24. Pipelines Crossing Contaminated Areas

This section provides the minimum standard criteria for the design and construction of water and sewer pipelines in contaminated areas. This section is intended to be a guideline. As new regulations, industry standards, and innovative technologies (remedial actions and pipeline construction) evolve, it is the responsibility of the designer to evaluate the technologies available and utilize the best available technology for pipeline construction in contaminated areas, such that the following four minimum standard criteria will be met to the WSSC's satisfaction:

a) No unreasonable risk to WSSC customers.

b) No more than minimal risk to WSSC workers (risk that could be managed with Level D personal protective equipment).

c) No more than minimal increase in operational and maintenance costs.

d) No unreasonable liability risks for the WSSC.

This section is arranged to provide the designer with general and background information about encountering contamination Section 24.a.2), the types of contaminants (Section 24.b.1), and how to determine the distribution of contaminants (Section 24.b.2) including consideration of future migration (Section 24.b.3) and risks (Section 24.b.4). Trench excavation in contaminated areas is outlined in Section 24.c, pipeline materials for contaminated areas are outlined in Section 24.d, and trench backfill considerations in Section 24.e.

a. General.

1) Definitions

a) Action Level - used by Occupational Safety & Health Administration (OSHA) and National Institute for Occupational Safety and Health (NIOSH) to express a health or physical hazard. Indicates the level of a harmful or toxic substance/activity which requires medical surveillance, increased industrial hygiene monitoring, or biological monitoring. Action levels are generally set at one half of the permissible exposure limit (PEL), but the actual level may vary from standard to standard. The intent is to identify a level at which the vast majority of randomly sampled exposures will be below the PEL.

b) Environmental Professional - registered Professional Engineer (geotechnical, environmental), geologist, engineering geologist, hydrogeologist, or environmental scientist certified by respective professional associations, or qualified by combination of education and experience to prepare subsurface investigation plans and direct their execution.

c) Groundwater Standard - either the Maximum Contaminant Level (MCL) value for a chemical, the Secondary Drinking Water Regulation value for a chemical, or the highest value from the criteria identified in the Maryland Department of the Environment Generic Numeric Cleanup Standards for Groundwater.

d) Hazardous Substance - any substance defined as a hazardous substance under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 or in any update or amendment; or identified as a controlled hazardous substance by the Department in the Code of Maryland Regulations.

e) Lower explosive limit (LEL) - the lowest concentration of gas or vapor that burns or explodes, at ambient temperatures, if an ignition source is present.

f) NAPL - Non Aqueous Phase Liquid (NAPL) in surface water, groundwater, the vadose zone, or the ground surface. NAPLs commonly encountered include LNAPLs, or light NAPLs which are commonly associated with petroleum-related products and have a density less than water, or DNAPLs, dense NAPLs, which are commonly associated with chlorinated solvents and have a density greater than water. Soluble NAPLs may partition to aqueous phase; volatile NAPLs may partition to gas phase.

g) Permissible Exposure Limit (PEL) – the maximum concentration of a chemical that a worker may be exposed to under OSHA regulations. PELs can be defined as ceiling values (or concentrations that should not be exceeded at any time), or 8-hour Time Weighted Averages that are average values of exposure over the course of an 8 hour work shift.

h) Soil Screening Criteria – Screening criteria (concentration for an individual chemical) above which additional assessment/evaluation of potential risk to human health or the environmental and/or design specification to address impacted soil are required. The soil screening criteria may be developed by the designer based on site specific land use. In lieu of developing site specific criteria, the designer may base the screening criteria on one of the following:

   EPA Region III Risk Based Concentration, State of Maryland Cleanup Standard for Non-residential Soil, or State of Maryland Anticipated Typical Concentrations (published background concentrations).

2) Encountering Contamination

To the extent practical, align the pipeline to avoid contaminated areas. See the Flowchart for Evaluating and Encountering Contamination in Pipeline Areas on page C-24.11 thru C-24.14 in this section. Where avoidance of contaminated areas is not practical, design and construction of the pipeline is to be planned such that nature and extent of contamination are delineated along the pipeline alignment. Following delineation, design and construction must be planned such that one of the following conditions is met:

a) All contamination is removed from the alignment area, and the areas immediately adjacent and/or up-gradient of the alignment to background conditions;

b) Contamination is removed from the alignment area and the areas immediately adjacent and/or up-gradient of the alignment based on state, federal, or site-specific screening criteria applicable for the alignment area; or,

c) The design and construction of the pipeline alignment incorporates engineering controls and response measures to mitigate contaminant migration pathways and exposures to the pipeline. Design and construction should also include the following:

(1) Delineation of the nature and extent of contamination along the pipeline alignment and the areas directly up-gradient of the alignment.

(2) Health and safety plan to address or eliminate potential worker exposures during pipeline construction and maintenance.

(3) Management plan for impacted media removed during pipeline construction and maintenance.

(4) Pipeline materials which are compatible with the contaminant(s) identified in soil, groundwater and/or soil gas.

(5) Design considerations to ensure no environmental degradation occurs along the pipeline trench or inside the pipeline due to the transport of contaminants. For an example of Environmental Considerations for Pipeline Design through Impacted Media are shown on page C-24.15 in this section. The designer must consider appropriate screening criteria for soil, groundwater and air; environmental monitoring recommendations specific to the contaminant(s) encountered; compatibility of system materials specific to the contaminant(s) encountered; and waste management options for contaminated soil and groundwater in completing investigation, design and construction of a pipeline through a contaminated area. Long term operation and maintenance requirements such as venting of gases, groundwater treatment, and health and safety plans for WSSC personnel should also be addressed.

3) Cross Reference to Related Information and WSSC Documents

For the WSSC minimum requirements for evaluating potential impacts along possible WSSC pipeline alignments, refer to the contamination screening procedures established in the WSSC Development Services Process Manual and the Design Checklist in Appendix A of this manual.

For geotechnical considerations for the design of pipelines through contaminated areas, see also Part Three, Section 19, (Geotechnical Considerations for Pipeline Alignments).

b. Contaminant Type and Distribution.

Water and sewer system materials (e.g. pipe material, linings, gaskets) can react with contaminants in the gas, liquid or solid phases in the surrounding external environment. Installation and repair of system components provide additional opportunity for contaminants in the subsurface environment to pose worker exposure as well as intrusion hazards into the pipeline. Commonly encountered contaminants include volatile organic compounds (petroleum – based and chlorinated solvents), explosive gases, asbestos, metals, and refuse.

1) Commonly Encountered Contaminants

a) Petroleum Products (LNAPL and partitioned)

Associated sources of petroleum products include gasoline filling stations, automotive repair facilities, bulk oil storage terminals, and underground storage tanks. Common chemicals of concern include benzene, toluene, ethylbenzene, xylenes (BTEX), methyl tert-butyl ether (MTBE), naphthalene, and semi-volatile organic compounds (SVOCs).

b) Chlorinated Solvents (DNAPL and partitioned)

Associated sources include dry cleaners, machining operations and automotive refinishing and repair operations. Common chemicals of concern include the VOCs tetrachloroethene (PCE or PERC), trichloroethene (TCE), trichloroethane (TCA), dichloroethene (DCE) isomers, vinyl chloride, carbon tetrachloride, and chlorobenzene.

c) Landfill Operations (e.g. explosive and toxic gases such as methane, hydrogen sulfide)

Associated concerns at landfills include explosive and toxic gases. Any VOC that is present at concentrations in excess of its LEL presents an explosive hazard. One common explosive gas, methane, is a colorless, odorless gas which present a health and safety hazard and explosion hazard. Its vapor density is 0.554 and is, therefore, lighter than air. Slightly soluble in water.

d) Asbestos

Associated sources include piping material (asbestos cement pipe material, surrounding geologic formation). Airborne asbestos fibers present a significant worker inhalation exposure hazard during the installation and repair of pipelines.

e) Metals

Associated sources include landfills and industrial facilities. Common metals identified include lead, arsenic, chromium, and mercury. May be less mobile in the subsurface if adsorbed on soil matrix, but some soluble ionic fraction can travel in groundwater.

2) Depth and Horizontal Extent of Impacted Ground Relative to Depth and Length of Pipeline

Where potential contamination has been confirmed, an investigation must be performed to determine the nature and extent of the contamination within the pipeline alignment area. Prior to start of construction activities, an environmental sampling plan, prepared by an Environmental Professional should be submitted to WSSC for review. Depending upon the site characteristics, regulatory oversight may be required. Where applicable, the Environmental Professional is responsible for coordinating and performing investigatory activities as promulgated. Timelines for submittals of environmental sampling plans, investigation results, and related documents should be established by the designer at the onset of the project and should be sufficient to allow the WSSC appropriate time for review and comment.

Examples of investigation considerations which may be appropriate for each of the above contaminants are presented on the environmental consideration matrix included in Flowchart for Evaluating and Encountering Contamination.

3) Future Contaminant Migration from Impacted Areas Adjoining New Pipeline

Potential future contaminant exposure and migration of the contaminant(s) should be considered as part of the pipeline design. Where appropriate, this evaluation may include fate and transport assumptions, evaluation of potential exposure pathways, and evaluation of the potential for permeation and leaching and transport along the pipeline alignment.

4) Risk Considerations

Risk to human health and the environment should be considered for alignments crossing or located in the vicinity of contaminated areas. The scope of the risk assessment may be qualitative or quantitative in nature. However, the designer must provide sufficient information to WSSC to evaluate the need for engineering controls and response measures to mitigate contaminant migration pathways and exposures along the pipeline alignment and to meet the four minimum standard criteria for the design and construction of water and sewer pipelines in contaminated areas as stated in the introduction to this section.

a) Acute vs. Chronic Exposure Conditions

Include within the risk assessment a summary of acute and chronic effects associated with the site contamination. Acute toxicity is considered to be any poisonous effect produced within a short period of time following exposure and resulting in biological harm and often death; chronic exposure is considered to be of a persistent, recurring, or long-term nature.

b) Comparison to Soil Screening Criteria

For each contaminant identified at the site, the maximum concentration should be compared to established state and / or federal screening criteria (human health and the environment), federal worker exposure criteria (OSHA action limits, permissible exposure limits) as an initial screening to determine engineering controls and/or response measures to be incorporated into the design and construction of the pipeline alignment.

c. Trench Excavation Considerations.

Where the contamination is left in place in the pipeline alignment area, or removed only to the extent required by state, federal, or site-specific screening criteria applicable for the alignment area, design and construction should incorporate engineering controls and response measures to mitigate contaminant migration pathways and exposures.

1) Soil Screening Criteria

Design and construction should include a plan for environmental oversight by an Environmental Professional and screening of soil excavated during construction of the pipeline. This plan should provide guidance for the screening, management, storage and disposal of contaminated soil removed during excavation activities. The plan should also specify screening equipment and action levels (for reuse, segregation, and disposal) specific to the contaminant identified within the pipeline alignment area. Specific soil screening equipment and action levels will be based on the contaminants and concentrations identified in the pipeline alignment area.

2) Dewatering

Design and construction should include a plan for testing, storage (if required), treatment (if required), and disposal of groundwater removed during dewatering. Dewatering must be performed in accordance with state and federal regulations and must meet any site specific discharge criteria (e.g. permits).

3) Worker Health and Safety

As is the case with all WSSC construction, it is the responsibility of the contractor to provide proper health and safety measures for his workers and comply with federal, state, and local laws, ordinances, and regulations pertaining to safety and handling of the contaminated soil and/or groundwater. The designer must submit all necessary information, including Health and Safety precautions, in order that the WSSC can inform the contractor of all potential hazards. Contractors' workers may need to receive health and safety training, be equipped with proper personal protection equipment and monitoring equipment, and undergo regular medical surveillance programs to monitor potential health impacts.

a) Protective clothing and equipment provided for worker safety shall be used during construction and shall conform with the contractor's Health and Safety Plan, and all applicable codes and regulations.

b) The contractor is to submit a Health and Safety Plan to the WSSC for review prior to the start of construction.

c) Once the construction has been completed, the contractor must provide a framework for Health & Safety Precautions that will be necessary during WSSC's future repair and maintenance of these pipelines.

4) Waste Management

Design must include a management plan for impacted media removed during pipeline construction and maintenance. Implementation of the plan will be the Contractor's responsibility, and the WSSC reserves the right to inspect for plan compliance during construction at any time. Required plan elements include:

a) All waste material generated during construction, including excavated soil and groundwater, as applicable, must be characterized for appropriate disposal and/or reuse options. Disposal must be performed in accordance with state and federal regulations.

b) Excavated material that is considered contaminated shall be segregated and each shall be stockpiled separately. Excavated material shall be placed on and covered with polyethylene sheeting and surrounded by a temporary fence with warning signs that read as follows: KEEP OUT. CONTAMINATED SOIL AND REFUSE MATERIAL.

c) Excavated material considered contaminated shall be transported off-site by a permitted waste carrier to an authorized contaminated waste disposal facility. The contractor shall arrange for transport and disposal of the segregated contaminated material, and shall be responsible for securing appropriate documentation certifying the proper transport and disposal of contaminated materials. The contractor shall submit this certification as soon as practicable and not later than 30 days after completion of work in the area of contamination.

d. Pipeline Material Considerations.

Materials selected for pipeline construction, including pipe materials, coatings, trench linings, gaskets, and appurtenances must be compatible with identified site contaminants such that permeation, leaching, or transport along the pipeline alignment area is limited to the greatest extent possible.

Examples of compatible material options, specific to the common contaminants presented in this section, are provided in the environmental consideration matrix included in Appendix 24-2; however, as industry standards and innovative construction technologies or materials emerge, it is the responsibility of the designer to evaluate the technologies available and utilize the best available technology for pipeline construction. Design guidelines and considerations for selection of appropriate pipeline materials are presented in this section.

1) Pipe Resistance to Permeation and Degradation by Liquids and Gases

a) Pipe Materials

(1) In general, PVC is not suitable for water supply lines and sewer lines in areas contaminated with gasolines and solvents.

(2) Extreme caution shall be used if HDPE pipe is to be used at a contaminated area as it has a limited resistance to gasolines and solvents. The pipe manufacturer's maximum pressure rating should be reduced by 25% as a safety factor when the long term strength of the pipe is considered to be affected. Recommended not to use HDPE.

(3) Concrete is not suitable for areas contaminated with gasolines and solvents, as they can permeate the concrete.

(4) Ductile Iron (DIP) and steel pipes are not attacked by and are impermeable to hydrocarbon compounds. However, they can be corroded by acids and electrochemical reactions if unprotected.

b) Coatings

(1) For the purpose of corrosion protection, DIP and steel pipes are sometimes furnished with liquid epoxy coating (Bitumastic 300M), tape coating (TAPECOAT'S MAF along with their 7000 EPOXY) or fusion bonded epoxy coating.

(2) An additional option for coating pipes is to wrap the pipe with a single layer of polyethylene. If contaminant concentrations are very high, a second layer of polyethylene should be used.

(3) The selection of coating for chemical resistance must be coordinated with other corrosion control considerations. See part three, Section 28 (Corrosion Control).

c) Trench Lining

Flowable fill is recommended for use in contaminated areas. Flowable fill, as described in Standard Specification Section 03300 (Cast-In-Place Concrete), shall be made of cement, fly ash, and water. The pipe should be encased in flowable fill to one foot above the crown of the pipe.

2) Gaskets

a) The most common type of gasket used for Reinforced Concrete Pipe (RCP) is manufactured from natural rubber (NR). The chemical compound of the gasket is poly-isoprene. Gaskets for all WSSC concrete sewer pipes shall meet the requirements of ASTM C443.

b) The common type of gasket used for DIP and PVC is made of a synthetic rubber, which is a copolymer of styrene and butadiene (SBR). It is generally suitable for applications in fresh water, salt water and sanitary sewage environments. All gaskets for DIP shall meet the minimum requirements of AWWA C111/A21.11. Gaskets for all WSSC PVC sewer pipes shall meet the requirements of ASTM F477.

c) Nitrile (NBR) or Buna-N gasket is another type of gasket made of synthetic rubber, which is a copolymer of butadiene and acrylonitrile. In general, this type of synthetic rubber has good resistance to refined petroleum products like gasoline, kerosene, jet fuel and lubricating oils. It may not be effective for use with aromatic hydrocarbons like benzene and toluene or chlorinated hydrocarbons like chloromethane and chlorobenzene.

d) Viton, Fluorel, or FKM gasket is made up of fluoroelastomer or fluorocarbon rubber. It is a very special and expensive synthetic terpolymer that contains various proportions of fluorine, ethylene, and propylene. This material offers chemical resistance to about 95% of all industrial chemicals including aromatics and chlorinated solvents. It currently represents the best available technology for gaskets used in a hostile chemical environment.

e) If the gasket will be used for the pipes in a contaminated area, then the additional test as specified by ASTM D471 shall also be conducted to determine the effect of the liquids.

3) Material Compatibility and Junction with Contiguous Pipeline in Non-Contaminated Areas

At a junction with a contiguous pipeline, piping materials and junctions from the non-contaminated areas must be compatible with the contaminated areas. Further, the junction must be designed to limit transport along the pipeline alignment area. Typical methods used to limit transport include pipe bedding materials such as non-permeable plugs and flowable fill (24.e.1).

e. Trench Backfill Considerations.

1) Pipe Bedding Materials (low relative permeability, ability to not act as preferential conduit for contaminant migration)

   a) Bentonite for backfill, where required, shall be 100 percent high swelling granular sodium bentonite, with a maximum moisture content of 12 percent.

   b) Flowable fill, as described above, is a WSSC recommended backfill option.

   c) Specify any necessary provisions for future maintenance of the pipelines with special backfill material.

2) Limiting Contaminant Migration to Private Property via the Pipeline

   Transport along utility lines is a known hazard to homeowners. Therefore, transport along utility lines must be eliminated. Two known methods to limit migration along the utility lines are non-permeable plugs and flowable fill, which is much less permeable than gravel. Flowable fill has already been successfully utilized by WSSC.

3) Trench Isolation

   Trench isolation is recommended in pipeline alignment areas intercepting contamination. In addition to low permeable pipe bedding materials, liners (e.g. HDPE), stainless steel or ductile iron sleeves or equivalent barrier should be considered to isolate the trench from the surrounding impact(s). For example, pipe can be installed within a steel casing to prevent permeation of low-molecular weight hydrocarbons into the pipeline through its rubber joint gaskets.

4) Surface Capping

   Containment technologies, such as surface capping, may be appropriate to control the migration of a contaminant to sensitive receptors without reducing or removing the contaminant. Capping also reduces the infiltration and percolation of precipitation, and limits leaching of shallow contaminants to deeper pipelines or to groundwater.

   a) Hard-surface capping works by maintaining a high-strength, low-permeability cover over the waste to stabilize surface soil and reduce infiltration of surface water. The low-permeability layer can be made from either asphalt or concrete.

   b) In situ capping involves using containment of contaminated soil with a stable cover formed using layers of soil, sediment, gravel, rock, and/or synthetic materials. The cap reduces contaminant mobility and access to the contaminants.

   c) Capping system designs should consider the effect of any possible subsurface diversion or redirection of soil gas that may have been emitted at the ground surface prior to capping.

5) Gas Venting Systems

Venting systems may be appropriate and should be considered where VOC or explosive gas (e.g. methane) contamination has been identified. Further, where explosive gas contamination has been identified in association with landfills, the long term settlement of the pipeline shall be considered and appropriate design measures should be incorporated.

a) Where the concentration of a VOC (e.g. or explosive gas) is identified at concentrations greater than 25% of its lower explosive limit, consideration of a gas venting system may be required to reduce VOC concentrations to the allowable levels.

b) For VOC impacts, bioventing or soil vapor extraction may be appropriate as they are in situ remediation technologies that use indigenous microorganisms or volatilization to decrease concentrations of organic constituents adsorbed to soils in the unsaturated zone. Soils in the capillary fringe and the saturated zone are not affected. In bioventing, the activity of the indigenous bacteria is enhanced by inducing air (or oxygen) flow into the unsaturated zone (using extraction or injection wells) and, if necessary, by adding nutrients. It should be noted that implementation of a bioventing or soil vapor extraction system in the pipeline alignment area may delay pipeline installation or maintenance activities.

6) Liquid Monitoring Systems

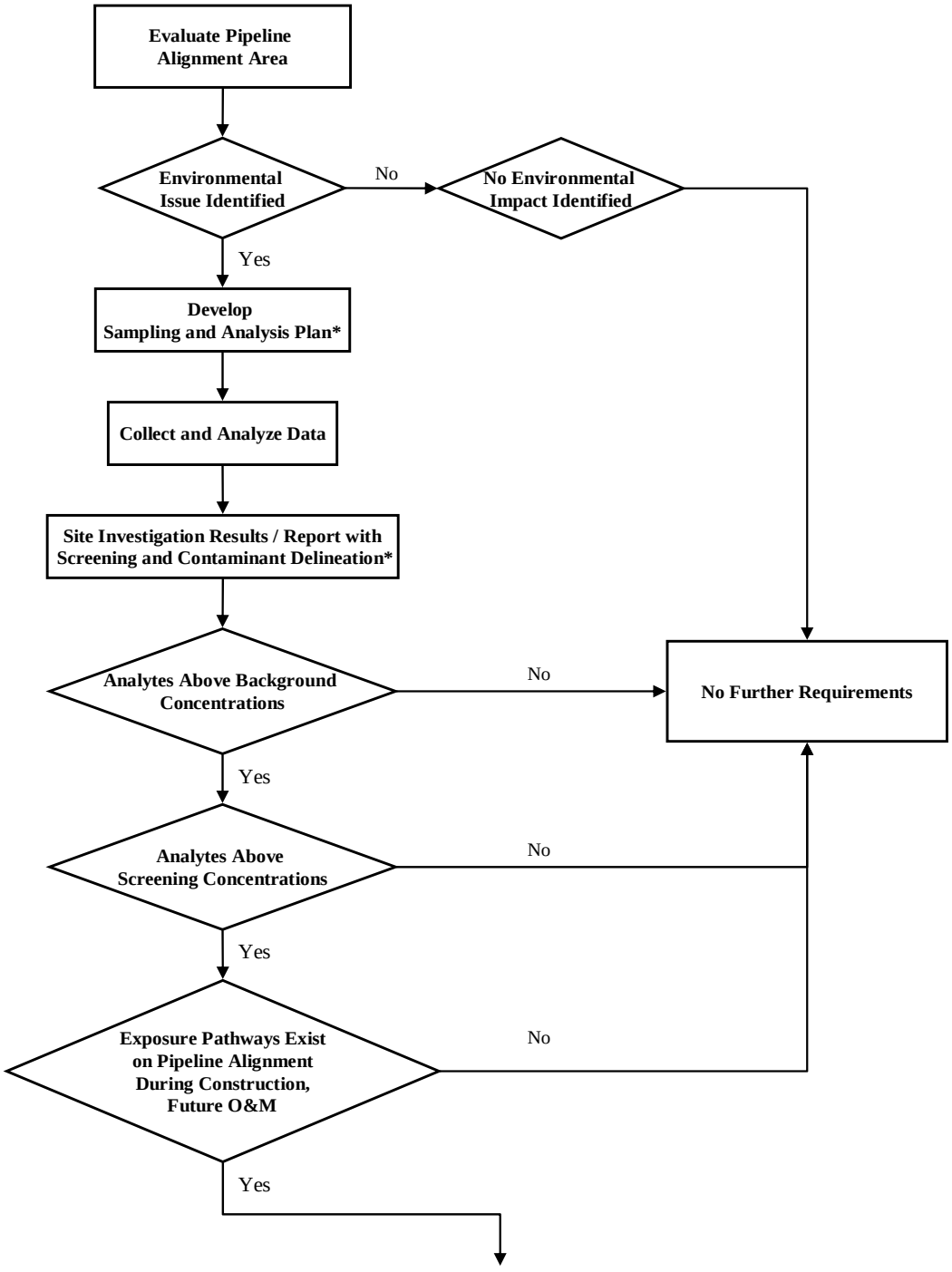
Where LNAPL, DNAPL, or concentrations of a contaminant are identified in groundwater intercepting the pipeline alignment area, a groundwater monitoring program, consisting of regular monitoring of groundwater quality and groundwater flow should be implemented as part of the design and construction of the pipeline to evaluate the continuing effectiveness of the pipeline design and ensure WSSC customer and worker safety.

f. Regulatory Considerations.

1) Coordination with EPA, MDE or County Environmental Agencies

Design and construction activities must comply with all applicable local, state and federal regulations. It is the responsibility of the designer to ensure the coordination with the appropriate agencies, obtain appropriate permits (e.g. NPDES, waste permits, utility clearances, etc.) and documentation (e.g. laboratory analytical reports), and conditions requiring oversight or specific training associated with the design and construction of the pipeline alignment.

FLOWCHART FOR EVALUATING AND ENCOUNTERING CONTAMINATION



FLOWCHART FOR EVALUATING AND ENCOUNTERING CONTAMINATION (continued)

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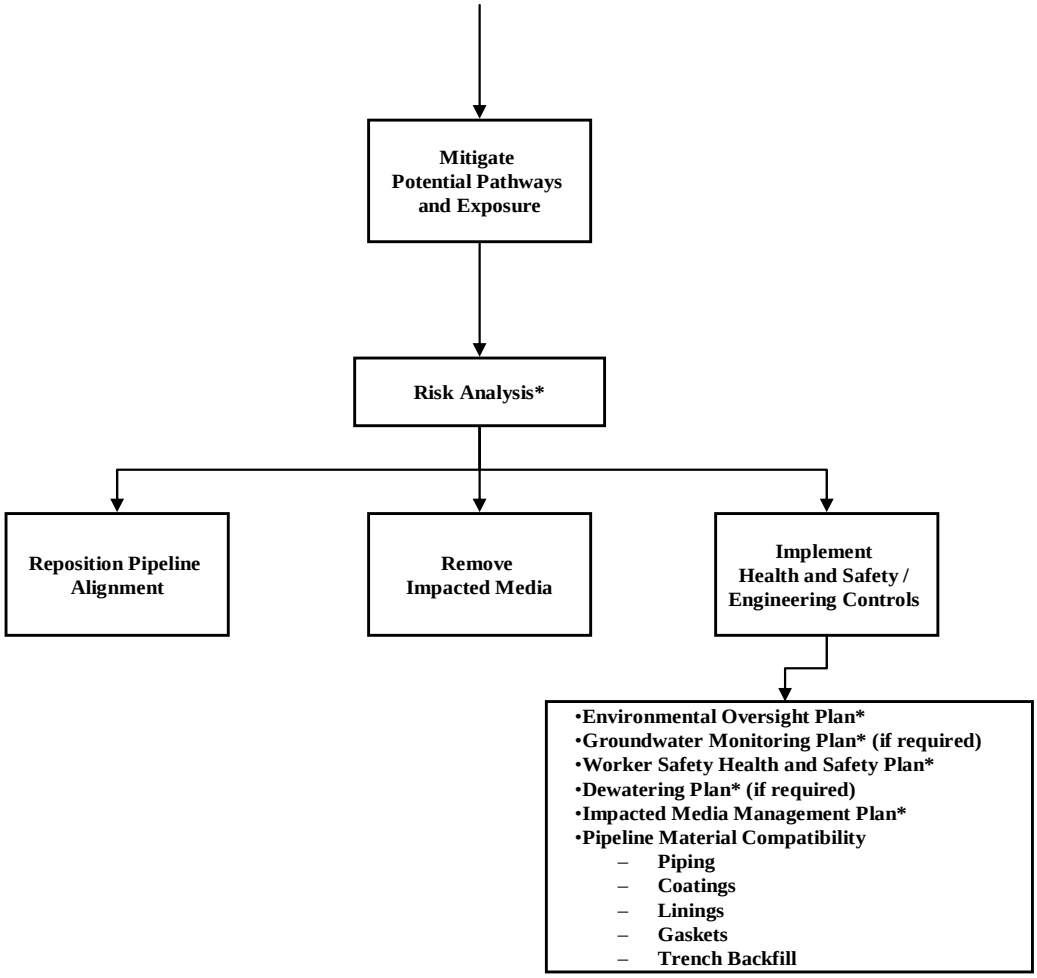

*WSSC review required before proceeding to next step.

FLOWCHART KEY

Flowchart for Evaluating and Encountering Contamination

EVALUATE ALIGNMENT AREA	The designer / applicant should evaluate the proposed alignment area for potential contamination in and surrounding the proposed alignment. At a minimum, completion of the WSSC Environmental Questionnaire and a site visit should be performed.
ENVIRONMENTAL ISSUE IDENTIFIED	If preliminary findings indicate a potential environmental condition, additional investigation should be performed to confirm or deny the presence of each potential environmental condition. Additional investigation could include: • Regulatory records review • Historic records review • Interviews with persons knowledgeable with the site • Phase I Environmental Site Assessment • Review of prior environmental investigations/remediation The results of the evaluation must be signed by an Environmental Professional and submitted to WSSC for review.
DEVELOP SAMPLING AND ANALYSIS PLAN	If an environmental condition has been confirmed or is suspected to exist, an investigation should be performed to determine the nature and extent of the contamination within the pipeline alignment area. Prior to start of construction activities, an environmental sampling plan, prepared by an Environmental Professional should be submitted to WSSC for review.
COLLECT AND ANALYZE DATA	Results of the environmental sampling should be compiled and interpreted. For each chemical identified in soil or groundwater within the pipeline alignment area, an exposure point concentration should be determined and compared to the selected screening criteria. Screening criteria may be background, or state or federally published standards (e.g. USEPA MCLs, USEPA RBCs, MDE Cleanup Standards).
BACKGROUND CONCENTRATIONS SCREENING	Background concentrations may be determined based on site-specific data or published background concentrations, such as the Maryland Anticipated Typical Concentrations (ATCs). If chemical(s) are identified below "background" concentrations, submit the results of the limited investigation for review by WSSC.
ANALYTES ABOVE SCREENING CRITERIA	A combination of background, state, and federally published standards, or site specific standards may be used for pipeline alignment area. If chemical(s) are identified above the selected criteria, the designer / applicant should perform an evaluation of potential exposure pathways. If chemical(s) are identified below screening criteria concentrations, submit the results of the limited investigation for review by WSSC.

FLOWCHART KEY (continued)

Flowchart for Evaluating and Encountering Contamination

EVALUATE POTENTIAL EXPOSURE PATHWAYS	The designer / applicant should evaluate nature and extent of impact and determine if exposure pathways exist 1.) during construction activities, 2.) within the pipeline alignment area, or will exist 3.) during future operation and maintenance of the pipeline. Submit the results of the evaluation and recommendations for review by WSSC. Example scenarios include the following: 1.) Non-volatile impacts (metals, asbestos) identified. Impacts are limited to surface soil above the pipeline alignment area and the contamination is not migrating. Exposure pathways during construction and future maintenance activities are complete. Recommend removal of impacted media, development of a plan for the management of impacted media and to address health and safety considerations during construction (e.g. dust monitoring, PPE). 2.) Volatile impacts are deep and limited to groundwater. Exposure pathway through soil vapor migration to the pipeline alignment area is complete. Recommend engineering controls, including using compatible pipeline materials to avoid permeation and transport and soil venting to avoid volatile gas buildup. 3.) Mixed media impacts identified throughout soil and groundwater intersecting the pipeline alignment area. All exposure pathways are complete. Recommend repositioning pipeline alignment, development of a plan for the management of impacted media and health and safety plan, and engineering controls during construction.

REMOVE IMPACTED MEDIA	Where impacted media removal has been recommended, an impacted media management plan identifying the proposed area and volume for excavation, excavation health and safety protocols and confirmatory sampling should be submitted to WSSC for review.

REPOSITION PIPELINE ALIGNMENT	Submit plans for repositioning of the pipeline alignment area for review to WSSC.

IMPLEMENT HEALTH AND SAFETY / ENGINEERING CONTROLS	As applicable, submit a health and safety plan, pipeline material recommendations and rationale, plan for the management of impacted media, and operations and maintenance plan to WSSC for review.

ENVIRONMENTAL CONSIDERATION MATRIX FOR PIPELINE DESIGN THROUGH IMPACTED MEDIA

Contaminant of Concern	Screening Criteria Reference			Environmental Monitoring Reference	Compatible Materials*				O&M
	Soil	Groundwater	Air		Piping	Gaskets	Trench Lining	Trench Backfill**	
Volatile Organic Compounds	MDE Cleanup Standards USEPA RBCs	MDE Cleanup Standards USEPA MCLs	PEL or TLV/STEL IDLH	NIOSH OSHA	Epoxy-coated Ductile Iron Pipe (hydrocarbons) Steel casing	NBR FKM EPDM (MEK, acetone)	Flowable Fill	Flowable Fill Bentonite	Venting Liquid Monitoring Groundwater Treatment Dewatering Health and Safety Plan
Semi-volatile Organic Compounds	MDE Cleanup Standards USEPA RBCs	MDE Cleanup Standards USEPA MCLs	PEL or TLV/STEL IDLH	NIOSH OSHA	PVC HDPE	Neoprene (heat and oil only) FKM	Overexcavate Geotextile fabric Warning layer	Clean Fill	Health and Safety Plan
Polychlorinated Biphenyls and Pesticides	MDE Cleanup Standards USEPA RBCs	MDE Cleanup Standards USEPA MCLs	PEL or TLV/STEL IDLH	NIOSH OSHA	PVC HDPE	NBR FKM	Overexcavate Geotextile fabric Warning layer	Clean Fill	Health and Safety Plan
Corrosive Soil/Groundwater	MDE Cleanup Standards USEPA RBCs	MDE Cleanup Standards USEPA MCLs	PEL or TLV/STEL IDLH	NIOSH OSHA	PVC HDPE	EPDM (dilute acids) FKM	Overexcavate Geotextile fabric Warning layer	Clean Fill	Health and Safety Plan
Mixed Impacts (Landfills)	MDE Cleanup Standards USEPA RBCs	MDE Cleanup Standards USEPA MCLs	PEL or TLV/STEL IDLH	NIOSH OSHA	Epoxy-coated Ductile Iron Pipe Steel casing	NBR FKM EPDM	Flowable Fill Bentonite	Flowable Fill Bentonite	Venting Liquid Monitoring Groundwater Treatment Dewatering Health and Safety Plan
Metals	MDE Cleanup Standards USEPA RBCs	MDE Cleanup Standards USEPA MCLs	PEL or TLV/STEL IDLH	NIOSH OSHA	PVC HDPE	NBR FKM	Overexcavate Geotextile fabric Warning layer	Clean Fill	Health and Safety Plan
Asbestos	MDE Cleanup Standards USEPA RBCs	MDE Cleanup Standards USEPA MCLs	PEL or TLV/STEL IDLH	NIOSH OSHA	***	***	***	***	Health and Safety Plan

* ANSI/AWWA Standards C900 through C950 state that if a water main must pass through an area of gross contamination, the manufacturer should be consulted regarding the permeation of the pipe walls and joint fittings prior to selecting the material. Pipe materials such as polyethylene, polybutylene, PVC, and asbestos cement; and elastomer gaskets (e.g. rubber, viton, etc.), may be subject to permeation by lower molecular weight organic solvents or petroleum products. It is recommended that newly lined pipes be flushed prior to release to service.

** Warning layer – placed to identify changed in soil conditions. Typically consists of thin, orange plastic webbing or equivalent.

*** Asbestos sources are typically associated with existing piping material (asbestos cement pipe material) or the surrounding geologic formation. Hazards presented are primarily associated with worker inhalation exposure hazard from airborne fibers during the installation and repair of pipelines.

Consideration Matrix Notes:

Screening Criteria/Environmental Monitoring References

MDE. 2001. *State of Maryland Department of the Environment Cleanup Standards for Soil and Groundwater Interim Final Guidance, Update No. 1.* August.

National Institute of Occupational Safety and Health (NIOSH)/Occupational Safety and Health Administration (OSHA)/U.S. Coast Guard (USCG)/U.S. Environmental Protection Agency (USEPA) *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, October 1985.

NIOSH. *Pocket Guide to Chemical Hazards (NPG).* U.S. Department of Health and Human Services, October 2003. DHHS (NIOSH) Publication No. 2004-103.

NIOSH. *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, October 1985.

OSHA. Standards for General Industry, 29 CFR 1910.1000, *Air Contaminants*.

OSHA. Standards for Construction Industry, 29 CFR 1926, including Hazardous Waste Operations and Emergency Response 29 CFR 1926.65, and Hazard Communication 29 CFR 1926.59.

OSHA. Standards for General Industry, Hazardous Waste Operations and Emergency Response 29 CFR 1910.120.

USEPA. Human Health Risk Assessment, Risk-Based Concentration Table. http://www.epa.gov/reg3hwmd/risk/human/index.htm.

USEPA. National Primary Drinking Water Regulations (NPDWRs or primary standards). http://www.epa.gov/safewater/mcl.html.

Piping Materials

Ductile Iron/Steel – Resistant to hydrocarbons; polyethylene encasement offers corrosion protection from acids and electrochemical reactions, in hydrocarbon impacted soil.

PVC – Polyvinyl chloride; not suitable for water supply lines and sewer lines in areas contaminated with gasolines and solvents.

HDPE – Limited resistance to gasolines and solvents. The pipe manufacturer's maximum pressure rating should be reduced by 25% as a safety factor when the long term strength of the pipe is considered to be affected.. Recommended not to use HDPE.

Concrete/Asbestos Cement – Not recommended for areas impacted with gasolines and solvents. Gasolines and solvents can permeate the concrete.

Coatings

Liquid Epoxy coating – Recommended for corrosion protection for ductile iron piping and steel piping.

Gasket Materials

Gaskets for all WSSC PVC sewer pipes shall meet the requirements of ASTM F477. If the gasket will be used for the pipes in a contaminated area, then the additional test as specified by ASTM D471 shall also be conducted to determine the effect of the contaminants present in the pipeline alignment area.

EPDM – Ethylene propylene diene monomer; EPDM is a general purpose synthetic rubber with good environmental resistance to dilute acids and bases, and chemical slats.

Neoprene – Heat and oil resistant synthetic rubber. Resistance to most unrefined petroleum products and aliphatic hydrocarbons, not recommended for solvents, fuels or unsaturated hydrocarbons.

NBR – Copolymer of butadiene and acrylonitrile, also referred to as nitrile. Synthetic rubber with good resistance to refined petroleum products such as gasoline, kerosene, jet fuel and lubricating oils. Not recommended for aromatic hydrocarbons such as benzene, toluene, or chlorinated hydrocarbons such as chloromethane and chlorobenzene.

FKM – Synthetic terpolymer, Fluorocarbon. Offers chemical resistance to 95% of all industrial chemicals including aromatics and chlorinated solvents. Excellent environmental and heat resistance.

NR – Most common gasket for Reinforced Concrete Pipe (RCP) is manufactured from natural rubber (NR). The chemical compound of the gasket is poly- isoprene. Gaskets for all WSSC concrete sewer pipes shall meet the requirements of ASTM C443.

SBR – Copolymer of styrene and butadiene that is the most common synthetic rubber used in pipe gaskets. SBR is the material upon which the AWWA C111/A21.11 Standard is based.

Trench Lining / Backfill

Flowable Fill – Recommended for use in contaminated areas. Flowable fill, as described in Specification Section 3300 (Cast-In-Place Concrete), shall be made of cement, fly ash, and water. The pipe should be encased in flowable fill to one foot above the crown of the pipe.

Washington Suburban Sanitary Commission
ENVIRONMENTAL QUESTIONNAIRE

		NO	YES
1.	To the best of your knowledge, is the property presently used for industrial and/or commercial purposes including, but not limited to, a landfill, gasoline station, motor repair facility, printing facility, dry cleaners, photo developing laboratory, junkyard, research laboratory, chemical manufacturing, mining, military facility or as a waste treatment, storage, disposal, processing, or recycling facility; or do you have any knowledge that the property was used for the above purposes in the past?	☐	☐
2.	To the best of your knowledge, is the adjoining property presently used for industrial and/or commercial purposes including, but not limited to, a landfill, gasoline station, motor repair facility, printing facility, dry cleaners, photo developing laboratory, junkyard, research laboratory, chemical manufacturing, mining, military facility or as a waste treatment, storage, disposal, processing, or recycling facility; or do you have any knowledge that the adjoining property was used for the above purposes in the past?	☐	☐
3.	To the best of your knowledge, are there currently any dumping, storage, burying, or burning of any hazardous substances, petroleum products, unidentified waste materials, industrial batteries, pesticides, paints, industrial drums, sacks of chemicals, or any other chemicals greater than 5 gallons at this property; or do you have any knowledge that the above activities occurred on the property in the past?	☐	☐
4.	To the best of your knowledge, are there currently any registered or unregistered underground and/or above ground storage tanks, vent pipes, fill pipes, injection and/or dry wells, transformers, capacitors, hydraulic equipment, stained soils, or contaminated wells at this property; or did you observe evidence or do you have any knowledge that the above were used/observed on the property in the past?	☐	☐
5.	Did you observe evidence or do you have any knowledge that fill material, other than top soil with a maximum depth of 4 feet, was ever brought to the property?	☐	☐
6.	Do you have knowledge of any past or present violations or alleged violations of environmental laws at the property?	☐	☐
7.	To the best of your knowledge, have any studies been prepared to address the impacts of any contamination that may exist on your property on the design, construction, and safe operation of water and sewer systems?	☐	☐
8.	Have you requested the WSSC to prepare on your behalf, and at your expense, a database search conducted per ASTM E-1527? If the answer to question 8 is no, please attach your database search or a Phase I report, per ASTM E-1527. Any Phase I report will be returned to you.	☐	☐

I HAVE ANSWERED THE ABOVE QUESTIONS TO THE BEST OF MY KNOWLEDGE AND HAVE INCLUDED AN EXPLANATION FOR ANY "YES" ANSWERS. IF APPLICABLE, I HAVE ATTACHED COPIES OF ANY REPORTS REFERENCED IN ITEM 7 ABOVE, OR ALL OF THEIR SECTIONS RELEVANT TO THE DESIGN, CONSTRUCTION, AND SAFE OPERATION OF WATER AND SEWER SYSTEMS. ALSO, I HEREBY ATTEST THAT I HAVE THE AUTHORITY TO SIGN THIS QUESTIONNAIRE AS THE OWNER OR AGENT/ENGINEER OF THE OWNER OF THIS PROPERTY.

Contract Number: _____

Name: _____ **Title:** _____

Signature: _____ **Date:** _____

Owner ☐ **or** **Agent/Engineer** ☐