryland UECA, Environment Article § 1-801 *et seq*. The environmental covenant shall include a map drawn to scale identifying where the soil or fill material has been placed and copies of the manifests, bill of lading, or other documentation demonstrating the transport and acceptance of soil or fill material at these offsite locations. The Department may sign on to the environmental covenant as agency and holder of the environmental covenant.

Category 3 – Restricted Use Soil and Fill Material, Cap Required

Category 3 – Restricted Use Soil and Fill Material, Cap Required screening levels for soil and fill material are based upon two receptors, a composite worker and a construction worker, with risks set at a HQ of 1 and cancer risks set at $1x10^{-5}$. Soil or fill material that meets the Restricted Use Soil and Fill Material, Cap Required definition may be transported for innovative reuse at a commercial or industrial property with existing soil and fill material containing hazardous substances or oil at concentrations within the same Category 3 parameters for placement beneath an engineered cap. The receiving site may be required to submit a written acknowledgement regarding the volume and nature of the soil or fill material to the LMA prior to transporting the material to the receiving location. The program regulating the receiving site may require additional documentation from a person who places or transports material in the Category 3 – Non-Residential Restricted Use Soil and Fill Material, Cap Required category. The receiving site may also be required to encumber the property with LUCs to assure that exposure to the soil or fill material meeting the Category 3 – Restricted Use Soil and Fill Material Cap Required definition is appropriately managed. The LUCs shall include a recorded environmental covenant that complies with Maryland's UECA. The environmental covenant shall include a map drawn to scale identifying where the soil or fill material has been placed and copies of the manifests, bill of lading, or other documentation demonstrating the transport and acceptance of soil or fill material at these offsite locations. The Department may sign on to the environmental covenant as agency and holder of the environmental covenant.

Category 4 – Ineligible Soil and Fill Material

For soil or fill material that exceeds the Restricted Use Soil and Fill Material, Cap Required (Category 3) screening levels, a person may not use the material for an innovative reuse. Any soil or fill material that exceeds the Category 3 screening levels

must be disposed of at either (1) an offsite disposal facility that is permitted by the State of Maryland or another State to accept solid wastes or fill material; or (2) for dredged material, to a dredge material containment facility. Category 4 material is considered to be significantly contaminated and must be managed specifically for the contaminants present. LMA may require persons to provide the Department with appropriate documentation, including but not limited to copies of the manifests, bill of lading, or other documentation demonstrating the transport and acceptance of soil or fill material to the offsite facility.

V. References

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U.S. EPA, 2017. Regional Screening Levels (RSLs) - Generic Tables (June 2017). Link: https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017.

Innovative Reuse and Beneficial Use of Dredged Material Guidance Document

Appendix A1 – Statute and Regulations

MDE has the authority to regulate proposed dredging activities and the management of dredged material under the following:

- Environment Article Title 5, Subtitle 5-1101 *et. seq*., Annotated Code of Maryland
- Environment Article Title 5, Subtitle 5-901 through 5-911, Annotated Code of Maryland; COMAR 26.23
- Environment Article Title 5, Subtitle 5-501 through 5-514; COMAR 26.17.04
- Environment Article Title 16; COMAR 26.24

MDE Solid Waste Program under the Land and Materials Administration has the authority to regulate use of dredged material for landfill cover and cap under the following:

- Environment Article, Title 9, Subtitle 9-204, 9-252, and 9-314, Annotated Code of Maryland; COMAR 26.04.07

MDE Land Restoration Program under the Land and Materials Administration has the authority to regulate use of dredged material for soil and fill material in order to prevent and address a release or threat of a release of hazardous substances or to approve the cleanup of properties through the Voluntary Cleanup Program under the following:

- Environment Article Title 7, Subtitle 7-222 and 7-503, Annotated Code of Maryland; COMAR 26.14

Appendix A2 – Suggested Parameter Analysis List

Table A2-1. Beneficial Use - Aquatic habitat restoration, creation, or enhancement, typical dredged material sampling

Typical Sampling Analyses	Suggested Analytical Method*
Physical Analyses	
Grain Size	ASTM D-422
Chemical & Nutrient Analyses	
Metals and Inorganic Analytes	
Priority Pollutant Metals	SW-846 EPA Method 6020
Mercury	SW-846 EPA Method 7471
Acid Volatile Sulfides/Simultaneously Extracted Metals (AVS/SEM)	EPA Method 821-R-100
Total Cyanide	SW-846 EPA Method 9014
Total Sulfides	SW-846 EPA Method 9030
Total Phosphorus	EPA Method 365.3/365.4
Ammonia-Nitrogen	EPA Method 350
Total Kjeldahl Nitrogen	EPA Method 351
Organic Analytes	
Total Organic Carbon	SW-846 EPA Method 5310B modified (Lloyd Khan)
Volatile Organic Compounds (VOCs) – TCL	SW-846 EPA Method 8260
Semivolatile Organic Compounds (SVOCs) - **TCL**, including Polycyclic Aromatic Hydrocarbons (PAHs)	SW-846 EPA Method 8270
Pesticides	SW-846 EPA Method 8081
Polychlorinated Biphenyls (PCBs) (Aroclors)	SW-846 EPA Method 8082
Dioxins/Furans	SW-846 EPA Methods 8280 & 8290
pH	EPA 9040
Total Sulfates	SW-846 EPA Method 9035 or other as is appropriate

*Use the most current version available for all analytical methods.

Table A2-2. Innovative Reuse - Landfill cover and closure cap, typical dredged material sampling

Typical Sampling Analyses	Analytical Method*
Physical Analyses	
Grain Size	ASTM D-422
Specific gravity	ASTM D-854
Percent moisture	ASTM D-2216
Atterberg limits	ASTM D-4318
Unified Soil Classification System (USCS)	ASTM D-2487
Chemical & Nutrient Analyses	
Metals and Inorganic Analytes	
Toxicity Characteristic Leaching Procedure (TCLP) – Full Analysis	SW-846 EPA Method 1311
Priority Pollutant Metals	SW-846 EPA Method 6020
Mercury	SW-846 EPA Method 7471
Organic Analytes	
Total Organic Carbon	SW-846 EPA Method 5310B modified (Lloyd Khan)
Volatile Organics (VOCs) – TCL	SW-846 EPA Method 8260
Semivolatile Organic Compounds (SVOCs) - TCL, including Polycyclic Aromatic Hydrocarbons (PAHs)	SW-846 EPA Method 8270
Organochlorine Pesticides	SW-846 EPA Method 8081
Polychlorinated Biphenyls (PCBs) Aroclors	SW-846 EPA Method 8082
pH	EPA 9040
Total Sulfates, Sulfides	SW-846 EPA Method 9035 or other as is appropriate
For Final Cap Include:	
Soil Testing for Vegetation Growth - Phosphorus, Potassium, Magnesium, Calcium - Cation Exchange Capacity - Organic Matter - Soluble Salts	

*Use the most current version available for all analytical methods.

Table A2-3. Innovative Reuse - Soil or Fill, including Soil Conditioner, typical dredged material sampling

Typical Sampling Analyses	Analytical Method*
Physical Analyses	
Grain Size	ASTM D-422
Specific gravity	ASTM D-854
Percent moisture	ASTM D-2216
Atterberg limits	ASTM D-4318
Chemical & Nutrient Analyses	
Priority Pollutant Metals	SW-846 EPA Method 6020
Mercury	SW-846 EPA Method 7471
Chromium, Hexavalent	SW-846 EPA Method 3060
Free and Total Cyanide	SW-846 EPA Method 9014
Volatiles (VOCs)	SW-846 EPA Method 8260
Semivolatile Organic Compounds (SVOCs), including Polycyclic Aromatic Hydrocarbons (PAHs)	SW-846 EPA Method 8270
Organochlorine Pesticides	SW-846 EPA Method 8081
Polychlorinated Biphenyls (PCBs) Total and Aroclors	SW-846 EPA Method 8082
Dioxins	SW-846 EPA Method 8280
Furans	SW-846 EPA Method 8090
TPH-DRO/GRO	SW-846 EPA Method 8015
Total Organic Carbon	SW-846 EPA Method 5310B modified (Lloyd Khan)
pH	EPA 9040
Lime Loading Rate	
Nutrient Content	Mehlich-3
Soluble Salts	EC1:2 (V:V)
Total Sulfates	SW-846 EPA Method 9035 or other as is appropriate

*Use the most current version available for all analytical methods

Appendix A3 – Screening Criteria

The screening criteria for soil and fill material is based on risk assessment calculations and methodology detailed in the Environmental Protection Agency (EPA) Regional Screening Levels (RSLs) for soil guidance document for risk assessments:

https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017

Default exposure assumptions and current human health toxicity values identified in the June 2017 RSLs Table were utilized to derive all screening criteria. When making soil and fill material site-specific determinations persons must use the exposure assumptions within the EPA RSL guidance document and the most recent toxicity values identified in the RSL tables. Exposure unit size and land use category must be considered when determining exposure point concentrations of the soil or fill material when performing use specific assessments.

The following is a summary of the screening criteria applicable to each potential use category of dredged material. Please refer to the MDE Land and Materials Administration's *Fill Material and Soil Management Fact Sheet* for additional details regarding use categories.

Category 1 – *Residential Unrestricted Use Soil and Fill Material*

- Criteria: EPA soil RSLs, assuming a resident at 1E-06 risks and hazard quotient (HQ) =0.1
- Potential reuse sites: All land uses, including residential properties

Category 2 – *Non-Residential Restricted Use Soil and Fill Material*

- Criteria: EPA industrial soil RSLs, assuming a worker at 1E-06 risks and HQ=0.1
- Potential reuse sites: Commercial or industrial properties

Category 3 – *Restricted Use Soil and Fill Material, Cap Required*

- Criteria: EPA soil RSLs, assuming a composite or construction worker at 1E-05 risks and HQ=1.0 (see Table A3-1 below)
- Potential reuse sites: Under a cap at a property with contaminant concentrations consistent with the same land use category

Category 4 – *Ineligible Soil and Fill Material*

- Criteria: Concentrations greater than Category 3 (see Table A3-1 below)
- Potential reuse sites: Not eligible for innovative reuse as soil or fill material

Category 1 and Category 2 screening criteria are set at a HQ=0.1 for non-carcinogens to account for potential additive effects and at a 1E-06 lifetime cancer risk for carcinogens. Alternatively, more detailed site-specific risk assessments that take into account site reuse may be performed with risk thresholds at a HQ=1 for non-carcinogens and a 1E-05 lifetime cancer risk for carcinogens. Table 1 below shows the criteria for Category 3.

In addition to the criteria described above and provided in Table 1 below, the following screening criteria apply for total petroleum hydrocarbon (TPH) diesel range organic (DRO) and gasoline range organics (GRO). These criteria are based upon the residential and non-residential soil cleanup standards set at a HQ equal to 0.1 for TPH published in the MDE *Cleanup Standards for Soils and Groundwater, June 2008: Interim Final Guidance (Update No. 2.1).*

- Category 1 TPH screening criteria: 230 mg/kg for TPH, DRO and 230 mg/kg for TPH,GRO
- Category 2 TPH screening criteria: 620 mg/kg for TPH, DRO and 620 mg/kg for TPH, GRO
- Category 3 TPH screening criteria: 620 mg/kg for TPH, DRO and 620 mg/kg for TPH, GRO
- Category 4 TPH screening criteria: exceeds Category 3 standard

Table A3-1: Innovative Use – Category 3 (Restricted Use Soil and Fill, Cap Required) Screening Criteria. **c** = cancerous, **n** = noncancerous, **sat** = concentration may exceed saturation, **max** = concentration may exceed ceiling limit, **NA** = Not Applicable

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Acenaphthene	83-32-9	45200	n	14400	n
Acephate	30560-19-1	985	n	308	n
Acetaldehyde	75-07-0	344	c	71.5	c
Acetochlor	34256-82-1	16400	n	5140	n
Acetone	67-64-1	670000	n	170000	n
Acetone Cyanohydrin	75-86-5	2460	max	691,000	n
Acetonitrile	75-05-8	3410	n	708	n
Acetophenone	98-86-2	117000	sat	33,900	n
Acetylaminofluorene, 2-	53-96-3	6.05	c	49.4	c
Acrolein	107-02-8	0.605	n	0.126	n
Acrylamide	79-06-1	46	c	375	c
Acrylic Acid	79-10-7	417	n	86.8	n
Acrylonitrile	107-13-1	11.3	c	14	c
Adiponitrile	111-69-3	35700000	max	2070000	max
Alachlor	15972-60-8	410	c	2570	n
Aldicarb	116-06-3	821	n	257	n
Aldicarb Sulfone	1646-88-4	821	n	257	n
Aldrin	309-00-2	1.84	c	10.2	c
Allyl Alcohol	107-18-6	14.9	n	3.11	n
Allyl Chloride	107-05-1	6.93	c	1.44	n

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Aluminum	7429-90-5	1120000	n	284000	n
Aluminum Phosphide	20859-73-8	467	n	136	n
Aluminum metaphosphate	13776-88-0	56800000	max	16500000	max
Ametryn	834-12-8	7390	n	2310	n
Aminobiphenyl, 4-	92-67-1	1.09	c	8.93	c
Aminophenol, m-	591-27-5	65700	n	20600	n
Aminophenol, o-	95-55-6	3280	n	1030	n
Aminophenol, p-	123-30-8	16400	n	5140	n
Amitraz	33089-61-1	2050	n	642	n
Ammonium Perchlorate	7790-98-9	818	n	238	n
Ammonium Sulfamate	7773-06-0	234000	n	67900	n
Ammonium polyphosphate	68333-79-9	56800000	max	16500000	max
Amyl Alcohol, tert-	75-85-4	344	n	71.6	n
Aniline	62-53-3	4030	c	1790	n
Anthracene	120-12-7	226000	n	71900	n
Anthraquinone, 9,10-	84-65-1	574	c	514	n
Antimony (metallic)	7440-36-0	467	n	136	n
Antimony Pentoxide	1314-60-9	584	n	170	n
Antimony Tetroxide	1332-81-6	467	n	136	n
Antimony Trioxide	1309-64-4	1,190,000	max	69,100	max
Aroclor 1016	12674-11-2	51.3	n	16.4	n
Aroclor 1221	11104-28-2	8.32	c	62.8	c
Aroclor 1232	11141-16-5	7.19	c	51.6	c
Aroclor 1242	53469-21-9	9.5	c	76	c
Aroclor 1248	12672-29-6	9.54	c	76.5	c
Aroclor 1254	11097-69-1	9.72	c	4.68	n
Aroclor 1260	11096-82-5	9.91	c	81	c
Aroclor 5460	11126-42-4	440	n	141	n
Arsenic, Inorganic	7440-38-2	30	c	142	n
Arsine	7784-42-1	4.09	n	1.19	n
Asulam	3337-71-1	29500	n	9250	n
Atrazine	1912-24-9	99.9	c	816	c
Auramine	492-80-8	26.1	c	213	c
Avermectin B1	65195-55-3	328	n	103	n
Azinphos-methyl	86-50-0	1230	n	385	n
Azobenzene	103-33-3	260	c	1880	c

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Azodicarbonamide	123-77-3	39700	n	2390	n
Barium	7440-39-3	217000	n	48700	n
Barium Chromate	10294-40-3	61.8	c	383	c
Benfluralin	1861-40-1	5840	n	1700	n
Benomyl	17804-35-2	41000	n	12800	n
Bensulfuron-methyl	83055-99-6	164000	n	51400	n
Bentazon	25057-89-0	24600	n	7710	n
Benz[a]anthracene	56-55-3	206	c	1690	c
Benzaldehyde	100-52-7	8180	c	33900	c
Benzene	71-43-2	50.8	c	90.2	n
Benzenediamine-2-methyl sulfate, 1,4-	6369-59-1	230	c	77.1	n
Benzenethiol	108-98-5	1170	n	339	n
Benzidine	92-87-5	0.0999	c	0.815	c
Benzo(j)fluoranthene	205-82-3	17.6	c	146	c
Benzo[a]pyrene	50-32-8	21.1	c	65.1	n
Benzo[b]fluoranthene	205-99-2	211	c	1750	c
Benzo[k]fluoranthene	207-08-9	2110	c	17500	c
Benzoic Acid	65-85-0	3280000	max	1030000	max
Benzotrichloride	98-07-7	2.52	c	19.1	c
Benzyl Alcohol	100-51-6	82100	n	25700	n
Benzyl Chloride	100-44-7	47.9	c	22.5	n
Beryllium and compounds	7440-41-7	2290	n	618	n
Bifenox	42576-02-3	7390	n	2310	n
Biphenthrin	82657-04-3	12300	n	3850	n
Biphenyl, 1,1'-	92-52-4	200	n	41.5	n
Bis(2-chloro-1-methylethyl) ether	108-60-1	46,700	sat	13,600	sat
Bis(2-chloroethoxy)methane	111-91-1	2460	n	771	n
Bis(2-chloroethyl)ether	111-44-4	10.3	c	62.1	c
Bis(2-ethylhexyl)phthalate	117-81-7	1640	c	5140	n
Bis(chloromethyl)ether	542-88-1	0.00362	c	0.0198	c
Bisphenol A	80-05-7	41000	n	12800	n
Boron And Borates Only	7440-42-8	233000	n	67200	n
Boron Trichloride	10294-34-5	2290000	max	618000	max
Boron Trifluoride	7637-07-2	46700	n	13500	n
Bromate	15541-45-4	46.7	c	354	c

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Bromo-2-chloroethane, 1-	107-04-0	1.13	c	6.24	c
Bromobenzene	108-86-1	1780	n	392	n
Bromochloromethane	74-97-5	628	n	131	n
Bromodichloromethane	75-27-4	12.8	c	70	c
Bromoform	75-25-2	857	c	4940	c
Bromomethane	74-83-9	30.1	n	6.28	n
Bromophos	2104-96-3	5840	n	1700	n
Bromoxynil	1689-84-5	223	c	1820	c
Bromoxynil Octanoate	1689-99-2	17500	n	5090	n
Butadiene, 1,3-	106-99-0	2.59	c	1.58	n
Butanoic acid, 4-(2,4-dichlorophenoxy)-	94-82-6	24600	n	7710	n
Butanol, N-	71-36-3	117000	sat	33900	sat
Butyl Benzyl Phthalate	85-68-7	12100	c	51400	n
Butyl alcohol, sec-	78-92-2	1450000	sat	367000	sat
Butylate	2008-41-5	58400	n	17000	n
Butylated hydroxyanisole	25013-16-5	115000	c	938000	c
Butylated hydroxytoluene	128-37-0	6380	c	52100	c
Butylbenzene, n-	104-51-8	58400	sat	17000	sat
Butylbenzene, sec-	135-98-8	117000	sat	33900	sat
Butylbenzene, tert-	98-06-6	117000	sat	33900	sat
Butylphthalyl Butylglycolate	85-70-1	821000	n	257000	n
Cacodylic Acid	75-60-5	16,400	n	5,140	n
Cadmium (Diet)	7440-43-9	982	n	277	n
Calcium Chromate	13765-19-0	61.8	c	383	c
Calcium Cyanide	592-01-8	1170	n	339	n
Calcium pyrophosphate	7790-76-3	56800000	max	16500000	max
Caprolactam	105-60-2	398000	n	110000	n
Captafol	2425-06-1	153	c	514	n
Captan	133-06-2	9990	c	33400	n
Carbaryl	63-25-2	82100	n	25700	n
Carbofuran	1563-66-2	4100	n	1280	n
Carbon Disulfide	75-15-0	3470	sat	728	sat
Carbon Tetrachloride	56-23-5	28.7	c	124	n
Carbonyl Sulfide	463-58-1	283	n	58.9	n
Carbosulfan	55285-14-8	8210	n	2570	n

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Carboxin	5234-68-4	82100	n	25700	n
Ceric oxide	1306-38-3	5360000	max	311000	max
Chloral Hydrate	302-17-0	117000	n	33900	n
Chloramben	133-90-4	12300	n	3850	n
Chloranil	118-75-2	57	c	466	c
Chlordane	12789-03-6	76.6	c	130	n
Chlordecone (Kepone)	143-50-0	2.3	c	18.8	c
Chlorfenvinphos	470-90-6	574	n	180	n
Chlorimuron, Ethyl-	90982-32-4	73900	n	23100	n
Chlorine	7782-50-5	0.775	n	0.161	n
Chlorine Dioxide	10049-04-4	34000	n	8870	n
Chlorite (Sodium Salt)	7758-19-2	35000	n	10200	n
Chloro-1,1-difluoroethane, 1-	75-68-3	225000	sat	46800	sat
Chloro-1,3-butadiene, 2-	126-99-8	0.441	c	2.39	c
Chloro-2-methylaniline HCl, 4-	3165-93-3	50	c	408	c
Chloro-2-methylaniline, 4-	95-69-2	230	c	771	n
Chloroacetaldehyde, 2-	107-20-0	121	c	918	c
Chloroacetophenone, 2-	532-27-4	179000	n	10400	n
Chloroaniline, p-	106-47-8	115	c	938	c
Chlorobenzene	108-90-7	1330	n	282	n
Chlorobenzene sulfonic acid, p-	98-66-8	82100	n	25700	n
Chlorobenzilate	510-15-6	209	c	1710	c
Chlorobenzoic Acid, p-	74-11-3	24600	n	7710	n
Chlorobenzotrifluoride, 4-	98-56-6	2510	n	657	n
Chlorobutane, 1-	109-69-3	46700	sat	13600	sat
Chlorodifluoromethane	75-45-6	205000	sat	42700	sat
Chloroethanol, 2-	107-07-3	23400	n	6790	n
Chloroform	67-66-3	13.8	c	75.3	c
Chloromethane	74-87-3	463	n	96.4	n
Chloromethyl Methyl Ether	107-30-2	0.885	c	4.89	c
Chloronaphthalene, Beta-	91-58-7	60300	n	19200	n
Chloronitrobenzene, o-	88-73-3	76.6	c	625	c
Chloronitrobenzene, p-	100-00-5	383	c	180	n
Chlorophenol, 2-	95-57-8	5840	n	1700	n
Chloropicrin	76-06-2	8.2	n	1.71	n
Chlorothalonil	1897-45-6	7410	c	3850	n

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Chlorotoluene, o-	95-49-8	23400	sat	6790	sat
Chlorotoluene, p-	106-43-4	23400	sat	6790	sat
Chlorozotocin	54749-90-5	0.0957	c	0.782	c
Chlorpropham	101-21-3	41000	n	12800	n
Chlorpyrifos	2921-88-2	821	n	257	n
Chlorpyrifos Methyl	5598-13-0	82.1	n	25.7	n
Chlorsulfuron	64902-72-3	16400	n	5140	n
Chlorthal-dimethyl	1861-32-1	8210	n	2570	n
Chlorthiophos	60238-56-4	657	n	206	n
Chromium(III), Insoluble Salts	16065-83-1	1750000	max	509000	max
Chromium(VI)	18540-29-9	63.3	c	425	c
Chrysene	218-01-9	21100	c	175000	c
Clofentezine	74115-24-5	10,700	n	3340	n
Cobalt	7440-48-4	347	n	97	n
Copper	7440-50-8	46700	n	13600	n
Copper Cyanide	544-92-3	5840	n	1700	n
Cresol, m-	108-39-4	41000	n	12800	n
Cresol, o-	95-48-7	41000	n	12800	n
Cresol, p-	106-44-5	82100	n	25700	n
Cresol, p-chloro-m-	59-50-7	82100	n	25700	n
Cresols	1319-77-3	82100	n	25700	n
Crotonaldehyde, trans-	123-73-9	17.2	c	130	c
Cumene	98-82-8	9950	sat	2120	sat
Cupferron	135-20-6	104	c	853	c
Cyanazine	21725-46-2	27.4	c	223	c
Cyanide (CN-)	57-12-5	147	n	32.6	n
Cyanogen	460-19-5	1170	n	339	n
Cyanogen Bromide	506-68-3	105000	n	30500	n
Cyanogen Chloride	506-77-4	58400	n	17000	n
Cyclohexane	110-82-7	27400	sat	5700	sat
Cyclohexane, 1,2,3,4,5-pentabromo-6-chloro-	87-84-3	1150	c	5140	n
Cyclohexanone	108-94-1	125000	sat	26200	sat
Cyclohexene	110-83-8	3060	sat	747	sat
Cyclohexylamine	108-91-8	234000	n	67900	n
Cyfluthrin	68359-37-5	20500	n	6420	n

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Cyhalothrin	68085-85-8	821	n	257	n
Cypermethrin	52315-07-8	49200	n	15400	n
Cyromazine	66215-27-8	12300	n	3850	n
DDD	72-54-8	95.7	c	514	n
DDE, p,p'-	72-55-9	92.8	c	693	c
DDT	50-29-3	85.3	c	155	n
Dalapon	75-99-0	24600	n	7710	n
Daminozide	1596-84-5	1280	c	10400	c
Decabromodiphenyl ether, 2,2',3,3',4,4',5,5',6,6'- (BDE-209)	1163-19-5	5740	n	1800	n
Demeton	8065-48-3	32.8	n	10.3	n
Di(2-ethylhexyl)adipate	103-23-1	19100	c	154000	c
Diallate	2303-16-4	377	c	3080	c
Diammonium phosphate	7783-28-0	56800000	max	16500000	max
Diazinon	333-41-5	574	n	180	n
Dibenz[a,h]anthracene	53-70-3	21.1	c	175	c
Dibenzo(a,e)pyrene	192-65-4	1.76	c	14.6	c
Dibenzofuran	132-64-9	1040	n	310	n
Dibenzothiophene	132-65-0	11700	n	3390	n
Dibromo-3-chloropropane, 1,2-	96-12-8	0.643	c	3.51	c
Dibromobenzene, 1,3-	108-36-1	467	n	136	n
Dibromobenzene, 1,4-	106-37-6	11700	n	3390	n
Dibromochloromethane	124-48-1	389	c	2950	c
Dibromoethane, 1,2-	106-93-4	1.59	c	8.89	c
Dibromomethane (Methylene Bromide)	74-95-3	98.1	n	20.5	n
Dibutyl Phthalate	84-74-2	82100	n	25700	n
Dibutyltin Compounds	NA	246	n	77.1	n
Dicalcium phosphate	7757-93-9	56800000	max	16500000	max
Dicamba	1918-00-9	24600	n	7710	n
Dichloro-2-butene, 1,4-	764-41-0	0.0937	c	0.508	c
Dichloro-2-butene, cis-1,4-	1476-11-5	0.325	c	1.76	c
Dichloro-2-butene, trans-1,4-	110-57-6	0.325	c	1.76	c
Dichloroacetic Acid	79-43-6	460	c	1030	n
Dichlorobenzene, 1,2-	95-50-1	9330	sat	1990	sat
Dichlorobenzene, 1,4-	106-46-7	114	c	623	c
Dichlorobenzidine, 3,3'-	91-94-1	51.1	c	417	c

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Dichlorobenzophenone, 4,4'-	90-98-2	7390	n	2310	n
Dichlorodifluoromethane	75-71-8	368	n	76.5	n
Dichloroethane, 1,1-	75-34-3	155	c	849	c
Dichloroethane, 1,2-	107-06-2	20.4	c	28.8	n
Dichloroethylene, 1,1-	75-35-4	995	n	208	n
Dichloroethylene, 1,2-cis-	156-59-2	2340	n	679	n
Dichloroethylene, 1,2-trans-	156-60-5	23,400	n	6,790	n
Dichlorophenol, 2,4-	120-83-2	2460	n	771	n
Dichlorophenoxy Acetic Acid, 2,4-	94-75-7	9640	n	2930	n
Dichloropropane, 1,2-	78-87-5	12.4	c	13.8	n
Dichloropropane, 1,3-	142-28-9	23400	sat	6790	sat
Dichloropropanol, 2,3-	616-23-9	2460	n	771	n
Dichloropropene, 1,3-	542-75-6	81.7	c	64.4	n
Dichlorvos	62-73-7	79.2	c	128	n
Dicrotophos	141-66-2	57.4	n	18	n
Dicyclopentadiene	77-73-6	5.41	n	1.12	n
Dieldrin	60-57-1	1.44	c	11.7	c
Diethanolamine	111-42-2	1640	n	510	n
Diethyl Phthalate	84-66-2	657000	n	206000	n
Diethylene Glycol Monobutyl Ether	112-34-5	23600	n	6300	n
Diethylene Glycol Monoethyl Ether	111-90-0	47900	n	13400	n
Diethylformamide	617-84-5	1170	n	339	n
Diethylstilbestrol	56-53-1	0.0657	c	0.536	c
Difenzoquat	43222-48-6	68100	n	21300	n
Diflubenzuron	35367-38-5	16400	n	5140	n
Difluoroethane, 1,1-	75-37-6	201000	sat	41800	sat
Dihydrosafrole	94-58-6	453	c	2970	c
Diisopropyl Ether	108-20-3	9380	n	1950	n
Diisopropyl Methylphosphonate	1445-75-6	93400	sat	27200	sat
Dimagnesium phosphate	7782-75-4	56800000	max	16500000	max
Dimethipin	55290-64-7	17900	n	5600	n
Dimethoate	60-51-5	1810	n	565	n
Dimethoxybenzidine, 3,3'-	119-90-4	14.4	c	117	c
Dimethyl methylphosphonate	756-79-6	13500	c	15400	n
Dimethylamino azobenzene [p-]	60-11-7	5	c	40.8	c
Dimethylaniline HCl, 2,4-	21436-96-4	39.6	c	323	c

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Dimethylaniline, 2,4-	95-68-1	115	c	514	n
Dimethylaniline, N,N-	121-69-7	1210	c	679	n
Dimethylbenz(a)anthracene, 7,12-	57-97-6	0.0844	c	0.699	c
Dimethylbenzidine, 3,3'-	119-93-7	2.09	c	17.1	c
Dimethylformamide	68-12-2	14700	n	3160	n
Dimethylhydrazine, 1,1-	57-14-7	0.242	n	0.0503	n
Dimethylhydrazine, 1,2-	540-73-8	0.0406	c	0.273	c
Dimethylphenol, 2,4-	105-67-9	16400	n	5140	n
Dimethylphenol, 2,6-	576-26-1	492	n	154	n
Dimethylphenol, 3,4-	95-65-8	821	n	257	n
Dimethylterephthalate	120-61-6	117000	n	33900	n
Dimethylvinylchloride	513-37-1	48.3	c	267	c
Dinitro-o-cresol, 4,6-	534-52-1	65.7	n	20.6	n
Dinitro-o-cyclohexyl Phenol, 4,6-	131-89-5	1640	n	514	n
Dinitrobenzene, 1,2-	528-29-0	82.1	n	25.7	n
Dinitrobenzene, 1,3-	99-65-0	82.1	n	25.7	n
Dinitrobenzene, 1,4-	100-25-4	82.1	n	25.7	n
Dinitrophenol, 2,4-	51-28-5	1640	n	514	n
Dinitrotoluene Mixture, 2,4/2,6-	NA	33.8	c	276	c
Dinitrotoluene, 2,4-	121-14-2	73.7	c	60	n
Dinitrotoluene, 2,6-	606-20-2	15.4	c	77.3	n
Dinitrotoluene, 2-Amino-4,6-	35572-78-2	2280	n	666	n
Dinitrotoluene, 4-Amino-2,6-	19406-51-0	2250	n	660	n
Dinitrotoluene, Technical grade	25321-14-6	51.1	c	231	n
Dinoseb	88-85-7	821	n	257	n
Dioxane, 1,4-	123-91-1	245	c	979	n
Diphenamid	957-51-7	24600	n	7710	n
Diphenyl Sulfone	127-63-9	657	n	206	n
Diphenylamine	122-39-4	82100	n	25700	n
Diphenylhydrazine, 1,2-	122-66-7	28.7	c	234	c
Dipotassium phosphate	7758-11-4	56800000	max	16500000	max
Diquat	85-00-7	1810	n	565	n
Direct Black 38	1937-37-7	3.23	c	26	c
Direct Blue 6	2602-46-2	3.1	c	25	c
Direct Brown 95	16071-86-6	3.42	c	27.6	c
Disodium phosphate	7558-79-4	56800000	max	16500000	max

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Disulfoton	298-04-4	32.8	n	10.3	n
Dithiane, 1,4-	505-29-3	11700	n	3390	n
Diuron	330-54-1	1640	n	514	n
Dodine	2439-10-3	16400	n	5140	n
EPTC	759-94-4	58400	n	17000	n
Endosulfan	115-29-7	7010	n	2040	n
Endothall	145-73-3	16400	n	5140	n
Endrin	72-20-8	246	n	77.1	n
Epichlorohydrin	106-89-8	81.7	n	17.1	n
Epoxybutane, 1,2-	106-88-7	671	n	140	n
Ethanol, 2-(2-methoxyethoxy)-	111-77-3	32800	n	10300	n
Ethephon	16672-87-0	4100	n	1280	n
Ethion	563-12-2	410	n	128	n
Ethoxyethanol Acetate, 2-	111-15-9	14200	n	3060	n
Ethoxyethanol, 2-	110-80-5	47400	n	11300	n
Ethyl Acetate	141-78-6	2640	n	549	n
Ethyl Acrylate	140-88-5	214	n	45	n
Ethyl Chloride	75-00-3	56700	sat	11800	sat
Ethyl Ether	60-29-7	234000	sat	67900	sat
Ethyl Methacrylate	97-63-2	7070	sat	1500	sat
Ethyl-p-nitrophenyl Phosphonate	2104-64-5	8.21	n	2.57	n
Ethylbenzene	100-41-4	254	c	1410	c
Ethylene Cyanohydrin	109-78-4	57400	n	18000	n
Ethylene Diamine	107-15-3	105000	n	30500	n
Ethylene Glycol	107-21-1	1640000	max	512000	max
Ethylene Glycol Monobutyl Ether	111-76-2	82100	n	25700	n
Ethylene Oxide	75-21-8	0.248	c	1.35	c
Ethylene Thiourea	96-45-7	65.7	n	20.6	n
Ethyleneimine	151-56-4	0.118	c	0.686	c
Ethylphthalyl Ethyl Glycolate	84-72-0	2460000	max	771000	max
Fenamiphos	22224-92-6	205	n	64.2	n
Fenpropathrin	39515-41-8	20500	n	6420	n
Fenvalerate	51630-58-1	20500	n	6420	n
Fluometuron	2164-17-2	10700	n	3340	n
Fluoranthene	206-44-0	30100	n	9580	n
Fluorene	86-73-7	30100	n	9580	n

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Fluoride	16984-48-8	46700	n	13500	n
Fluorine (Soluble Fluoride)	7782-41-4	70000	n	20300	n
Fluridone	59756-60-4	65700	n	20600	n
Flurprimidol	56425-91-3	12300	n	3850	n
Flusilazole	85509-19-9	1640	n	514	n
Flutolanil	66332-96-5	410000	n	128000	n
Fluvalinate	69409-94-5	8210	n	2570	n
Folpet	133-07-3	73900	n	23100	n
Fomesafen	72178-02-0	2050	n	642	n
Fonofos	944-22-9	1640	n	514	n
Formaldehyde	50-00-0	733	c	689	n
Formic Acid	64-18-6	122	n	25.4	n
Fosetyl-AL	39148-24-8	2050000	max	642000	max
Furan	110-00-9	1040	n	310	n
Furazolidone	67-45-8	6.05	c	49.4	c
Furfural	98-01-1	2640	n	697	n
Furium	531-82-8	15.3	c	125	c
Furmecyclox	60568-05-0	766	c	6250	c
Glufosinate, Ammonium	77182-82-2	4920	n	1540	n
Glutaraldehyde	111-30-8	476,000	max	13300	max
Glycidyl	765-34-4	206	n	49.1	n
Glyphosate	1071-83-6	82100	n	25700	n
Guanidine	113-00-8	11700	n	3390	n
Guanidine Chloride	50-01-1	16400	n	5140	n
Guanidine Nitrate	506-93-4	24600	n	7710	n
HCDD, 1,2,3,4,6,7,8,-	35822-46-9	0.0217	c	0.167	c
Haloxyfop, Methyl	69806-40-2	41	n	12.8	n
Heptachlor	76-44-8	6.26	c	45	c
Heptachlor Epoxide	1024-57-3	3.3	c	4.41	n
Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189)	39635-31-9	5.16	c	5.46	n
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-	67562-39-4	0.0221	c	0.0217	n
Heptane, N-	142-82-5	286	n	77.6	n
Hexabromobenzene	87-82-1	2340	n	679	n
Hexabromodiphenyl ether, 2,2',4,4',5,5'- (BDE-153)	68631-49-2	164	n	51.4	n

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Hexachlorobenzene	118-74-1	9.6	c	60.1	c
Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167)	52663-72-6	5.11	c	5.45	n
Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157)	69782-90-7	5.03	c	5.44	n
Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156)	38380-08-4	5.04	c	5.44	n
Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169)	32774-16-6	0.00511	c	0.00545	n
Hexachlorobutadiene	87-68-3	52.6	c	296	c
Hexachlorocyclohexane, Alpha-	319-84-6	3.65	c	29.8	c
Hexachlorocyclohexane, Beta-	319-85-7	12.8	c	104	c
Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	25.4	c	90.2	n
Hexachlorocyclohexane, Technical	608-73-1	12.8	c	104	c
Hexachlorocyclopentadiene	77-47-4	7.45	n	1.55	n
Hexachlorodibenzo-p-dioxin	34465-46-8	0.00223	c	0.00217	n
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-	39227-28-6	0.00223	c	0.00217	n
Hexachlorodibenzo-p-dioxin, Mixture	NA	0.00468	c	0.0364	n
Hexachlorodibenzofuran, 1,2,3,4,7,8-	70648-26-9	0.00218	c	0.00216	n
Hexachloroethane	67-72-1	80.5	c	114	n
Hexachlorophene	70-30-4	246	n	77.1	n
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	280	c	971	n
Hexamethylene Diisocyanate, 1,6-	822-06-0	13.2	n	2.74	n
Hexamethylphosphoramide	680-31-9	328	n	103	n
Hexane, N-	110-54-3	2450	sat	516	sat
Hexanedioic Acid	124-04-9	1640000	max	514000	max
Hexanone, 2-	591-78-6	1340	n	299	n
Hexazinone	51235-04-2	27100	n	8480	n
Hexythiazox	78587-05-0	20500	n	6420	n
HpCDD, 2,3,7,8-	37871-00-4	0.0217	c	0.0216	n
HpCDF, 1,2,3,4,7,8,9-	55673-89-7	0.0221	c	0.0217	n
HpCDF, 2,3,7,8-	38998-75-3	0.0221	c	0.0217	n
HxCDD, 1,2,3,6,7,8-	57653-85-7	0.00223	c	0.00217	n
HxCDD, 1,2,3,7,8,9-	19408-74-3	0.00223	c	0.00217	n
HxCDF, 1,2,3,6,7,8-	57117-44-9	0.00218	c	0.00216	n

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
HxCDF, 1,2,3,7,8,9-	72918-21-9	0.00223	c	0.00217	n
HxCDF, 2,3,4,6,7,8-	60851-34-5	0.00223	c	0.00217	n
HxCDF, 2,3,7,8-	55684-94-1	0.00223	c	0.00217	n
Hydramethylnon	67485-29-4	14000	n	4370	n
Hydrazine	302-01-2	10.9	c	82.5	c
Hydrazine Sulfate	10034-93-2	10.9	c	82.5	c
Hydrogen Chloride	7647-01-0	119000000	max	6910000	max
Hydrogen Cyanide	74-90-8	145	n	32.1	n
Hydrogen Fluoride	7664-39-3	46700	n	13500	n
Hydrogen Sulfide	7783-06-4	11900000	max	691000	max
Hydroquinone	123-31-9	383	c	3130	c
Imazalil	35554-44-0	376	c	642	n
Imazaquin	81335-37-7	205000	n	64200	n
Imazethapyr	81335-77-5	2050000	max	642000	max
Indeno[1,2,3-cd]pyrene	193-39-5	211	c	1750	c
Iodine	7553-56-2	11700	n	3390	n
Iprodione	36734-19-7	523	n	4270	c
Iron	7439-89-6	818000	n	238000	n
Isobutyl Alcohol	78-83-1	350000	sat	102000	sat
Isophorone	78-59-1	24200	c	51400	n
Isopropalin	33820-53-0	17500	n	5090	n
Isopropanol	67-63-0	24000	n	5010	n
Isopropyl Methyl Phosphonic Acid	1832-54-8	82100	n	25700	n
Isoxaben	82558-50-7	41000	n	12800	n
JP-7	NA	1790000000	max	104000000	max
Lactofen	77501-63-4	6570	n	2060	n
Lead Chromate	7758-97-6	61.8	c	383	c
Lead Phosphate	7446-27-7	3850	c	29100	c
Lead acetate	301-04-2	2700	c	22000	c
Lead and Compounds	7439-92-1	800		800	
Lead subacetate	1335-32-6	2700	c	22000	c
Lewisite	541-25-3	5.84	n	1.7	n
Linuron	330-55-2	6320	n	1980	n
Lithium	7439-93-2	2340	n	679	n
Lithium Perchlorate	7791-03-9	818	n	238	n

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
MCPA	94-74-6	410	n	128	n
MCPB	94-81-5	3610	n	1130	n
MCPP	93-65-2	821	n	257	n
Malathion	121-75-5	16400	n	5140	n
Maleic Anhydride	108-31-6	80500	n	23200	n
Maleic Hydrazide	123-33-1	410000	n	128000	n
Malononitrile	109-77-3	82.1	n	25.7	n
Mancozeb	8018-01-7	24,600	n	1280	n
Maneb	12427-38-2	4,100	n	1280	n
Manganese (Non-diet)	7439-96-5	25600	n	5530	n
Mephosfolan	950-10-7	73.9	n	23.1	n
Mepiquat Chloride	24307-26-4	24600	n	7710	n
Mercaptobenzothiazole, 2-	149-30-4	2090	c	1030	n
Mercuric Chloride	7487-94-7	350	n	102	n
Mercury (elemental)	7439-97-6	46	sat	9.49	sat
Merphos	150-50-5	35	n	25.7	n
Merphos Oxide	78-48-8	82.1	n	25.7	n
Metalaxyl	57837-19-1	49200	n	15400	n
Methacrylonitrile	126-98-7	103	n	28.7	n
Methamidophos	10265-92-6	41	n	12.8	n
Methanol	67-56-1	1220000	sat	297000	sat
Methidathion	950-37-8	1230	n	385	n
Methomyl	16752-77-5	20500	n	6420	n
Methoxy-5-nitroaniline, 2-	99-59-2	469	c	3830	c
Methoxychlor	72-43-5	4100	n	1280	n
Methoxyethanol Acetate, 2-	110-49-6	512	n	108	n
Methoxyethanol, 2-	109-86-4	3520	n	882	n
Methyl Acetate	79-20-9	1170000	sat	339000	sat
Methyl Acrylate	96-33-3	601	n	126	n
Methyl Ethyl Ketone (2-Butanone)	78-93-3	193000	n	43700	n
Methyl Hydrazine	60-34-4	4.4	c	0.916	c
Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	139,000	sat	28900	sat
Methyl Isocyanate	624-83-9	19.3	n	4.02	n
Methyl Mercury	22967-92-6	117	n	33.9	n
Methyl Methacrylate	80-62-6	19200	sat	4000	sat

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Methyl Parathion	298-00-0	205	n	64.2	n
Methyl Phosphonic Acid	993-13-5	49200	n	15400	n
Methyl Styrene (Mixed Isomers)	25013-15-4	2650	n	617	n
Methyl methanesulfonate	66-27-3	232	c	1890	c
Methyl tert-Butyl Ether (MTBE)	1634-04-4	2050	c	11500	c
Methyl-1,4-benzenediamine dihydrochloride, 2-	615-45-2	246	n	77.1	n
Methyl-5-Nitroaniline, 2-	99-55-8	2550	c	5140	n
Methyl-N-nitro-N-nitrosoguanidine, N-	70-25-7	2.77	c	22.6	c
Methylaniline Hydrochloride, 2-	636-21-5	177	c	1440	c
Methylarsonic acid	124-58-3	8210	n	2570	n
Methylbenzene,1-4-diamine monohydrochloride, 2-	74612-12-7	164	n	51.4	n
Methylbenzene-1,4-diamine sulfate, 2-	615-50-9	230	c	77.1	c
Methylcholanthrene, 3-	56-49-5	1.04	c	8.53	c
Methylene Chloride	75-09-2	3160	c	754	n
Methylene-bis(2-chloroaniline), 4,4'-	101-14-4	230	c	514	n
Methylene-bis(N,N-dimethyl) Aniline, 4,4'-	101-61-1	500	c	4080	c
Methylenebisbenzenamine, 4,4'-	101-77-9	14.4	c	117	c
Methylenediphenyl Diisocyanate	101-68-8	3570000	max	207000	max
Methylnaphthalene, 1-	90-12-0	727	c	6030	c
Methylnaphthalene, 2-	91-57-6	3010	n	958	n
Methylstyrene, Alpha-	98-83-9	81800	sat	23800	sat
Metolachlor	51218-45-2	123000	n	38500	n
Metribuzin	21087-64-9	20500	n	6420	n
Metsulfuron-methyl	74223-64-6	205000	n	64200	n
Mineral oils	8012-95-1	3500000	sat	1020000	sat
Mirex	2385-85-5	1.67	c	12.3	c
Molinate	2212-67-1	1640	n	514	n
Molybdenum	7439-98-7	5830	n	1680	n
Monoaluminum phosphate	13530-50-2	56800000	max	16500000	max
Monoammonium phosphate	7722-76-1	56800000	max	16500000	max
Monocalcium phosphate	7758-23-8	56800000	max	16500000	max
Monochloramine	10599-90-3	117000	n	33900	n
Monomagnesium phosphate	7757-86-0	56800000	max	16500000	max

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Monomethylaniline	100-61-8	1640	n	514	n
Monopotassium phosphate	7778-77-0	56800000	max	16500000	max
Monosodium phosphate	7558-80-7	56800000	max	16500000	max
Myclobutanil	88671-89-0	20500	n	6420	n
N,N'-Diphenyl-1,4-benzenediamine	74-31-7	246	n	77.1	n
Naled	300-76-5	2340	n	679	n
Naphtha, High Flash Aromatic (HFAN)	64742-95-6	35000	n	10200	n
Naphthalene	91-20-3	167	c	123	n
Naphthylamine, 2-	91-59-8	12.8	c	104	c
Napropamide	15299-99-7	98500	n	30800	n
Nickel Acetate	373-02-4	8150	n	1780	n
Nickel Carbonate	3333-67-3	8150	n	1780	n
Nickel Carbonyl	13463-39-3	11100	n	2110	n
Nickel Hydroxide	12054-48-7	11100	n	2110	n
Nickel Oxide	1313-99-1	11600	n	2420	n
Nickel Refinery Dust	NA	11100	n	2110	n
Nickel Soluble Salts	7440-02-0	22400	n	5570	n
Nickel Subsulfide	12035-72-2	19.2	c	146	c
Nickelocene	1271-28-9	8150	n	1780	n
Nitrate	14797-55-8	1870000	max	543000	max
Nitrite	14797-65-0	117000	n	33900	n
Nitroaniline, 2-	88-74-4	7990	n	2240	n
Nitroaniline, 4-	100-01-6	1150	c	1030	n
Nitrobenzene	98-95-3	224	c	319	n
Nitrocellulose	9004-70-0	2460000000	max	7710000000	max
Nitrofurantoin	67-20-9	57400	n	18000	n
Nitrofurazone	59-87-0	17.7	c	144	c
Nitroglycerin	55-63-0	82.1	n	25.7	n
Nitroguanidine	556-88-7	82100	n	25700	n
Nitromethane	75-52-5	236	c	77.1	n
Nitropropane, 2-	79-46-9	0.597	c	3.24	c
Nitropyrene, 4-	57835-92-4	17.6	c	146	c
Nitroso-N-ethylurea, N-	759-73-9	0.851	c	6.95	c
Nitroso-N-methylurea, N-	684-93-5	0.191	c	1.56	c
Nitroso-di-N-butylamine, N-	924-16-3	4.57	c	31.6	c

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Nitroso-di-N-propylamine, N-	621-64-7	3.28	c	26.8	c
Nitrosodiethanolamine, N-	1116-54-7	8.21	c	67	c
Nitrosodiethylamine, N-	55-18-5	0.153	c	1.25	c
Nitrosodimethylamine, N-	62-75-9	0.339	c	1.43	n
Nitrosodiphenylamine, N-	86-30-6	4690	c	5140	n
Nitrosomethylethylamine, N-	10595-95-6	0.912	c	5.99	c
Nitrosomorpholine [N-]	59-89-2	3.43	c	28	c
Nitrosopiperidine [N-]	100-75-4	2.44	c	20	c
Nitrosopyrrolidine, N-	930-55-2	10.9	c	89.3	c
Nitrotoluene, m-	99-08-1	82.1	n	25.7	n
Nitrotoluene, o-	88-72-2	149	c	305	n
Nitrotoluene, p-	99-99-0	1440	c	1030	n
Nonane, n-	111-84-2	72.5	sat	16	sat
Norflurazon	27314-13-2	12300	n	3850	n
OCDD	3268-87-9	0.744	c	0.722	n
OCDF	39001-02-0	0.744	c	0.722	n
Octabromodiphenyl Ether	32536-52-0	2460	n	771	n
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	57000	n	16600	n
Octamethylpyrophosphoramide	152-16-9	1640	n	514	n
Octyl Phthalate, di-N-	117-84-0	8210	n	2570	n
Oryzalin	19044-88-3	2950	c	24100	c
Oxadiazon	19666-30-9	4100	n	1280	n
Oxamyl	23135-22-0	20500	n	6420	n
Oxyfluorfen	42874-03-3	314	c	2560	c
Paclobutrazol	76738-62-0	10700	n	3340	n
Paraquat Dichloride	1910-42-5	3690	n	1,160	n
Parathion	56-38-2	4,920	n	7.71	n
PeCDD, 2,3,7,8-	36088-22-9	0.000223	c	0.000217	n
PeCDF, 1,2,3,7,8-	57117-41-6	0.00744	c	0.00722	n
PeCDF, 2,3,4,7,8-	57117-31-4	0.000744	c	0.000722	n
Pebulate	1114-71-2	58,400	n	238	n
Pendimethalin	40487-42-1	24600	n	7710	n
Pentabromodiphenyl Ether	32534-81-9	2340	sat	679	sat
Pentabromodiphenyl ether, 2,2',4,4',5-(BDE-99)	60348-60-9	82.1	n	25.7	n
Pentachlorobenzene	608-93-5	934	n	272	n

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123)	65510-44-3	4.94	c	5.43	n
Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118)	31508-00-6	4.86	c	5.42	n
Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105)	32598-14-4	4.87	c	5.43	n
Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114)	74472-37-0	5.03	c	5.44	n
Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126)	57465-28-8	0.00148	c	0.00163	n
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-	40321-76-4	0.000223	c	0.000217	n
Pentachloroethane	76-01-7	363	c	2750	c
Pentachloronitrobenzene	82-68-8	126	c	953	c
Pentachlorophenol	87-86-5	39.7	c	344	c
Pentaerythritol tetranitrate (PETN)	78-11-5	1640	n	514	n
Pentane, n-	109-66-0	3410	sat	710	sat
Perchlorate and Perchlorate Salts	14797-73-0	818	n	238	n
Perfluorobutane sulfonic acid (PFBS)	375-73-5	16400	n	5140	n
Perfluorobutanesulfonate	45187-15-3	16400	n	5140	n
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	16.4	n	5.14	n
Perfluorooctanesulfonate	45298-90-6	16.4	n	5.14	n
Perfluorooctanoic acid (PFOA)	335-67-1	16.4	n	5.14	n
Permethrin	52645-53-1	41,000	n	12800	n
Phenacetin	62-44-2	10400	c	85300	c
Phenmedipham	13684-63-4	197000	n	61700	n
Phenol	108-95-2	246000	n	77000	n
Phenol, 2-(1-methylethoxy)-, methylca	114-26-1	3280	n	1030	n
Phenothiazine	92-84-2	410	n	128	n
Phenyl Isothiocyanate	103-72-0	234	n	67.9	n
Phenylenediamine, m-	108-45-2	4920	n	1540	n
Phenylenediamine, o-	95-54-5	191	c	1030	n
Phenylenediamine, p-	106-50-3	821	n	257	n
Phenylmercuric Acetate	62-38-4	65.7	n	20.6	n
Phenylphenol, 2-	90-43-7	11800	c	96700	c
Phorate	298-02-2	137	n	42.8	n
Phosgene	75-44-5	1.29	n	0.268	n

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Phosmet	732-11-6	16400	n	5140	n
Phosphine	7803-51-2	350	n	102	n
Phosphoric Acid	7664-38-2	29100000	max	2860000	max
Phosphorus, White	7723-14-0	23.4	n	6.79	n
Phthalic Acid, P-	100-21-0	821000	max	257000	max
Phthalic Anhydride	85-44-9	1620000	max	478000	max
Picloram	1918-02-1	57400	n	18000	n
Picramic Acid (2-Amino-4,6-dinitrophenol)	96-91-3	82.1	n	25.7	n
Picric Acid (2,4,6-Trinitrophenol)	88-89-1	739	n	231	n
Pirimiphos, Methyl	29232-93-7	54.7	n	17.1	n
Polybrominated Biphenyls	59536-65-1	0.766	c	1.8	n
Polychlorinated Biphenyls (high risk)	1336-36-3	9.42	c	75.1	c
Polymeric Methylene Diphenyl Diisocyanate (PMDI)	9016-87-9	3570000	max	207000	max
Polyphosphoric acid	8017-16-1	56800000	max	16500000	max
Potassium Cyanide	151-50-8	2340	n	679	n
Potassium Perchlorate	7778-74-7	818	n	238	n
Potassium Perfluorobutane Sulfonate	29420-49-3	16400	n	5140	n
Potassium Perfluorooctane Sulfonate	2795-39-3	16.4	n	5.14	n
Potassium Silver Cyanide	506-61-6	5840	n	1700	n
Potassium tripolyphosphate	13845-36-8	56800000	max	16500000	max
Prochloraz	67747-09-5	153	c	1250	c
Profluralin	26399-36-0	7010	n	2040	n
Prometon	1610-18-0	12300	n	3850	n
Prometryn	7287-19-6	32800	n	10300	n
Propachlor	1918-16-7	10700	n	3340	n
Propanil	709-98-8	4100	n	1280	n
Propargite	2312-35-8	703	c	5740	c
Propargyl Alcohol	107-19-7	2340	n	679	n
Propazine	139-40-2	16400	n	5140	n
Propham	122-42-9	16400	n	5140	n
Propiconazole	60207-90-1	82100	n	25700	n
Propionaldehyde	123-38-6	313	n	65.2	n
Propyl benzene	103-65-1	24300	sat	5360	sat
Propylene	115-07-1	9260	sat	1930	sat
Propylene Glycol	57-55-6	16,400,000	max	862000	max

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Propylene Glycol Dinitrate	6423-43-4	1620000	max	93800	max
Propylene Glycol Monomethyl Ether	107-98-2	373000	n	89100	n
Propylene Oxide	75-56-9	97.4	c	154	n
Propyzamide	23950-58-5	61500	n	19300	n
Pyrene	129-00-0	22600	n	7190	n
Pyridine	110-86-1	1170	n	339	n
Quinalphos	13593-03-8	410	n	128	n
Quinoline	91-22-5	7.66	c	62.5	c
Quizalofop-ethyl	76578-14-8	7390	n	2310	n
Refractory Ceramic Fibers	NA	179000000	max	10400000	max
Resmethrin	10453-86-8	24,600	n	7710	n
Ronnel	299-84-3	58400	n	17000	n
Rotenone	83-79-4	3280	n	1030	n
Safrole	94-59-7	104	c	853	c
Selenious Acid	7783-00-8	5840	n	1700	n
Selenium	7782-49-2	5840	n	1700	n
Selenium Sulfide	7446-34-6	5840	n	1700	n
Sethoxydim	74051-80-2	115000	max	36000	max
Silica (crystalline, respirable)	7631-86-9	17900000	max	1040000	max
Silver	7440-22-4	5840	n	1700	n
Silver Cyanide	506-64-9	117000	max	33900	max
Simazine	122-34-9	191	c	1280	n
Sodium Acifluorfen	62476-59-9	10700	n	3340	n
Sodium Azide	26628-22-8	4670	n	1360	n
Sodium Cyanide	143-33-9	1170	n	339	n
Sodium Dichromate	10588-01-9	61.8	c	383	c
Sodium Diethyldithiocarbamate	148-18-5	85.1	c	695	c
Sodium Fluoride	7681-49-4	58400	n	16900	n
Sodium Fluoroacetate	62-74-8	16.4	n	5.14	n
Sodium Metavanadate	13718-26-8	1170	n	339	n
Sodium Perchlorate	7601-89-0	818	n	238	n
Sodium Tungstate	13472-45-2	934	n	272	n
Sodium Tungstate Dihydrate	10213-10-2	934	n	272	n
Sodium acid pyrophosphate	7758-16-9	56800000	max	16500000	max
Sodium aluminum phosphate (acidic)	7785-88-8	56800000	max	16500000	max

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Sodium aluminum phosphate (anhydrous)	10279-59-1	56800000	max	16500000	max
Sodium aluminum phosphate (tetrahydrate)	10305-76-7	56800000	max	16500000	max
Sodium hexametaphosphate	10124-56-8	56800000	max	16500000	max
Sodium polyphosphate	68915-31-1	56800000	max	16500000	max
Sodium trimetaphosphate	7785-84-4	56800000	max	16500000	max
Sodium tripolyphosphate	7758-29-4	56800000	max	16500000	max
Stirofos (Tetrachlorovinphos)	961-11-5	960	c	7710	c
Strontium Chromate	7789-06-2	61.8	c	383	c
Strontium, Stable	7440-24-6	701000	n	204000	n
Strychnine	57-24-9	246	n	77.1	n
Styrene	100-42-5	34800	sat	7570	sat
Styrene-Acrylonitrile (SAN) Trimer	NA	2460	n	771	n
Sulfolane	126-33-0	821	n	257	n
Sulfonylbis(4-chlorobenzene), 1,1'-	80-07-9	657	n	206	n
Sulfur Trioxide	7446-11-9	5950000	max	345000	max
Sulfuric Acid	7664-93-9	5950000	max	345000	max
Sulfurous acid, 2-chloroethyl 2-[4-(1,1-dimethylethyl)phenoxy]-1-methylethyl ester	140-57-8	919	c	7500	c
TCDD, 2,3,7,8-	1746-01-6	0.000216	c	0.000216	n
TCDF, 2,3,7,8-	51207-31-9	0.00217	c	0.00216	n
TCMTB	21564-17-0	24,600	n	2570	n
Tebuthiuron	34014-18-1	57400	n	18000	n
Temephos	3383-96-8	16400	n	5140	n
Terbufos	13071-79-9	29.2	n	8.48	n
Terbutryn	886-50-0	821	n	257	n
Tetrabromodiphenyl ether, 2,2',4,4'- (BDE-47)	5436-43-1	82.1	n	25.7	n
Tetrachlorobenzene, 1,2,4,5-	95-94-3	350	n	102	n
Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77)	32598-13-3	1.58	c	1.64	n
Tetrachlorobiphenyl, 3,4,4',5- (PCB 81)	70362-50-4	0.48	c	0.542	n
Tetrachloroethane, 1,1,1,2-	630-20-6	87.5	c	484	c
Tetrachloroethane, 1,1,2,2-	79-34-5	26.7	c	152	c
Tetrachloroethylene	127-18-4	389	n	82.1	n

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Tetrachlorophenol, 2,3,4,6-	58-90-2	24600	n	7710	n
Tetrachlorotoluene, p- alpha, alpha, alpha-	5216-25-1	1.64	c	12.4	c
Tetraethyl Dithiopyrophosphate	3689-24-5	410	n	128	n
Tetraethyl Lead	78-00-2	0.117	n	0.0339	n
Tetrafluoroethane, 1,1,1,2-	811-97-2	427000	sat	88900	sat
Tetrahydrofuran	109-99-9	94200	n	20200	n
Tetrapotassium phosphate	7320-34-5	56800000	max	16500000	max
Tetrasodium pyrophosphate	7722-88-5	56800000	max	16500000	max
Tetryl (Trinitrophenylmethylnitramine)	479-45-8	2330	n	677	n
Thallic Oxide	1314-32-5	23.4	n	6.79	n
Thallium (I) Nitrate	10102-45-1	11.7	n	3.39	n
Thallium (Soluble Salts)	7440-28-0	11.7	n	3.39	n
Thallium Acetate	563-68-8	11.7	n	3.39	n
Thallium Carbonate	6533-73-9	23.4	n	6.79	n
Thallium Chloride	7791-12-0	11.7	n	3.39	n
Thallium Selenite	12039-52-0	11.7	n	3.39	n
Thallium Sulfate	7446-18-6	23.4	n	6.79	n
Thifensulfuron-methyl	79277-27-3	35300	n	11100	n
Thiobencarb	28249-77-6	8210	n	2570	n
Thiocyanates	NA	234	n	67.9	n
Thiocyanic Acid	463-56-9	234	n	67.9	n
Thiodiglycol	111-48-8	79200	n	23200	n
Thiofanox	39196-18-4	246	n	77.1	n
Thiophanate, Methyl	23564-05-8	1980	c	6860	n
Thiram	137-26-8	12300	n	3850	n
Tin	7440-31-5	701000	max	204000	max
Titanium Tetrachloride	7550-45-0	595000	max	34500	max
Toluene	108-88-3	46800	sat	11400	sat
Toluene-2,4-diisocyanate	584-84-9	26.7	n	5.54	n
Toluene-2,5-diamine	95-70-5	128	c	51.4	n
Toluene-2,6-diisocyanate	91-08-7	22.1	n	4.6	n
Toluidine, o- (Methylaniline, 2-)	95-53-4	1440	c	11700	c
Toluidine, p-	106-49-0	766	c	1030	n
Total Petroleum Hydrocarbons (Aliphatic High)	NA	3500000	sat	1020000	sat

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Total Petroleum Hydrocarbons (Aliphatic Low)	NA	2180	sat	443	sat
Total Petroleum Hydrocarbons (Aliphatic Medium)	NA	440	sat	92.5	sat
Total Petroleum Hydrocarbons (Aromatic High)	NA	32800	n	10300	c
Total Petroleum Hydrocarbons (Aromatic Low)	NA	423	n	90.2	n
Total Petroleum Hydrocarbons (Aromatic Medium)	NA	600	n	130	n
Toxaphene	8001-35-2	20.9	c	171	c
Tralomethrin	66841-25-6	6150	n	1930	n
Tri-n-butyltin	688-73-3	350	n	102	n
Triacetin	102-76-1	65700000	max	20600000	max
Triadimefon	43121-43-3	27900	n	8740	n
Triallate	2303-17-5	456	c	3460	c
Trialuminum sodium tetra decahydrogenoctaorthophosphate (dihydrate)	15136-87-5	56800000	max	16500000	max
Triasulfuron	82097-50-5	8210	n	2570	n
Tribenuron-methyl	101200-48-0	6570	n	2060	n
Tribromobenzene, 1,2,4-	615-54-3	5840	n	1700	n
Tribromophenol, 2,4,6-	118-79-6	7390	n	2310	n
Tributyl Phosphate	126-73-8	2550	c	2570	n
Tributyltin Compounds	NA	246	n	77.1	n
Tributyltin Oxide	56-35-9	246	n	77.1	n
Tricalcium phosphate	7758-87-4	56800000	max	16500000	max
Trichloro-1,2,2-trifluoroethane, 1,1,2-	76-13-1	28100	sat	5860	sat
Trichloroacetic Acid	76-03-9	328	c	2680	c
Trichloroaniline HCl, 2,4,6-	33663-50-2	792	c	6470	c
Trichloroaniline, 2,4,6-	634-93-5	24.6	n	7.71	n
Trichlorobenzene, 1,2,3-	87-61-6	934	n	272	n
Trichlorobenzene, 1,2,4-	120-82-1	256	c	53.7	n
Trichloroethane, 1,1,1-	71-55-6	35600	sat	7430	sat
Trichloroethane, 1,1,2-	79-00-5	6.31	n	1.31	c
Trichloroethylene	79-01-6	18.7	n	3.93	c
Trichlorofluoromethane	75-69-4	350,000	sat	656	sat

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Trichlorophenol, 2,4,5-	95-95-4	82100	n	25700	n
Trichlorophenol, 2,4,6-	88-06-2	821	n	257	c
Trichlorophenoxyacetic Acid, 2,4,5-	93-76-5	8210	n	2570	n
Trichlorophenoxypropionic acid, -2,4,5	93-72-1	6570	n	2060	n
Trichloropropane, 1,1,2-	598-77-6	5840	sat	1700	sat
Trichloropropane, 1,2,3-	96-18-4	1.09	c	4.28	n
Trichloropropene, 1,2,3-	96-19-5	3.07	n	0.639	n
Tricresyl Phosphate (TCP)	1330-78-5	16400	n	5140	n
Tridiphane	58138-08-2	2460	n	771	n
Triethylamine	121-44-8	485	n	101	n
Triethylene Glycol	112-27-6	1640000	max	514000	max
Trifluoroethane, 1,1,1-	420-46-2	62300	sat	13000	sat
Trifluralin	1582-09-8	4250	c	2550	n
Trimagnesium phosphate	7757-87-1	56800000	max	16500000	max
Trimethyl Phosphate	512-56-1	1150	c	938	n
Trimethylbenzene, 1,2,3-	526-73-8	2050	sat	448	sat
Trimethylbenzene, 1,2,4-	95-63-6	1770	sat	384	sat
Trimethylbenzene, 1,3,5-	108-67-8	1510	sat	327	sat
Trimethylpentene, 2,4,4-	25167-70-8	11700	sat	3390	sat
Trinitrobenzene, 1,3,5-	99-35-4	32400	n	9600	n
Trinitrotoluene, 2,4,6-	118-96-7	514	n	154	n
Triphenylphosphine Oxide	791-28-6	16400	n	5140	n
Tripotassium phosphate	7778-53-2	56800000	max	16500000	max
Tris(1,3-Dichloro-2-propyl) Phosphate	13674-87-8	16400	n	5140	n
Tris(1-chloro-2-propyl)phosphate	13674-84-5	8210	n	2570	n
Tris(2,3-dibromopropyl)phosphate	126-72-7	13.1	c	96.3	c
Tris(2-chloroethyl)phosphate	115-96-8	1150	c	1800	n
Tris(2-ethylhexyl)phosphate	78-42-2	7180	c	25700	n
Trisodium phosphate	7601-54-9	56800000	max	16500000	max
Tungsten	7440-33-7	934	n	272	n
Uranium (Soluble Salts)	NA	233	n	67.5	n
Urethane	51-79-6	23	c	188	c
Vanadium Pentoxide	1314-62-1	8390	n	1350	n
Vanadium and Compounds	7440-62-2	5830	n	1630	n
Vernolate	1929-77-7	1170	n	339	n

Chemical	CAS No.	Screening Criteria			
		Composite Worker (mg/kg)		Construction Worker (mg/kg)	
Vinclozolin	50471-44-8	985	n	308	n
Vinyl Acetate	108-05-4	3840	n	799	n
Vinyl Bromide	593-60-2	5.25	c	3.74	n
Vinyl Chloride	75-01-4	16.8	c	80.2	n
Warfarin	81-81-2	246	n	77.1	n
Xylene, P-	106-42-3	2420	sat	505	sat
Xylene, m-	108-38-3	2370	sat	495	sat
Xylene, o-	95-47-6	2790	sat	583	sat
Xylenes	1330-20-7	2490	sat	519	sat
Zinc Cyanide	557-21-1	58400	n	17000	n
Zinc Phosphide	1314-84-7	350	n	102	n
Zinc and Compounds	7440-66-6	350000	max	102000	max
Zineb	12122-67-7	41000	n	12800	n
Zirconium	7440-67-7	93.4	n	27.2	n

Table A3-2. Beneficial Use – TEL and PEL Screening Levels in Sediment (NOAA SQRs)

Screening Quick Reference Table for Inorganics in Sediment

These tables were developed for screening purposes only: they do not represent official NOAA policy and do not constitute criteria or clean-up levels.
All attempts have been made to ensure accuracy; however, NOAA is not liable for errors. Values are subject to changes as new data become available.

Analyte		FRESHWATER SEDIMENT									MARINE SEDIMENT						
All concentrations in parts per billion dry weight unless specified otherwise		"Background" [1]	ARCS *H. azteca* TEL [2]	TEC [3]	TEL [3]	LEL [4]	PEC [3]	PEL [3]	SEL [4]	UET [1]	T_{20} [5]	TEL [6]	ERL [6]	T_{50} [5]	PEL [6]	ERM [6]	AET [7]
Predicted Toxicity Gradient:		> Increasing →									> Increasing →						
Aluminum (%)	Al	0.26%	2.55%														1.8% N
Antimony	Sb	160								3,000 M	630			2,400			9,300 E
Arsenic	As	1,100	10,798	9,790	5,900	6,000	33,000	17,000	33,000	17,000 I	7,400	7,240	8,200	20,000	41,600	70,000	35,000 B
Barium	Ba	700										130,100#					48,000 A
Cadmium	Cd	100-300	583	990	596	600	4,980	3,530	10,000	3,000 I	380	680	1,200	1,400	4,210	9,600	3,000 N
Chromium	Cr	7,000-13,000	36,286	43,400	37,300	26,000	111,000	90,000	110,000	95,000 H	49,000	52,300	81,000	141,000	160,000	370,000	62,000 N
Cobalt	Co	10,000				50,000+											10,000 N
Copper	Cu	10,000-25,000	28,012	31,600	35,700	16,000	149,000	197,000	110,000	86,000 I	32,000	18,700	34,000	94,000	108,000	270,000	390,000 MO
Iron (%)	Fe	0.99-1.8 %	18.84%			2%			4%	4% I							22% N
Lead	Pb	4,000-17,000	37,000	35,800	35,000	31,000	128,000	91,300	250,000	127,000 H	30,000	30,240	46,700	94,000	112,000	218,000	400,000 B
Manganese	Mn	400,000	630,000			460,000			1,100,000	1,100,000 I							260,000 N
Mercury	Hg	4-51		180	174	200	1,060	486	2,000	560 M	140	130	150	480	700	710	410 M
Nickel	Ni	9,900	19,514	22,700	18,000	16,000	48,600	36,000	75,000	43,000 H	15,000	15,900	20,900	47,000	42,800	51,600	110,000 EL
Selenium	Se	290															1,000 A
Silver	Ag	<500				500 +				4,500 H	230	730	1,000	1,100	1,770	3,700	3,100 B
Strontium	Sr	49,000															
Tin	Sn	5,000										48 *					> 3,400 N
Vanadium	V	50,000															57,000 N
Zinc	Zn	7,000-38,000	98,000	121,000	123,000	120,000	459,000	315,000	820,000	520,000 M	94,000	124,000	150,000	245,000	271,000	410,000	410,000 I
Lead 210 $^{bq}/_{g}$ dw						0.5 ^			< 9.7 ^								
Polonium 210 $^{bq}/_{g}$ dw						0.6 ^			< 8.7 ^								
Radium 226 $^{bq}/_{g}$ dw						0.1 ^			< 13 ^								
Sulfides										130,000 M							4,500 MO

- Based on SLC approach using sensitive species HC5%; ES&T 2005 39(14):5148-5156.
* - Based upon EQp approach using current AWQC CCC
^ - Based on SLC approach to derive LEL and SEL; Env'al Monitor & Ass'ment 2005 110:71-85
+ - Carried over from Open Water disposal Guidelines; treated as if LEL for management decisions.
Bioassay endpoints: M – Microtox; B – Bivalve; E – Echinoderm larvae; O – Oyster larvae;
A – Amphipod; N – Neanthes; L –Larval bioassay; plus, I – Infaunal community impacts

Sources
1 – Buchman, M. 1999. NOAA HAZMAT Report 99-1.
2 – EPA 905-R96-008
3 – Arch ET&C 2000, 39(1)20- TEL and PEL are also known as Canadian ISQGs and PELs
4 – Guidelines for the protection and management of aquatic sediment quality in Ontario Aug 1993
5 – ET&C 2002, 21(9)1993-
6 – Ecotox. 1996, 5(4):253-
7 – Chapter 173-204 WAC, 1991/95 as supplemented by WA Dept of Ecology staff with unpublished data.

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		ARCS *Hyalella* TEL[1]	TEL[2]	TEC[2]	LEL[3]	PEL[2]	PEC[2]	SEL[3]	UET[4] @1%TOC	Target	Intervention	T_{22}[6]	TEL[7]	ERL[7]	T_{50}[6]	PEL[7]	ERM[7]	AET[8]	EqP[9] @1%TOC
2,3,7,8-TCDD dioxin TEQs	1746016		0.00085 c			0.0215 c			0.0088†H		1 S		0.00085 c			0.0215 c		0.0036 N	
Acenaphthene	83329		6.71 c			88.9 c			290 M			19	6.71	16	116	88.9	500	130 E	
Acenaphthylene	208968		5.87 c			128 c			160 M			14	5.87	44	140	128	640	71 E	
Acrylonitrile	107131									0.07	100 S								
Aldrin	309002				2			80	40 I	0.06	1,700 LB							9.5 AE	
Aldrin + Dieldrin + Endrin	na									5	140 L								
Anthracene	120127	10	46.9 c	57.2	220	245 c	845	3,700	260 M	39 LB	1,600 LB	34	46.9	85.3	290	245	1,100	280 E	
Atrazine	1912249									0.2	710 LB								
BCH compounds (sum)	na									10	6,400 L								
Benz[a]anthracene	56553	15.72	31.7	108	320	385	1,050	14,800	500 I	25 L	2,500 L	61	74.8	261	466	693	1,600	960 E	
Benzene	71432									10	1,000								57
Benzo(ghi)perylene	191242				170			3,200	300 M	570 LB	33,000 LB	67			497			670 M	
Benzo[a]pyrene	50328	32.4	31.9	150	370	782	1,450	14,400	700 I	52 L	7,000 L	69	88.8	430	520	763	1,600	1,100 E	
Benzo[b]fluoranthene	205992											130			1,107			1,800 E I	
Benzo[k]fluoranthene	207089	27.2			240			13,400	13,400B	380 LB	38,000 LB	70			537			1,800 E I	
Benzoic acid	65850																	65 O	
Benzyl alcohol	100516																	52 B	
BHC, alpha (α-HCH)	319846				6			100		3	< 2,000								
BHC, beta (β-HCH)	319857				5			210		9	< 2,000								
BHC, delta (δ-HCH)	319868									< 10	< 2,000								
BHC, gamma- (γ-HCH; Lindane)	58899		0.94	2.37	3	1.38	4.99	10	9 I	0.05	1,200 L		0.32			0.99		> 4.8 N	3.7
Biphenyl	92524											17			73				1,100
Bis(2-ethylhexyl)phthalate (DEHP)	117817								750 †M	< 100	10,000 LB		182			2647		1,300 I	
Bromoform (Tribromomethane)	75252										75,000								650
Butanol	35296721										30,000 S								
Butyl acetate, 1- or 2-	na										200,000 S								
Butyl benzyl phthalate	85687									< 100	48,000 LB							63 M	1,100
Carbaryl	63252									0.03	450 LB								
Carbofuran	1563662									0.02	17 LB								
Carbon tetrachloride (Tetrachloromethane;Tetra)	56235									170 LB	1,000								1,200

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		ARCS *Hyalella* TEL[1]	TEL[2]	TEC[2]	LEL[3]	PEL[2]	PEC[2]	SEL[3]	UET[4] @1%TOC	Target	Intervention	T_{23}[6]	TEL[7]	ERL[7]	T_{25}[6]	PEL[7]	ERM[7]	AET[8]	
Catechol (o-Dihydroxybenzene)	120809									3.2 LB	2,600 LB								
Chlordane	57749		4.5	3.24	7	8.9	17.6	60	30 I	0.03	4,000		2.26	0.5		4.79	6	2.8 A	
Chlordane (alpha)	5103719									< 0.03	< 4,000								
Chlordane (gamma)	5103742									< 0.03	< 4,000								
Chloro, 4- 2-methyl phenol	1570645										< 15,000 S								
Chloro, 4- 2-methylphenoxy acetic acid (MCPA)	94746									0.05	4,000								
Chloro, 4- 3-methyl phenol	59507										< 15,000 S								
Chloro, 4- methyl phenols	na										15,000 S								
Chloroaniline	27134265									5	50,000								
Chlorobenzenes (sum)	na									30	30,000								820
Chloroform (trichloromethane)	67663									20	10,000								
Chloronaphthalene, 1-	90131									57 LB	< 10,000								
Chloronaphthalene, 2-	91587									250 LB	< 10,000								
Chlorophenol, 2-	95578									55 LB	7,800 LB							0.333	
Chlorophenol, 3-	108430									35 L	14,000 L								
Chlorophenol, 4-	106489									20 LB	1,400 LB								
Chlorophenols (sum)	na									10	10,000								
Chrysene	218019	26.83	57.1	166	340	862	1,290	4,600	800 I	8,100 LB	35,000 LB	82	108	384	650	846	2,800	950 E	
Cresol [m-] (3-Methyl phenol)	108394									1,600 L	16,000 L								
Cresol [o-] (2-Methyl phenol)	95487									500 L	50,000 L							8 B	
Cresol [p-] (4-Methyl phenol)	106445									5.1 LB	2,600 LB							100 B	
Cresols, sum	1319773									50	5,000								
Cyclohexanone	108941									100	45,000								
DDD, 4,4- (p,p-DDD, TDE)	72548		3.54	4.88	8	8.51	28	60	< 60 I	3.9 LB	34,000 LB		1.22	2		7.81	20	< 16 I	
DDE, 4,4- (p,p-DDE)	72559		1.42	3.16	5	6.75	31.3	190	<50 I	5.8 LB	1,300 LB		2.07	2.2		374	27	< 9 I	
DDT, 4,4- (p,p-DDT)	50293		1.19 c	4.16	8	4.77 c	62.9	710	50 I	9.8 LB	1,000 L		1.19	1		4.77	7	< 12 E	
DDT+DDE+DDD (sum)	na		7	5.28	7	4,450	572	120	50 I	10	4,000		3.89	1.58		51.7	46.1	11 B	
Diazinon	333415																		1.9
Dibenz[ah]anthracene	53703	10	6.22 c	33	60	135 c		1,300	100 M			19	6.22	63.4	113	135	260	230 OM	
Dibenzofuran	132649								5,100 H									110 E	2,000

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Dichloroaniline, 2,4-	554007									< 5	< 50,000 S								
Dichloroaniline, 3,4-	95761									< 5	< 50,000 S								
Dichloroaniline, 3,4-	95761									< 5	< 50,000 S								
Dichlorobenzene, 1,2-	95501									< 30	17,000 LB							13 N	340
Dichlorobenzene, 1,3-	541731									< 30	24,000 LB								1700
Dichlorobenzene, 1,4-	106467									< 30	18,000 LB							110 IM	350
Dichlorobenzenes	25321226									< 30	19,000 LB								
Dichloroethane, 1,1-	75343									20	15,000								
Dichloroethane, 1,2-	107062									20	4,000								
Dichloroethene, 1,1- (vinylidene chloride)	75354									100	300								
Dichloroethene, 1,2- (cis or trans)	540590									200	1,000								
Dichlorophenol, 2,4-	120832									< 10	8,400 LB							0.2083	
Dichlorophenol, 2,6-	87650									< 10	57,000 LB								
Dichlorophenol, 3,4-	95772									< 10	57,000 LB								
Dichlorophenol, 3,5-	591355									< 10	5,400 LB								
Dichlorophenols (sum)	na									< 10	22,000 LB								
Dichloropropane, 1,2- (propylene dichloride)	78875									< 2	< 2,000								
Dieldrin ‡	60571		2.85	1.9	2	6.67	61.8	910	300 I	0.5	1,900 LB	0.83	0.72	0.02	2.9	4.3	8	1.9 E	
Diethyl phthalate	84662									530 L	53,000 L							6 BL	630
Diethylene-glycol	111466										270,000 S								
Dihydroxybenzenes, sum	na									62 LB	8,000 LB								
Di-iso-butyl phthalate	84695									92 LB	17,000 LB								
Dimethyl phthalate	131113									1,000 LB	84,000 LB							6 B	
Dimethylnaphthalene, 2,6-	581420											25			133				
Dimethylphenol, 2,4-	105679																	18 N	
Di-n-butyl phthalate	84742								110 H	7,000 LB	36,000 LB							58 BL	11,000
Di-n-octyl phthalate	117840									< 100	< 60,000							61 BL	
Dodecylbenzene	25155300										1,000,000 S								
Endosulfan (a or b)	115297									0.01	4,000								2.9 α 14 β

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Endosulfan II	33213659																		
Endrin	72208		2.67	2.22	3	62.4	207	1,300	500 I	0.04	95 L								
Ethyl acetate	141786										75,000 S								
Ethyl acetate	141786										75,000 S								
Ethyl benzene	100414									30	50,000							4 EL	3,600
Ethylene glycol	107211										100,000 S								
Fluoranthene	206440	31.46	111	423	750	2,355	2,230	10,200	1,500 M	1,000 LB	260,000	119	113	600	1,034	1,494	5,100	1,300 E	
Fluorene	86737	10	21.2 c	77.4	190	144 c	536	1,600	300 M			19	21.2	19	114	144	540	120 E	540
Formaldehyde	50000										100 S								
Guthion (Azinphos-methyl)	865000									0.005	2,000 S								
Heptachlor	76448								10 I	0.7	4,000							0.3 B	
Heptachlorepoxide	1024573		0.6	2.47	5	2.74	16	50	30 I	0.0002	4,000	0.6 c				2.74 c			
Hexachlorobenzene	118741				20			240	100 I	1.4 LB	2,000 LB							6 B	
Hexachlorobutadiene (HCBD)	87683																	1.3 E	
Hexachlorocyclohexane (BHC)	608731				3			120	100 I										
Hexachloroethane	67721																	73 BL	1,000
Hydroquinone (p-dihydroxybenzene)	123319									50	43,000 LB								
Indeno[1,2,3-cd]pyrene	193395	17.32			200			3,200	330 M	31 LB	1,900 LB	68			488			600 M	
Linar alkylbenzene sulfonates (LAS)	na												<12,800 €			>62,000 €			
Malathion	121755																		0.67
Maneb	12427382									2	22,000 L								
Methanol	67561										30,000 S								
Methoxychlor	72435																		19
Methyl ethyl ketone (MEK; 2-Butanone)	78933										35,000 S								
Methyl naphthalene, 2-	91576											21	20.2	70	128	201	670	64 E	
Methylene chloride (Dichloromethane, DCM)	75092									18 LB	3,900 L								
Methylnaphthalene, 1-	90120											21			94				
Methylphenanthrene, 1-	832699											18			112				
Methyl-tert-butyl ether (MTBE)	1634044										100,000 S								
Mirex	2385855				7			1,300	800 I										

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Monochloroaniline (3 isomers)	na									5	50,000								
Monochlorobenzenes	108907									< 30	15,000 LB								820
Monochloronaphthalenes	na									120 LB	10,000								
Monochlorophenols (sum)	na									< 10	5,400 L								
Naphthalene	91203	14.65	34.6 c	176		391 c	561		600 I	120 LB	17,000 LB	30	34.6	160	217	391	2,100	230 E	480
Nitrobenzene	98953																	21 N	
Nitrosodiphenylamine, N-	86306																	28 I	
Nonylphenol	25154523		1,400 c										1,000 c						
PAHs, Low MW	na	76.42							5,300 M	< 1,000	< 40,000		312	552		1,442	3,160	1,200 E	
PAHs, High MW	na	193							6,500 M	< 1,000	< 40,000		655	1,700		6,676	9,600	7,900 E	
PAHs, Total	na	264.1		1,610	4,000		22,800*	100,000*	12,000 M	1,000	40,000		1,684	4,022		16,770	44,792		
PCB 105	32598144									1.5 LB	< 1,000								
PCB 126	57465288									0.0025 LB	920 LB								
PCB 77	32598131									0.42 LB	< 1,00								
PCB-Aroclor 1254	na		60 c		60	340 c		340					63.3 c			709 c			
PCBs (sum)	1336363	31.62	34.1	59.8	70	277	676	5,300	26 M	0.3 LB	1,000	35	21.6	22.7	368	189	180	130 M	
Pentachloroaniline	527208										10,000 S								
Pentachlorobenzene	608935									15 LB	16,000 LB								690
Pentachlorophenol [PCP: at ph 7.8‡]	87865									< 10	8,000 LB							17 B	
Perylene	198550											74			453				
Phenanthrene	85018	18.73	41.9	204	560	515	1,170	9,500	800 I	3,300 LB	31,00 LB	68	86.7	240	455	544	1500	660 E	
Phenol	108952								48 † H	50	14,000 LB							130 E	
Phthalates (sum)	na									100	60,000								
Propanol, 2- (Isopropanol)	67630										220,000 S								
Pyrene	129000	44.27	53	195	490	875	1,520	8,500	1,000 i			125	153	665	932	1,398	2,600	2,400 E	
Pyridine	110861									100	500								
Resorcinol (m-dihydroxybenzene)	108463									34 LB	4,600 LB								
Styrene (Vinyl benzene)	100425									200 LB	86,000 LB								
Tetrachloroaniline, 2,3,5,6-	3481207										< 30,000 S								
Tetrachlorobenzene, 1,2,3,4-	634662									160 L	16,000 L								
Tetrachlorobenzene, 1,2,3,5-	634902									6.5 L	650 L								

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ANALYTE All concentrations in parts per billion dry weight unless specified otherwise	CAS Number	FRESHWATER SEDIMENT								DUTCH Sediment[5]		MARINE SEDIMENT							Eco Tox EqP[9] @1%TOC
		ARCS *Hyalella* TEL[1]	TEL[2]	TEC[2]	LEL[3]	PEL[2]	PEC[2]	SEL[3]	UET[4] @1%TOC	Target	Intervention	T_{23}[6]	TEL[7]	ERL[7]	T_{50}[6]	PEL[7]	ERM[7]	AET[8]	
Tetrachlorobenzene, 1,2,4,5-	95943									10 L	1,000 L								
Tetrachlorobenzenes	na									22 L	2,200 L								
Tetrachloroethylene (Tetrachloroethene; PCE; PER)	127184									2	4,000							57 I	530
Tetrachlorophenol, 2,3,4,5-	4901513									< 10	< 10,000								
Tetrachlorophenol, 2,3,4,6-	58902									< 10	< 10,000								
Tetrachlorophenols (sum)	25167833									< 10	< 10,000								
Tetrahydrofuran	109999									100	2,000								
Tetrahydrothiophene	110010									100	8,800 LB								
Toluene	108883									10	47,000 L								670
Toxaphene	8001352		0.1 c										0.1 c						28
Tributyltinoxide	56359									< 10	< 2,500								
Trichloroaniline (multiple isomers)	na										10,000 S								
Trichloroaniline, 2,4,5-	636306										< 10,000 S								
Trichlorobenzene, 1,2,3-	87616									< 11 L	5,000 L								
Trichlorobenzene, 1,2,4-	120821									11 LB	5,100 LB							> 4.8 E	9,200
Trichlorobenzenes	12002481									38 L	11,000 L								
Trichloroethane, 1,1,1-	71556									70	15,000								170
Trichloroethane, 1,1,2-	79005									400	10,000								
Trichloroethene (TCE)	na									7.8 L	2,500 L							41 N	1,600
Trichlorophenol, 2,3,5-	na									< 10	4,500 L								
Trichlorophenol, 2,4,5-	95954									< 10	22,000 LB							3 I	
Trichlorophenol, 2,4,6-	88062									< 10	110,000 LB							6 I	
Triclorophenols, (sum)	na									< 10	22,000 L								
Vinyl chloride	75014									10	100								
Xylene	1330207									130 LB	17,000 LB							4 BL	
Xylene, m-	108383									110 LB	18,000 LB								25
Xylene, o-	95476									89 LB	9,300LB								

4: Entry is lowest, reliable value among AET tests, on 1% TOC basis: I - Infaunal community impact ; M - Microtox bioassay ; H - *Hyalella azteca* bioassay ; † - value on dry weight basis.
5: S – Serious Contamination; L – Environmental Risk Limit for soil; LB – Environmental Risk Limit for soil or bedded sediment
8: Entry is lowest value among AET tests: I - Infaunal community impact ; A - Amphipod ; B - Bivalve ; M- Microtox bioassay ; O - Oyster larvae ; E - Echinoderm larvae ; L - $Larval_{max}$; or , N - *Neanthes* bioassay.

Screening Quick Reference Tables for Organics – Sediment

These tables were developed for screening purposes only: they do not represent official NOAA policy and do not constitute criteria or clean-up levels.
All attempts have been made to ensure accuracy; however, NOAA is not liable for errors. Values are subject to changes as new data become available.

Sources

1 – Assessment & Remediation of Contaminated Sediments (ARCS) Program, Sept 1996. EPA 905-R96-008.

2 – MacDonald et al, 2000. Arch ET&C 39(1):20-
C – Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, Summary Tables Update 2002, www.ccme.ca/publications/cegg_rcqe.html

3 – Persuad 1993. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Thompson et al., 2005. Enval Monitor & Assessment 110:71-

4 – Buchman 1999. NOAA HAZMAT Report 99-1.

5 – Entry is lower of current VROM Environmental Quality standards or the updated RIVM Environmental Risk Limits. Risk limits are typically divided by 100 to derive the Target value; this computation has not been done here.
Dutch Target/Intervention: E.M.J. Verbruggen, R. Posthumus and A.P. van Wezel, 2001. Ecotoxicological Serious Risk Concentrations for soil, sediment, and (ground)water: updated proposal for first series of compounds. Nat. Inst. Public Health and the Env., and subsequent updates as published elsewhere.
Min. Housing, Spatial Plan. And the Env., 2000. Annexes Circular on target values and intervention values for soil remediations.

6 – Field et al., 2002. ET&C 21:1993-

7 – MacDonald et al., 1996. Ecotox. 5(4):253-
C – Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, Summary Tables Update 2002, www.ccme.ca/publications/cegg_rcqe.html
€ - DelValls et al., 1999. Ecotox. & Env Rest 2(1):34-

8 – Wash Dept Ecol Publ 95-308, 1995 and 97-323a, 1997
Gries & Waldrow Puget Sound Dredged Disposal Analysis Rept 1996. http://www.ecy.wa.gov/biblio/wac173204.html
plus unpublished information.

9 – EcoUpdate EcoTox Thresholds, http://www.epa.gov/oswer/riskassessment/

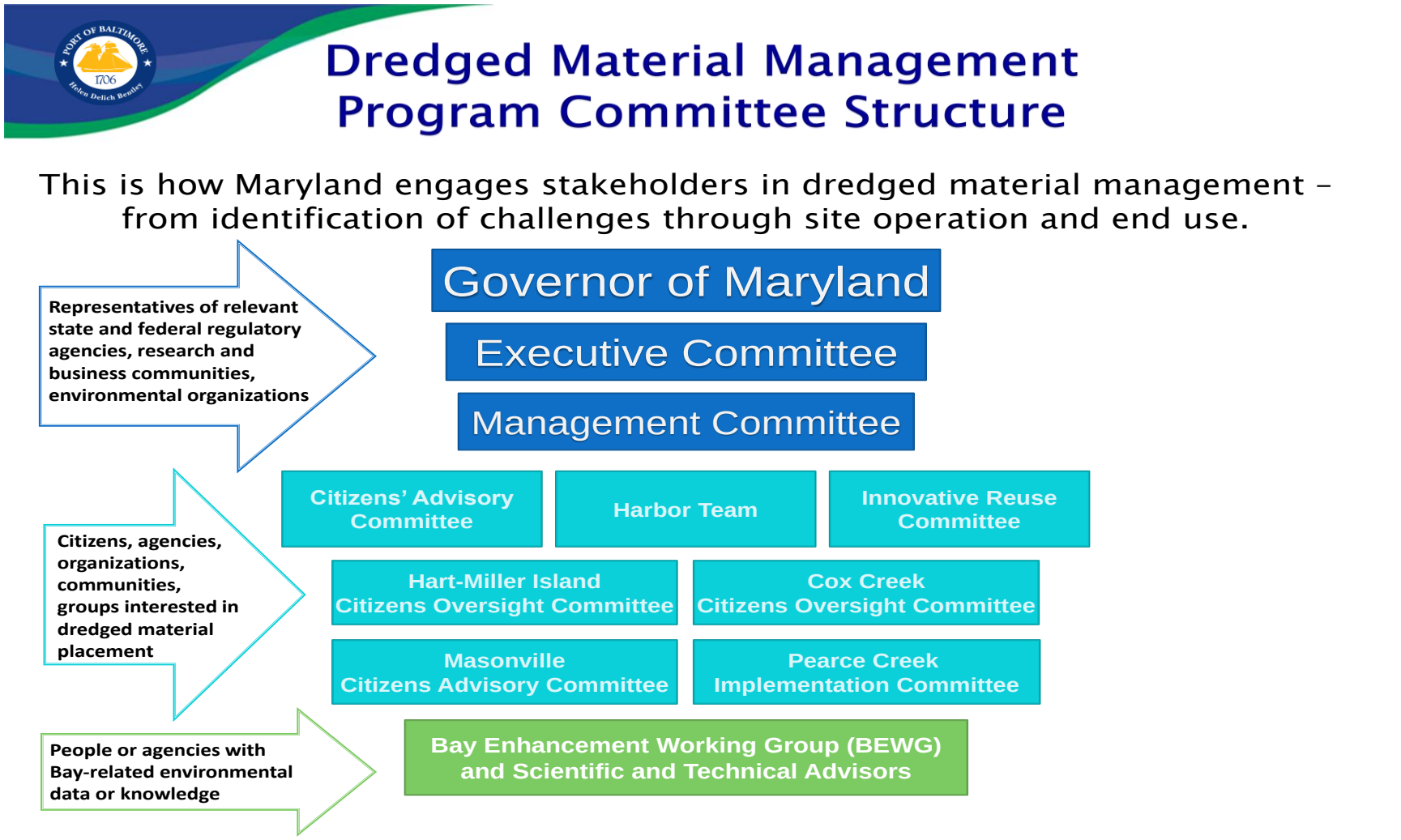
4: Entry is lowest, reliable value among AET tests, on 1% TOC basis: I - Infaunal community impact ; M - Microtox bioassay ; H - *Hyalella azteca* bioassay ; † - value on dry weight basis.
5: S – Serious Contamination; L – Environmental Risk Limit for soil; LB – Environmental Risk Limit for soil or bedded sediment
8: Entry is lowest value among AET tests: I - Infaunal community impact ; A - Amphipod ; B - Bivalve ; M- Microtox bioassay ; O - Oyster larvae ; E - Echinoderm larvae ; L - $Larval_{max}$; or , N - *Neanthes* bioassay.

Table A3-3. Maximum Regulatory Concentrations for the Toxicity Characteristic Leaching Procedure (TCLP)

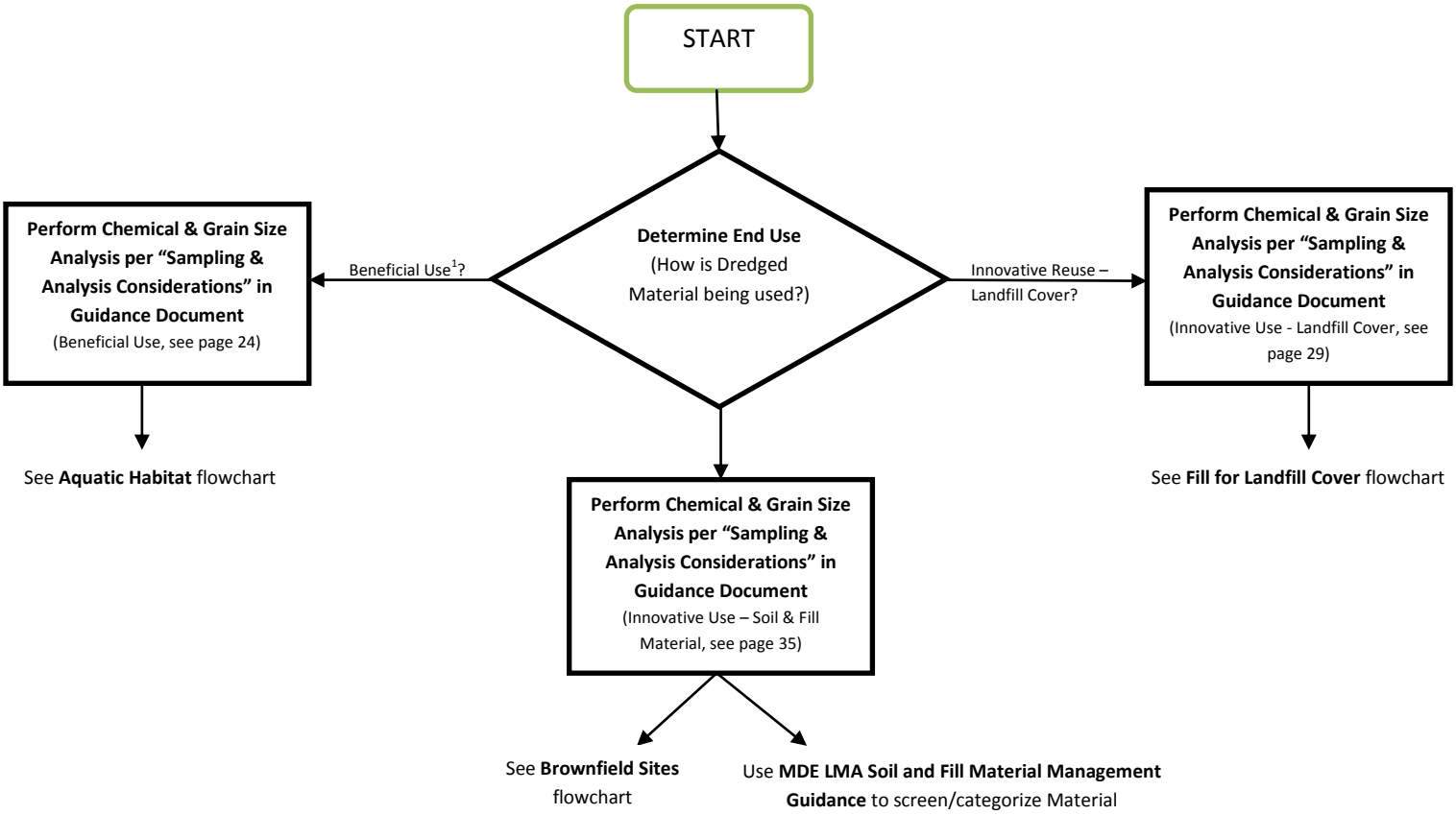
EPA HW[2]	Contaminant	CAS[2]	Regulatory Level (mg/L)
D004	Arsenic	7440-38-2	5
D005	Barium	7440-39-3	100
D018	Benzene	71-43-2	0.5
D006	Cadmium	7440-43-9	1
D019	Carbon tetrachloride	56-23-5	0.5
D020	Chlordane	57-74-9	0.03
D021	Chlorobenzene	108-90-7	100
D022	Chloroform	67-66-3	6
D007	Chromium	7440-47-3	5
D023	o-Cresol	95-48-7	200.0[3]
D024	m-Cresol	108-39-4	200.0[3]
D025	p-Cresol	106-44-5	200.0[3]
D026	Cresol	NA	200.0[3]
D016	2,4-D	94-75-7	10
D027	1,4-Dichlorobenzene	106-46-7	7.5
D028	1,2-Dichloroethane	107-06-2	0.5
D029	1,1-Dichloroethylene	75-35-4	0.7
D030	2,4-Dinitrotoluene	121-14-2	0.13[4]
D012	Endrin	72-20-8	0.02
D031	Heptachlor (and its epoxide)	76-44-8	0.008
D032	Hexachlorobenzene	118-74-1	0.13[4]
D033	Hexachlorobutadiene	87-68-3	0.5
D034	Hexachloroethane	67-72-1	3
D008	Lead	7439-92-1	5
D013	Lindane	58-89-9	0.4
D009	Mercury	7439-97-6	0.2
D014	Methoxychlor	72-43-5	10
D035	Methyl ethyl ketone	78-93-3	200
D036	Nitrobenzene	98-95-3	2
D037	Pentachlorophenol	87-86-5	100
D038	Pyridine	110-86-1	5.0[4]
D010	Selenium	7782-49-2	1
D011	Silver	7440-22-4	5
D039	Tetrachloroethylene	127-18-4	0.7
D015	Toxaphene	8001-35-2	0.5
D040	Trichloroethylene	79-01-6	0.5
D041	2,4,5-Trichlorophenol	95-95-4	400
D042	2,4,6-Trichlorophenol	88-06-2	2
D017	2,4,5-TP (Silvex)	93-72-1	1
D043	Vinyl chloride	75-01-4	0.2

1 Hazardous waste number.
2 Chemical abstracts service number.
3 If o-, m-, and p-Cresol concentrations cannot be differentiated, the total cresol (D026) concentration is used. The regulatory level of total cresol is 200 mg/l.
4 Quantitation limit is greater than the calculated regulatory level. The quantitation limit therefore becomes the regulatory level.

Appendix A4 – DMMP Committee Structure

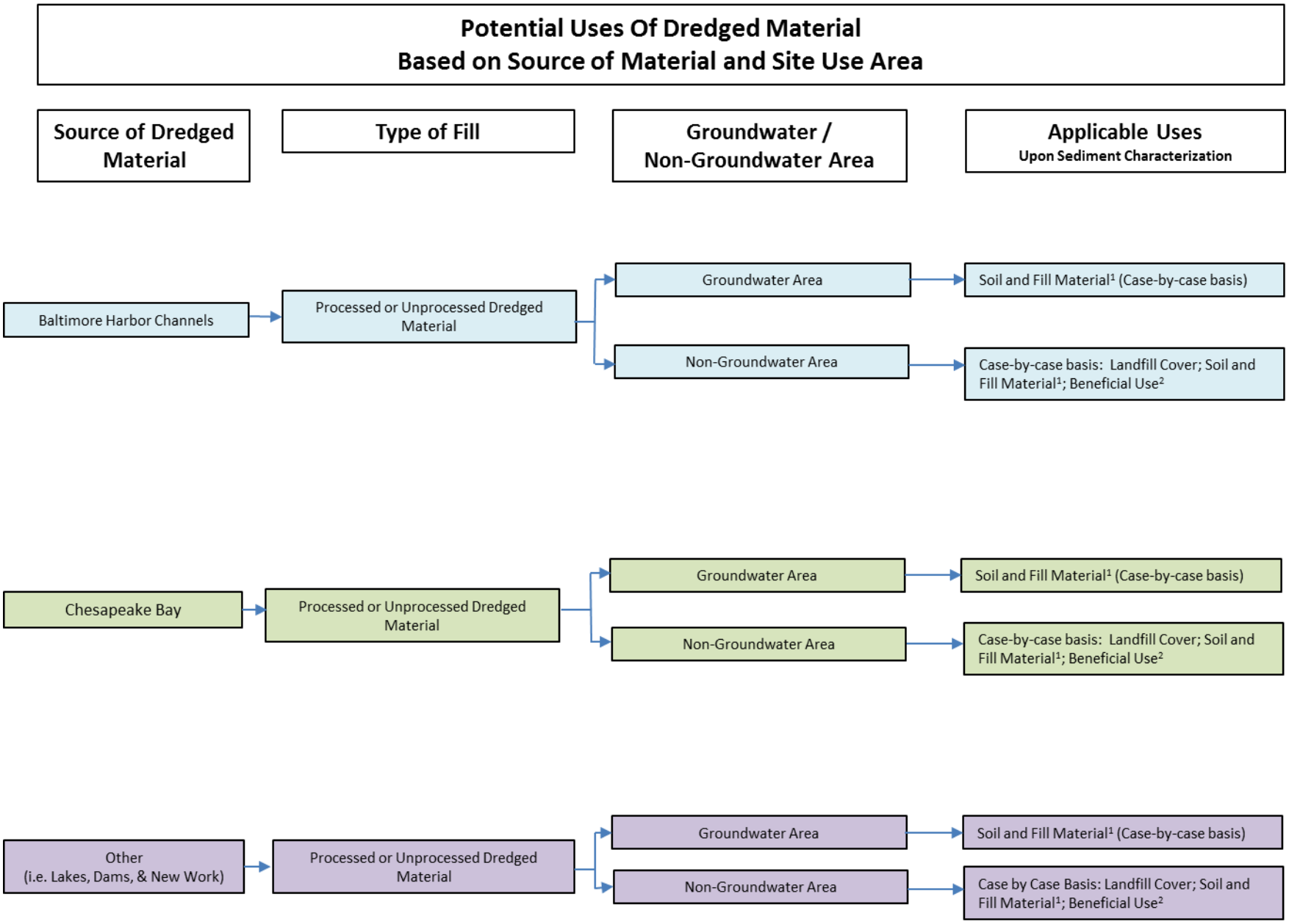


Appendix A5 – Overall End Use Determination Flowchart



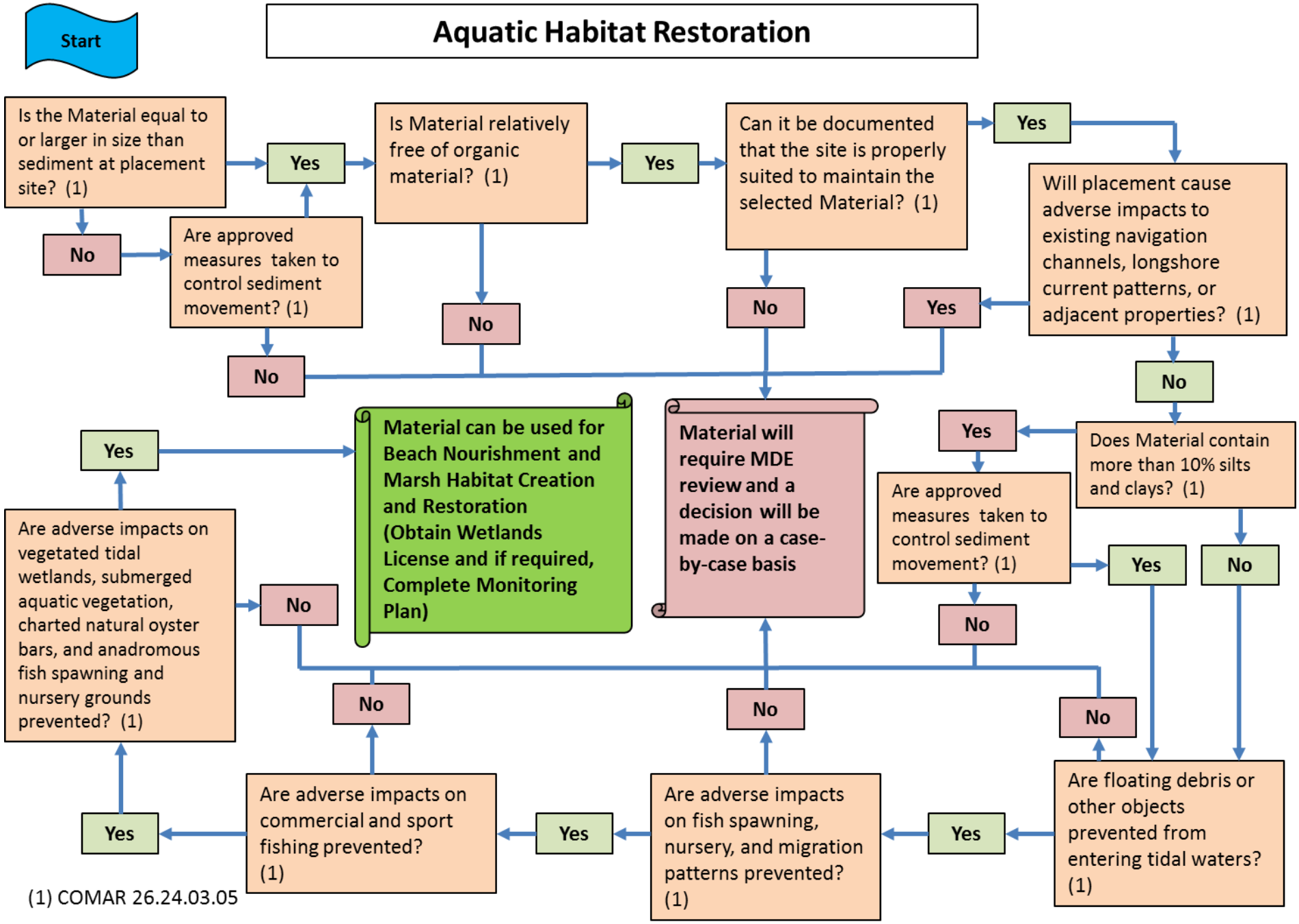
1. *Beneficial use of dredged material* is defined in Maryland Environmental Code §5-1101(a)(3) as a range of any of the following uses of dredged material from the Chesapeake Bay and its tributary waters placed into waters or onto bottomland of the Chesapeake Bay or its tidal tributaries, including Baltimore Harbor: (1) The restoration of underwater grasses; (2) The restoration of islands; (3) The stabilization of eroding shorelines; (4) The creation or restoration of wetlands; and (5) The creation, restoration, or enhancement of fish or shellfish habitats. Although this statutory language specifically calls out material from the Chesapeake Bay and its tidal tributaries, the beneficial use definition in regards to aquatic habitat terms could be used as a guide for dredging projects throughout Maryland.

2. *Innovative Reuse* is defined in Maryland Environmental Code §5-1101(a)(6) as "the use of dredged material in the development or manufacturing of commercial, industrial, horticultural, agricultural, or other products." Innovative reuse includes alternative daily, intermediate, or final cover to traditional earthen material that is currently used at active landfills, as well as soil and fills materials in the reclamation of brownfields, engineered fill for roadway bed material, parking lot foundations, or embankments and manufactured soil or soil amendments.



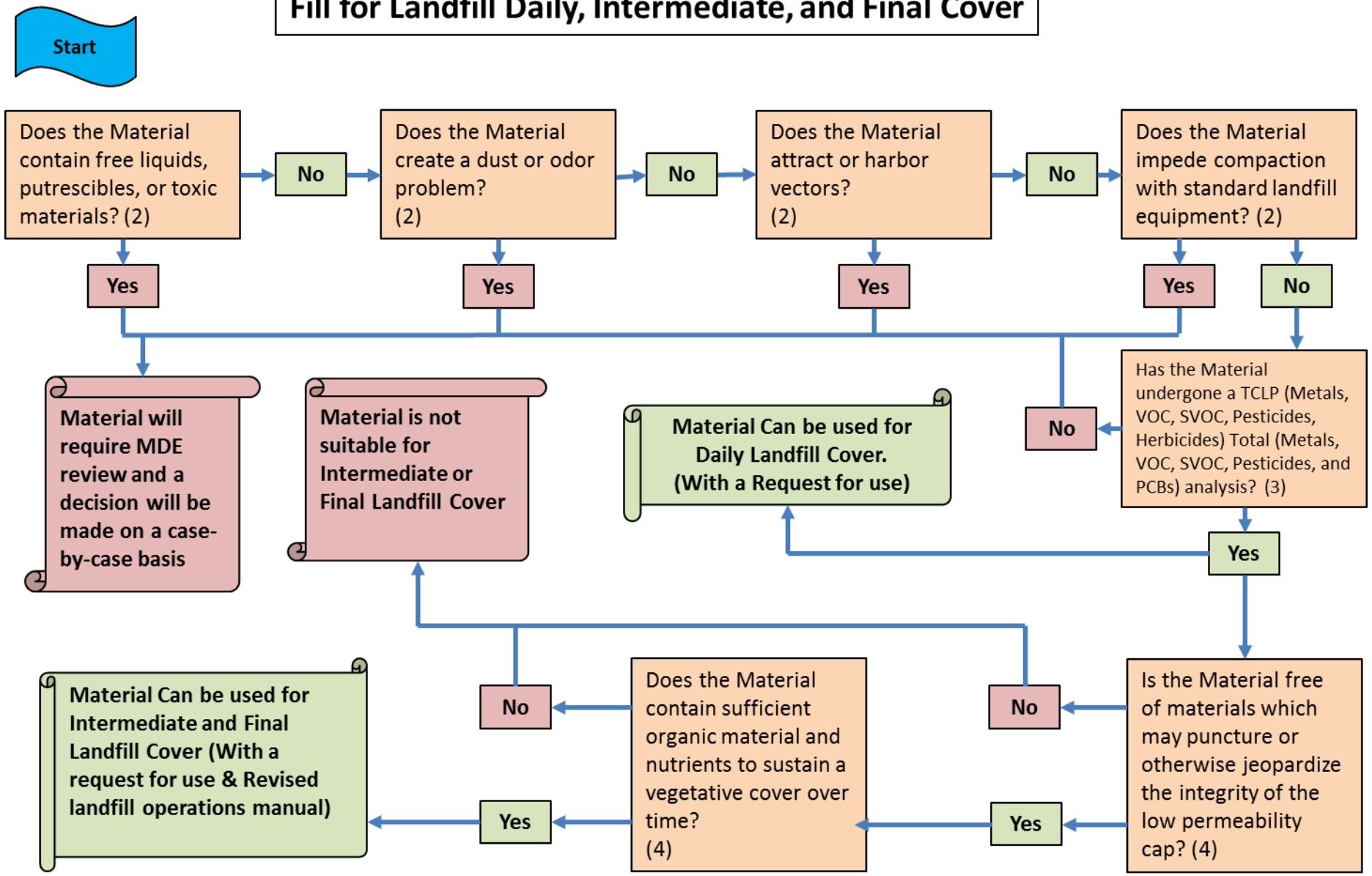
1. Brownfields Sites, Engineered Fill, Manufactured Soil or Amendment
2. Marsh Creation/Restoration, Beach Nourishment, Shoreline, Aquatic Habitat Creation/Restoration

Aquatic Habitat Restoration

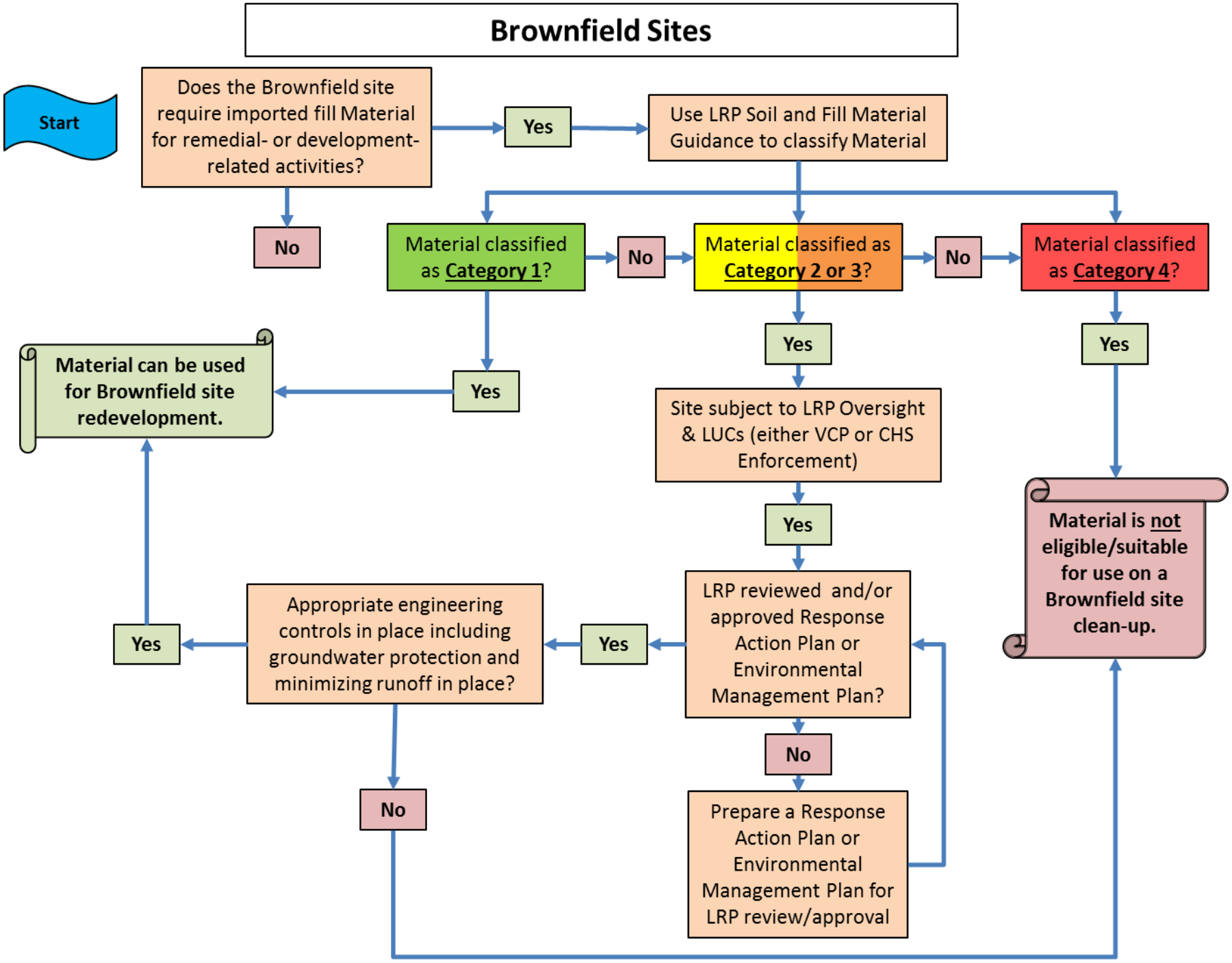


(1) COMAR 26.24.03.05

Fill for Landfill Daily, Intermediate, and Final Cover



(2) COMAR 26.04.07.10
(3) Innovative and Beneficial Use Workgroup Table of Uses: Fill for landfill daily cover with containment (Technical Criteria)
(4) COMAR 26.04.07.21


Brownfield Sites
Start
Does the Brownfield site require imported fill Material for remedial- or development-related activities?
Yes
No
Use LRP Soil and Fill Material Guidance to classify Material
Material classified as Category 1?
No
Material classified as Category 2 or 3?
No
Material classified as Category 4?
Yes
Material can be used for Brownfield site redevelopment.
Yes
Yes
Site subject to LRP Oversight & LUCs (either VCP or CHS Enforcement)
Yes
Material is not eligible/suitable for use on a Brownfield site clean-up.
LRP reviewed and/or approved Response Action Plan or Environmental Management Plan?
Yes
Appropriate engineering controls in place including groundwater protection and minimizing runoff in place?
Yes
No
Prepare a Response Action Plan or Environmental Management Plan for LRP review/approval
No

Appendix A6 – MDE Fill Material & Soil Management: Five Example Scenarios

Maryland Department of the Environment

Fill Material and Soil Management

Five Example Scenarios

The purpose of this document is to provide example scenarios for the reuse of dewatered dredged material (or fill material) and excess soil during the cleanup and redevelopment of properties throughout Maryland. To ensure that all projects are addressed consistently, the Department has prepared a draft Innovative Reuse and Beneficial Use of Dredged Material Guidance Document and accompanying Fill Material and Soil Management Fact Sheet. The fact sheet lists four categories of fill or soil material. The following hypothetical scenarios provide selected examples of how the guidance document and fact sheet can be applied to projects at sites under the purview of Land and Materials Administration's (LMA) regulatory programs.

Scenarios:

1. Use of fill material at a residential development (Category 1)
2. Use of fill material at a park, school, recreational facility, with or without an environmental cap (Categories 1 and/or 2)
3. Use of blended fill material for industrial redevelopment, with or without an environmental cap (Categories 1, 2, and/or 3)
4. Use of fill material for landfill cover (daily, intermediate and final) or on top of landfill closure cap (Categories 1 and/or 2)
5. Use of fill material impacted by oil or a controlled hazardous substance (Categories 1, 2, and/or 3)

Sources of dewatered dredged material or fill material and the proposed end use of the material or property will influence sampling requirements. Contact the Department for specific sampling requirements. The proposed fill material is sampled based on the projected volume of material that will be transported to the site and potentially the area of the site affected. Generally, a comprehensive multi-incremental sampling of source material is recommended in order to demonstrate that chemical concentrations meet the appropriate category criteria. Users of fill material must ensure appropriate erosion and sediment control mechanisms are in place to protect surface waters of the State.

1. Use of fill material at a residential development

- A developer needs fill material for a residential development grading project. Because this is a residential development, fill material must be initially screened against Category 1 screening criteria (based on an HQ of 0.1 and a 10^{-6} cancer risk). The fill material may be sampled as received or after any blending that is needed for the project. If the material passes the initial Category 1 screening criteria, the material may be used with no restrictions. If it does not pass the initial Category 1 screening criteria, a residential risk assessment may be conducted. The risk assessment is a more detailed process that takes into account site-specific factors but allows for a more flexible risk standard (based on an HI of 1 and a 10^{-5} cancer risk). By undergoing this additional evaluation, the developer

may determine that the dredged material is acceptable for the proposed Category 1 use even though it did not meet the initial screening criteria,

Groundwater Use Areas - Additional Considerations
If Scenario 1 occurs in a groundwater use area, the following additional considerations would apply:

- The Department discourages placement of fill material at or below the water table.
- Volume and source of fill material, geochemistry of fill material, local geology and hydrology as well as any other site specific factors, including mitigating factors that may exist or will be implemented, should be considered when placing large volumes of fill material in groundwater use areas.
- The Department may restrict the volume, depth, thickness of placement, and design features of a soil placement area, or reject the proposal, if the leachability of constituents of the material is likely to render groundwater unpotable or cause other material harm to the environment or public health or safety.

2. Use of fill material at a park, school, recreational facility, with or without an environmental cap

- A municipality or school needs fill material to construct recreational ball fields. For this type of end use (i.e., recreational facility, park, school), proposed fill material should be initially screened against Category 1 screening criteria (based on an HQ of 0.1 and a 10^{-6} cancer risk). The fill material may be sampled as received or after any blending that is needed for the project (either blending for engineering or vegetative growth purposes).

Scenario A: Use at a site with existing Category 1 soils:

- If the proposed fill material in the above example passes the initial Category 1 screening criteria, the material may be used with no restrictions. If it does not pass the initial Category 1 screening criteria, a recreational risk assessment may be conducted (based on an HI of 1 and a 10^{-5} cancer risk) to determine if the material may be used without restrictions.

Scenario B: Use at a site with existing Category 2 or 3 soils:

- If the proposed fill material in the above example is determined by sampling to fall within Category 2 or 3 rather than Category 1, it may be used at a park, school, or recreational facility under an environmental cap as long as existing soils or fill materials

at the site fall within the same or less stringent category. For example, off-site fill material that falls within Category 2 may be used under an environmental cap at a site with existing soils within Categories 2, 3, or 4, while off-site fill material that falls within Category 3 may only be used under an environmental cap at a site with existing soils within Categories 3 or 4. In this scenario, an environmental cap that meets a recreational or residential land use and institutional LUCs would be required.

Groundwater Use Areas - Additional Considerations
If Scenario 2 occurs in a groundwater use area, the following additional considerations would apply:

- The Department discourages placement of fill material at or below the water table.
- Volume and source of fill material, geochemistry of fill material, local geology and hydrology as well as any other site specific factors, including mitigating factors that may exist or will be implemented should be considered when placing large volumes of fill material in groundwater use areas.
- The Department may restrict the volume, depth, thickness of placement, and design features of a soil placement area, or reject the proposal, if the leachability of constituents of the material is likely to render groundwater unpotable or cause other material harm to the environment or public health or safety.

3. Use of blended fill material for industrial redevelopment, with or without an environmental cap

Scenario A: Use at a site with existing Category 2 soils:

- A developer is redeveloping an industrial site and needs a large quantity of fill material. The existing soils at the site fall within Category 2. The proposed fill material is sampled after being blended to meet engineering specifications. The sampling results show that the material meets the initial Category 2 screening criteria (based on an HQ of 0.1 and a 10^{-6} cancer risk). No further risk assessment is required and the material may be used at the site without a cap. An institutional LUC should be implemented to ensure that the property remains in industrial or commercial use.
- If the proposed fill material in the above example does not meet the initial Category 2 screening criteria, the developer may conduct a non-residential risk assessment that considers the final end use of the property. If the risk assessment shows that the fill material is acceptable for use at the site (based on an HI of 1 and a 10^{-5} cancer risk), the

material fits within Category 2 and may be used at the site without a cap. An institutional LUC should be implemented to ensure that the property remains in industrial or commercial use.

Scenario B: Use at a site with existing Category 4 soils.

- A developer is redeveloping an industrial site and needs a large quantity of fill material. The existing soils at the site fall within Category 4. The proposed fill material is sampled, after being blended to meet engineering specifications. Based on a risk assessment of the fill material, some of the fill material falls into Category 1, some into Category 2, and some into Category 3 . Fill material that falls into Categories 1 and 2 may be used throughout the site and may serve as an environmental cap. Fill material that falls into Category 3 may be used as fill material beneath an environmental cap. An institutional LUC should be implemented to ensure that the property remains in industrial or commercial use and that the environmental cap is maintained.

Groundwater Use Areas - Additional Considerations
If Scenario 3 occurs in a groundwater use area, the following additional considerations would apply:

- The Department discourages placement of fill material at or below the water table.
- Volume and source of fill material, geochemistry of fill material, local geology and hydrology as well as any other site specific factors, including mitigating factors that may exist or will be implemented should be considered when placing large volumes of fill material in groundwater use areas.
- The Department may restrict the volume, depth, thickness of placement, and design features of a soil placement area, or reject the proposal, if the leachability of constituents of the material is likely to render groundwater unpotable or cause other material harm to the environment or public health or safety.

4. Use of fill material for landfill cover (daily, intermediate and final) or on top of landfill closure cap

- **Scenario A: Use as daily cover**. Fill material proposed for use as daily cover should meet Category 1 or 2 screening criteria (based on an HQ of 0.1 and a 10^{-6} cancer risk). The fill material may be sampled as received or after any blending that is needed for the project. If the material does not meet the Category 2 screening criteria, a non-residential risk assessment may be performed (based on an HI of 1 and a 10^{-5} cancer risk) to assist

LMA in evaluating the use of the material as daily cover. All applicable regulations governing the landfill apply.

- **Scenario B: Use as intermediate or final cover**. Fill material proposed for use as intermediate or final cover should meet Category 1 or 2 screening criteria (based on an HQ of 0.1 and a 10^{-6} cancer risk). The fill material may be sampled as received or after any blending that is needed for the project. If the fill material falls into Category 1 or 2, it may be used at a landfill as intermediate or final cover if it will support vegetative growth. If the material does not meet the Category 2 screening criteria, a non-residential risk assessment may be performed (based on an HI of 1 and a 10^{-5} cancer risk) to assist LMA in evaluating the use of the material as intermediate or final cover. All applicable regulations governing the landfill apply.
- **Scenario C: Use on a closure cap**. Fill material that falls into Category 1 may be used at a landfill as the final two feet of soil over the closure cap. Fill material that meets Category 2 may be used with LUCs restricting future use of the landfill for recreational purposes. The fill material may be sampled as received or after any blending that is needed for the project. If the material does not meet the Category 2 screening criteria, a site-specific risk assessment (based on an HI of 1 and a 10^{-5} cancer risk) can be performed that takes into account the final end use of the property (e.g., recreational facility, park, etc.) to assist LMA in evaluating the use of the material on the closure cap. All applicable regulations governing the landfill apply.

5. Use of fill material impacted by oil or a controlled hazardous substance

- **Scenario A: Category 1 fill material impacted by oil or a hazardous substance**. A developer needs 500 tons of Category 1 fill material. The fill material may be sampled as received or after any blending that is needed for the project. When sampling for TPH, soil compositing is not recommended. All chemical concentrations fall within the initial Category 1 screening criteria (based on an HQ of 0.1 and a 10^{-6} cancer risk), or the proposed fill material undergoes a residential risk assessment (based on an HI of 1 and a 10^{-5} cancer risk) that determines the material is acceptable for use at the site. Additionally, total petroleum hydrocarbon (TPH) diesel range organics (DRO) or gasoline range organics (GRO) concentrations are below the Category 1 screening

criteria of 230 mg/kg. The oil and controlled hazardous substance impacted fill material may be used with no restrictions. Note: Category 1 fill material may also serve as a clean cap on properties that require an environmental cap. An institutional LUC is not necessary unless the fill material will serve as an environmental cap on a contaminated property.

- **Scenario B: Category 2 fill material impacted by oil or a hazardous substance**. A developer needs a large quantity of Category 2 fill material. The fill material may be sampled as received or after any blending that is needed for the project. When sampling for TPH, soil compositing is not recommended. All chemical concentrations fall within the initial Category 2 screening criteria (based on an HQ of 0.1 and a 10^{-6} cancer risk), or the proposed fill material undergoes a non-residential risk assessment (based on an HI of 1 and a 10^{-5} cancer risk) that determines the fill material is acceptable for use at the site. Additionally, TPH-DRO and TPH-GRO concentrations are below the Category 2 screening criteria of 620 mg/kg. No further risk assessment is required and the material may be used at the site without a cap. An institutional LUC should be implemented to ensure that the property remains in industrial or commercial use.
- **Scenario C: Category 3 fill material impacted by oil or a hazardous substance**. A developer needs fill material to use as engineered fill underneath environmental caps on an industrial property. The fill material may be sampled as received or after any blending that is needed for the project. When sampling for TPH, soil compositing is not recommended. All chemical concentrations fall within the Category 3 screening criteria and TPH-DRO and TPH-GRO concentrations are below 620 mg/kg. No risk assessment is required and the material may be used at the site beneath an environmental cap. An institutional LUC should be implemented to ensure that the property remains in industrial or commercial use.
- **Scenario D: Category 4 material impacted by oil or a hazardous substance**. Proposed fill material is sampled after any blending and is found to exceed Category 3 criteria, or TPH-DRO and TPH-GRO concentrations are found to exceed 620 mg/kg. The material should not be used as soil or fill material. LMA may require a LUC and cap maintenance requirements if the material will remain in place, or may require transfer of the material to a waste facility permitted to accept the material.

Groundwater Use Areas - Additional Considerations

If Scenario 5 occurs in a groundwater use area, the following additional considerations would apply:

- In groundwater use areas, users of fill material impacted by liquid phase mobile contaminants of concern, such as petroleum hydrocarbons and liquid phase industrial products, must ensure placement of fill material does not adversely impact groundwater resources.
- The Department discourages placement of fill material at or below the water table.
- Volume and source of fill material, geochemistry of fill material, local geology and hydrology as well as any other site specific factors, including mitigating factors that may exist or will be implemented should be considered when placing large volumes of fill material in groundwater use areas.

Additional factors to consider when utilizing fill material

- Volatiles are not a common component of most fill materials such as dredged material or most urban fill. However, if fill materials are from locations with known volatile organic compound (VOCs) impacts, or facilities with known recognized environmental conditions where VOCs are present, the user should consider vapor intrusion and potentially other engineering controls prior to use of fill material.
- Site and use specific factors should always be considered when utilizing fill materials and the guidance and supporting documents are designed to work in conjunction with existing laws and regulations and do not constitute a substitute for those laws and regulations. This is particularly relevant for erosion and sediment control.
- Other alternate uses and sources of fill material will be considered on a case by case basis and the Department encourages research in these fields.