MULTI-SITE CONCEPTUAL SITE MODEL

FORMER MANUFACTURED GAS PLANT SITES

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Revision 0
August 5, 2007

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FIGURES

ACROYNMS

BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
BLRA	Baseline Risk Assessment
BTEX	benzene, toluene, ethybenzene, xylene
CC	coal carbonization
COPCs	constituents of potential concern
CSM	Generalized Conceptual Site Model
CWG	carbureted water gas
DNAPL	dense non-aqueous phase liquid
HHRA	Human Health Risk Assessment
LNAPL	light non-aqueous phase liquid
MGP	manufactured gas plant
NAPL	non-aqueous phase liquid
PVOCs	petroleum volatile organic compounds
RAF	Risk Assessment Framework
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
SLERA	Screening Level Ecological Risk Assessment
SOW	Statement of Work
SSWP	Site Specific Work Plans
USEPA	United States Environmental Protection Agency
VOCs	volatile organic compounds

1 INTRODUCTION

1.1 Overview

This Generalized Conceptual Site Model (CSM) was prepared in accordance with the Statements of Work (SOWs) attached to the Settlement Agreement and Administrative Order on Consent (Settlement Agreement) between the United States Environmental Protection Agency (USEPA) and Wisconsin Public Service Corporation effective May 5, 2006; The Peoples Gas Light and Coke Company (Peoples Gas) effective June 5, 2007 and North Shore Gas Company effective July 23, 2007.

Development of the CSM is based on existing knowledge of each Site (generically presented) and discussions with USEPA. Media, pathways and/or receptors identified herein may not warrant further consideration at each of these Sites, or additional media, pathways and/or receptors may be identified in the Site-Specific Work Plans (SSWP), depending on site-specific conditions. The Site-Specific Completion Reports and/or SSWPs present the remedial investigation and remediation activities performed at each of the Sites. The completeness of these activities will be assessed by USEPA.

The Generalized CSM integrates historic property information to develop hypotheses of source areas, fate and transport mechanisms, exposure scenarios, and complete and incomplete exposure pathways. It also identifies potentially exposed receptors under the current and reasonably anticipated future land and water uses.

The Generalized CSM will be refined in the SSWPs and will be used to focus sampling design and/or remedial action efforts. As more data are generated, the CSM will be further refined to reflect the individual pathways at each particular Site. Similarly, as remedial actions are completed, the CSM will be revised to show those pathways that no longer exist.

An exposure pathway describes the course a chemical takes from the source to the receptor and is defined by five elements: 1) A source and mechanism of release; 2) An environmental transport medium; 3) A point of potential exposure with the contaminated medium; 4) A route of exposure at the exposure point; and 5) A receptor population. When all these elements are present, a pathway is considered complete. Only complete exposure pathways are considered for evaluation in a risk assessment.

The CSM includes the following:

Section 2.0 MGP Background – This section describes the former MGP processes, structures, and typical waste handling procedures to provide a framework for including each pathway.

Section 3.0 Former MGP and Physical Setting – This section identifies information that will be included in the SSWPs that affects the site-specific CSM pathways including manmade features, potential off-site sources, property boundaries, Site access, and other factors that may affect release, fate and transport.

Section 4.0 Potential Constituents, Media, and Pathways of Concern – This section identifies the process residuals, typical constituents of potential concern (COPCs), the media which are anticipated to be affected by previous operations, the interaction between the media, and the potential pathways to be considered.

Section 5.0 Potential Receptors and Exposure Scenarios – This section identifies the current and reasonable anticipated future land-use human health and ecological exposure scenarios and receptors that will be considered in the Generalized CSM. This section also identifies additional information to be included in the SSWP related to the demographics of the area, resource use locations, potential habitat locations, etc. and summarized the approach to be used to refine potential receptors that may be carried forward in risk assessments.

The approach to refining potential receptors that may be carried forward in risk assessments, the exposure assumptions for each receptor, and the tools for evaluating human health and ecological risks are discussed in the SSWP.

2 MGP BACKGROUND

2.1 Manufactured Gas Plant History

MGPs were industrial facilities that produced gas from coal, oil and other feedstocks. MGPs began operating in the United States in the early 1800s and as settlement and population centers expanded throughout the century. Coal gas from MGPs was used for all the same purposes that natural gas is used for today. In addition, in the late 1800s, gas was used for lighting prior to the introduction of electricity. Coal gas was stored on the MGP and then piped to the surrounding area for use in lighting, cooking, and heating homes and businesses.

At first, MGPs provided small amounts of gas for street lighting systems. However, by 1900, production had greatly increased, and gas was widely used for heating and cooking in urban centers, as most towns with sizable populations (over a few thousand people) had at least one MGP.

Following the end of World War II, MGPs were generally phased out as interstate pipelines provided natural gas to be distributed from the Midwest throughout the country. Natural gas replaced coal gas as the fuel of choice because it was both cheaper to provide and cleaner burning (NYSDEC, 2006). The MGPs formerly operated by Integrys and its predecessors were constructed as early as 1871; operations at most of the facilities ceased by the 1960s..

2.2 Gas Production Methods

Two processes were used to produce coal gas at the Integrys facilities. Coal Carbonization (CC) was the first process used to make gas at all the facilities, and it was relatively simple compared with the Carbureted Water Gas (CWG) process that was later used to produce gas.

Coal gas manufacturing using the CC process included the following (NYSDEC, 2006):

- The coal was heated in closed retorts (or beehive ovens) that kept the coal from combusting or burning by limiting the amount of air that could enter the retort;
- Volatile aromatic hydrocarbons would be driven off as a gas;
- The gas was then collected, cooled, and purified before being used; and
- By-product of the coal was coke, which was a valuable industrial commodity.

Following the Civil War, carbureted water gas (CWG) was introduced, and this method produced a gas mixture that burned hotter and brighter than gas produced using CC (NYSDEC, 2006). The former MGPs addressed by this document converted to the CWG process prior to closing down.

A variety of water gas processes were developed, but in general they shared these common process steps, including:

- Heating of the coal in a closed retort, similar to CC;
- During the heating process, steam was injected into the retort, and a chemical reaction occurred that produced a flammable gas mixture of methane and carbon monoxide; and
- Liquid petroleum hydrocarbons were sprayed into the hot gas mixture, and this created additional methane, as the hydrocarbon chains were "cracked" by the high temperature (a similar "cracking procedure is used today to convert crude oil into the constituents that comprise gasoline). The "cracking" procedure increased the heating and lighting potential of the gas (NYSDEC, 2006).

2.3 Waste/By-Products

Production of manufactured gas created a number of different by-products and wastes, such as coal tar, which was a dense oily liquid. The coal tar would separate from the gas throughout production, storage, and distribution, and this material was collected at various points in the process. Sometimes, coal tar was sold for use as a lumber preservative or for roofing material, while other times it was simply disposed of via on-property pits or other land disposal activities, from which it could contaminate soil, groundwater, surface water, and water body sediments.

Other byproducts included purifier wastes, which were comprised of either lime or wood chips (treated with iron oxides) that were was used to remove cyanide and sulfur from the coal gas. Once the purifying material had become saturated with impurities, this material was generally discarded on the property as fill. Purifier wastes may contain complexed cyanide compounds that can contaminate soil and groundwater. The wastes can also generate strong, objectionable odors when exposed at the ground surface (NYSDEC, 2006).

A listing of typical process by-products is summarized below (GRI, 1996).

Process Residuals from Manufactured Gas Plants

Process Residual	Coal Carbonization	Carbureted Water Gas
Coal Tar	X	X
Oil Tar	-	X
Tar/Oil/Water Emulsion	-	X
Tar Decanter Sludge	X	-
Ammonia Saturator Sludge	X	-
Acid/Caustic Hydrocarbon Treatment Sludges	X	-
Wastewater Treatment Sludges	X	X
Coke	X	-
Ash	X	X
Spent Oxide/Lime	X	X
Sulfur Scrubber Blowdowns	X	X
Ammonium Sulfate	X	-

"X": residual was produced by the process; "-": residual was not produced by process

A listing of typical MGP components, the use of the component and the location and potential for MGP residuals is summarized below (Hatheway, 2005).

Component	MGP Use	Waste Source Location & Potential
Transportation Spur	Delivery point of feedstocks; exit point of salable residuals.	Human labor was a significant cost to gas making. Feedstocks were brought as close as possible to the retorts and generator houses.
Coal Yard	Storage area which kept coal dry for optimal use in firing boilers or as retort feedstock.	Kept as close as feasible to the retorts and generators. Many plants chose to place coal in sheds so as to optimize gasification in the presence of minimal water content.
Coke Yard	By-product coke from coal-gas plants.	Used symbiotically as feedstock for various water gas plants, especially as co-located.
Retort House	Coal-gas retorts housed internally in benches; groups of benches known as stacks.	The central building of the gas-making process; generally located at the corner of the plant with highest elevation and near the gate, from which the processed gas left the plant through the station meter. Origin of coke quench water = ammoniacal liquor.

Component	**MGP Use**	**Waste Source Location & Potential**
Generator House	Location of generator sets for carburetted water gas and oil-gas processes.	Generation capacity such that vastly smaller space required for commensurate production over that required for coal-gas process.
Condenser House	Building or addition immediately adjacent to retort house or generator house.	After 1910, tended to be out-of-doors. Same configuration used for all gas generating processes; a wet process that concentrated and/or precipitated tars for further management.
Scrubber	Tall (5-10 m) right-circular cylinders with slanted trays holding contaminant-absorbing wood fiber/chips.	Usually employed a water shower to remove tar and other process residuals from the gas. Residuals captured in scrubber sump for further management.
Washer	Gas immersed in agitated water bath to cool gas and drop tar particles into its sump.	With carburetted water gas and enhanced oil-gas. When designed as a water-seal/wash box, placed first in the clarification sequence as a seal against back-flow of gas.
Combined Washer-Scrubber	When employed, generally post-1895.	Enhanced the recovery of tar from gas. Trapped tar held on sorbant and in sump.
Sumps of Clarification Devices	Condensers, scrubbers and washers, and their combinations had bottom sumps to trap and yield tar and tar sludges.	Tar generally removed manually for recovery, reuse or dumping. Spills and leaks assumed in a generic sense. Tar sludges contained refractory geologic impurities such as quartz and feldspar, entering the system mainly from feedstocks.
Exhauster	Steam-driven gas evacuator employed to reduce gas pressure and promote flow through system.	Position of exhauster chosen by the plant gas engineer to achieve optimal flow of gas through the tar-removal clarification process; most plants had a backup exhauster in parallel.

Component	MGP Use	Waste Source Location & Potential
Purifiers (Purifier Boxes)	Gas was passed through "boxes" containing layers of lime, wood chips, iron impregnated wood chips, oxide of iron (particles) and/or strips of iron as various forms of sorbants, often in conjunction with each other.	Purifier Wastes, Purifier Box Wastes, Oxide Box Wastes Generally employed minimally as a pair of "boxes" in series, with at least a spare pair in parallel. The boxes trapped some tar, but were designed to trap sulfur, cyanide, arsenic and other heavy metals all of which originated in or from the organic gas feedstock materials. If wood chips were used, they typically decompose beyond recognition. The residual from the chips is typically recognizable from the blue staining resulting from the presence of ferrocyanides, if present (also identified as "Prussian Blue").
Relief Holder	With coal gas, the oldest of the gas holders, serving as a raw-gas exposure to tar-dropping seal water before clarification/purification. With carburetted or oil-enhanced water gas a usually necessary presence to buffer gas-pressure variations on blow-run cycles. Under some circumstances it was possible for small CWG plants to operate without a relief holder.	Relief holders of the first variety can be expected to have subsurface "tanks" (pits = basins) commonly abandoned and virtually full of unrecovered tar. Second variety holder tanks tend to be less commonly abandoned with large volumes of water-gas tar, unless dumped at time of plant decommissioning.
Gas Holders (Gasometers) As many as needed; ever more and larger as the gas business expanded.	Generally predicated on the largest holder being equivalent to one day's make.	Prime concern for subsurface tanks most common to pre-1900 varieties. Base of gas holders may also have been constructed at surface grade. Pre-1900 varieties typically have a subsurface water-seal tank likely to have leaked considerable amounts of precipitated and trapped PAH through various fractures related to brick, masonry and/or concrete or composite construction materials. Valve pits commonly exhibit hot-spot concentrations of PAH contamination.

Component	MGP Use	Waste Source Location & Potential
Tar Wells and Tar Cisterns Aka ammonia wells	Subsurface tanks, right-circular cylinders and rectangular or square-sided; brick, masonry or concrete or composite.	Commonly designed with a self-functioning gas-liquor (process water) discharge system to carry off lightest-fraction of gas liquor while retaining the gravity-separated tar fraction; all subject to through-fracture flow leakage to the surrounding earth during the operational period.
Tar Extractor	Typically an above-ground mechanical device for separating tar particles from the passing gas.	Most common and best known were the "P & E" devices of French manufacture.
Tar Separator	Both as above-ground devices housed in structures and as subsurface rectangular-form concrete or wood "tanks," the latter often made of wood planks subject to between-plank leakage.	Above-ground devices were machines built to physically separate tar particles from gas liquor; below-ground devices contained flow baffles functioning to slow in-out flow of gas liquor carrying suspended tar, the latter dropped to the sump of the tar separator.
Boiler House	Necessary to power the extractor and a variety of small steam engines and fluid pumps.	Generally consumed coal or by-product coke; could be rigged for burning tar, under close supervision of temperatures. Ash not expected to be toxic unless later so exposed.
Oil Storage Tanks (AST & UST)	Illuminating or enriching oil for non-coal-gas production.	Generally petroleum oils susceptible to biodegradation if leaked or spilled; generally no incentive or rationale to dump.
Plant Plumbing	Below-ground piping, often in trenches or pipe chases.	Virtually all process piping was subject to corrosion and release of PAHs, or release through joints and seams. Well known to the gas industry since 1860s.
Yard Drips (Drip Pots)	Light-oil (drip oil) collection sumps placed along gas-flow pipes in the gas yard.	Used to collect naphthalene and other light oils; these were of value and were recycled, usually as carburetion oils for water gas, or as industrial solvents. Sometimes disposed as herbicide or by dumping.
Furnaces	The fire box located below gas benches and all boilers.	Source of operational heat; residue was only ash, cinder, clinker or slag; not expected to be hazardous by nature of its formation.

Component	MGP Use	Waste Source Location & Potential
Station Meter	Plant production measuring device housed in a building at the gas-outlet from the plant.	Generally co-located with the plant office and in the up-gradient end of the property, near the plant gate. Not a source of contamination.
Governor	Gas flow control device adjusting distributed gas to main distribution pressure.	Should not be a source of contamination.
Rail-Spur Spills	Operational-era spills of tars and other fluid residuals (light oils and ammonia) being transferred off-property as by-products.	Naturally most prominent at larger plants and those plants engaged in by-product recovery operations.
Purification Box Media Spreading Ground	Wood-chip and some forms of iron oxide media could be revivified on this pad and returned for re-use short of ultimate "spent" condition	Action implies shaking and mass-expansion via pitch forks. Sulfur and Prussian blue (cyanide) could be raked up and sold as by-products in many instances.
Spent Wood-Chip Box Waste Burning Ground	A corner or side area of the gas yard where dry chips could be torched and destroyed by fire.	Required dry climate or dry season; ashes carried to a plant dump.
Plant Dump	Primary disposal area on the gas yard; broken, fractured, slagged retort bricks; generator lining bricks, all manner of scurf or other carbon-slag wastes, ash, clinker, slag, off-specification tar, tar sludge, lampblack, box wastes, bottles, purifier shelf slats, broken window glass, corroded pipe, scrap iron, wagon and vehicle parts, and broken gas-plant equipment.	Expect a toxic character in general. Plant dump likely will be found in or at the furthest down-slope corner or extension of the gas yard, along the adjacent creek, stream, or river, or filling any original topographic declivity of the ground on the property. In almost all cases, the plant dump was filled early and supplemented with multiple dumps around the periphery of the gas plant, to within a several-block wagon haul distance.

3 FORMER MGPS & PHYSICAL SETTING

The Completion Reports and/or SSWPs will include a brief description or reference to reports containing a description of each former MGP's features that potentially affect the site-specific CSM pathways. Including:

Historical Features – Former MGP structure locations and description (i.e., pilings or slab on grade, materials, etc.), underground pipe alignments, and shoreline alignments. If available, the historical features may include information regarding the surrounding land-use and potential off-property historic source areas.

Physical Boundaries – Past and current property boundaries, former MGP facility boundaries, administrative controls including fencing, deed restrictions and property ownership.

Current Site Use – Includes boundaries of the former MGP facility, former-Integrys-owned properties, and current-Integrys-owned properties. The current property use will include a description of current Site features including ground cover, buildings, underground utilities, and Site features that influence potential pathways (i.e., containment walls, treatment systems, etc.). The current property use will also include a description of the surrounding land-use, groundwater-use, and potential off-property source areas. In addition, the surrounding areas, zoning and reasonably anticipated future zoning will be discussed.

Ecological Habitat Evaluation – Prior to scoping the RI activities, a Site reconnaissance will be performed to assess the potential terrestrial and aquatic ecological habitat. This assessment will be used to refine the potential receptors identified in the Generalized CSM. The approach to the ecological habitat evaluation will be discussed in the SSWP.

Topographic and Surface Water Features – The most current topographic map will be provided with the current surface water features (i.e., storm sewers, low areas, etc.) and drainage pathways.

Geology and Hydrogeology – A description of the regional and Site geology and hydrogeology will be provided with a figure presenting the locations of previous soil borings and groundwater monitoring wells and the most recent groundwater conditions (depth to groundwater and flow).

Areas of Concern – A description of the area of concern in which MGP residuals are known to occur as a result of previous remedial investigations. The areas will be mutually agreed upon with USEPA and discussion of the nature and extent of affected media will be included.

4 POTENTIAL CONSTITUENTS, MEDIA AND PATHWAYS OF CONCERN

4.1 Constituents of Potential Concern (COPCs)

The by-products resulting from the manufacture of coal gas contain a number of different chemical constituents that are a cause for concern when left untreated in the environment. Based on previous investigations at each of the Integrys former MGPs and the COPCs identified in the Management of Manufactured Gas Plant Sites (GRI, 1996), these constituents include the following:

- Polynuclear aromatic hydrocarbons (PAHs);
- Volatile organic compounds (VOCs). Typically, the VOCs of concern at MGPs are benzene, toluene, ethylbenzene, and xylenes (BTEX) and trimethylbenzenes, collectively referred to as petroleum volatile organic compounds (PVOCs);
- Phenols;
- Complexed cyanide compounds; and
- Metals which may include: aluminum, antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, vanadium, and zinc.

Previously collected Site data will be used to identify potential data gaps (as described in Site-Specific Completion Reports), identify the appropriate COPCs for the Site (e.g., arsenic concentrations in groundwater were consistently non-detect and will not be considered a COPC) and focus the proposed RI (e.g., elevated concentrations of PAHs near a former outfall will be further evaluated as part of the proposed RI). In general, previously collected data and limited supplemental data will be used to assess human health and ecological risk in the upland areas of the Sites. The previously collected data will be reviewed for usability (e.g., detection levels, are the constituents likely to change in the environment, etc.). New data will be generated for all of the Sites to assess the human health and ecological risk in the aquatic environment.

The need to evaluate specific constituents will be assessed on a site-by-site basis. Additional constituents may also be included to assess potential non-MGP related contamination, if appropriate, and will be identified in the SSWP. Criteria for including or excluding constituents will be based primarily on historic data and may include:

- Background concentrations;
- Screening benchmarks;
- Site relatedness;
- Spatial distribution;
- Frequency of occurrence in Site media; and
- Potential for bioaccumulation or biomagnification.

Of the waste by-products summarized in Section 2.3, generally, those produced as part of the gas production process are the main sources of the BTEX, PAHs, and phenols while the by-products generated from the purification of the gas are the main sources for the nitrogen, sulfur, and metals (GRI, 1996). A summary of the by-products and the associated constituents of potential concern are listed below:

Process Residual	**Constituents of Potential Concern**
Coal tar/oil tar Tar/oil/water emulsion Tar decanter sludge Coke	PAHs, BTEX, and phenols
Wastewater treatment sludge	PAHs, BTEX, phenols, nitrogen, sulfur, and metals
Spent purifier (oxide/lime) and scrubber wastes Ash	nitrogen, sulfur, and inorganic compounds (most commonly cyanide)

Contamination at most MGP sites results from the release of tar or tar/oil/water emulsions. Therefore, BTEX and PAHs are the contaminants of concern. In addition to the BTEX and PAHs associated with the tar, the purifier wastes are a potential source of complexed cyanide compounds. Generally, the cyanide complexes present on MGP sites include iron cyanide and other non-toxic, non-lethal cyanide compounds. However, in aquatic environments photodegradation of complexed cyanide compounds may result in the release of cyanide ions, which could theoretically result in the formation of more toxic forms of cyanide. Also, water that comes into contact with purifier waste is often highly acidic.

Former tar or tar/oil/water emulsions that were disposed on the MGP property can be observed in two forms of a non-aqueous phase liquid (NAPL). A dense NAPL (DNAPL) includes a non-aqueous phase or immiscible liquid which remains as a separate phase or layer and has a specific gravity greater than water. DNAPL has the potential to migrate on top of or along a confining unit or is immobilized as a residual. DNAPLs may flow down the slope of the aquifer bottom in directions which are not the same as the direction of groundwater movement. Light NAPL (LNAPL) includes a non-aqueous phase or immiscible liquid which remains as a separate phase or layer and has a specific gravity less than water. Because LNAPLs are less dense than water, they tend to float on top of the water table and are also commonly referred to as a floating product. Typically, LNAPLs will move through the subsurface in the same direction that the groundwater moves. DNAPL and LNAPL may exist at a former MGP, may contain COPCs, and may interact with all media at a Site. Each Site is different geologically and hydraulically which affects where MGP-residuals are found at the Site.

4.2 Potential Media of Concern

Exposure media contain the source or become contaminated through migration of the contaminant from the source area. While the source of affected media is not completely understood at each Site, it is assumed that the primary sources of affected media are associated with past management practices of MGP products, waste, and/or by-products. Specifically, it is assumed sources of affected media are related to past accidental releases of MGP products, waste and/or by-products (i.e., leaking tar wells or subsurface piping) or on-property disposal of MGP waste and/or by-products (i.e., purifier wood chips used as fill or non-salable tar-water emulsions discharged on-property) which were standard practices for the time.

An overview of the media of concern, potential pathways and receptors is provided in Figure 1. The following media are considered directly contaminated or primary sources of contamination in the Generalized CSM:

- Soil (Surface Soil and Subsurface Soil); and
- Surface Water.

The soil media are divided into two categories, based on depth below ground surface (bgs) and therefore, the accessibility of COPCs.

The interaction between primary sources of contamination with other environmental media may have resulted in secondary sources of contamination, which under certain circumstances, may re-contaminate environmental media, as described in Section 4.3.

The following media are considered a secondary source of contamination in the Generalized CSM:

- Air;
- Groundwater; and
- Sediment.

Source removal at several the Integrys properties has been performed and may affect whether media continue to be of concern. MGP residuals have been detected in groundwater at each of the Sites. Groundwater monitoring and institutional controls are used where necessary or are being considered to manage the potential risks associated with MGP residuals in groundwater.

4.3 Potential Pathways of Concern

Pathways of concern include the primary, secondary and re-contamination pathways shown on Figure 1 and summarized below.

4.3.1 Surface Soil

Surface soil generally includes the upper two feet of soil, or as otherwise appropriate for the Site conditions, depending on land use. A significant portion of several of the properties is paved.

Potentially Affected Media	Potential Pathways
Air	▪ Vapor released from surface soil.
Groundwater	▪ Infiltration of surface water through affected surface soil may leach COPCs.
Surface Water	▪ Overland flow of surface water may transport COPCs.
Sub surface Soil	▪ Movement through surface soil to sub surface soil.
Sediment	▪ Overland flow of surface water may transport COPCs in surface soil to settle on the bed of a surface water body.

4.3.2 Sub surface Soil

Sub surface soil typically includes the unsaturated soil zone below surface soil, extending to the groundwater table.

Potentially Affected Media	Potential Pathways
Air	▪ Vapor released from subsurface sources during remediation or after Site redevelopment.
Groundwater	▪ Infiltration of surface water through affected sub surface soil may leach COPCs. ▪ COPCs in subsurface soil may be soluble in groundwater.
Surface Water	▪ Eroding riverbanks may release COPCs in sub surface soil.

Sediment	▪ Eroding riverbanks may release COPCs in sub surface soil.

4.3.3 Surface Water

All of the former MGPs addressed by this document are located either on a relatively large water body or in close proximity. All are in urban settings.

Potentially Affected Media	Potential Pathways
Sediment	▪ COPCs in surface water may settle on the bed of a surface water body.

4.3.4 Air

At sites with buildings, or at sites where future buildings could be constructed, air will be considered on a site-by-site basis. Air may contain vapors with COPCs released from impacted surface soil, subsurface soil and groundwater.

4.3.5 Groundwater

All of the former MGPs addressed by this document have relatively shallow depths to groundwater, particularly adjacent to the river.

Potentially Affected Media	Potential Pathways
Air	▪ Vapor released from underlying groundwater during remediation or after Site redevelopment.
Surface Water	▪ Gaining surface water bodies may transport COPCs. ▪ Groundwater leaching may transport COPCs.
Sediment	▪ Discharging groundwater may transport

	COPCs to the bed of a surface water body.

4.3.6 Sediment

Sediments considered in the General CSM include soft deposits overlying consolidated material of various descriptions.

Potentially Affected Media	Potential Pathways
Surface Water	▪ COPCs partitioning from sediment particles. ▪ Activities that disturb sediment may release COPCs.
Groundwater	▪ Recharge from surface water bodies may transport COPCs from buried sediment or native material.

5 POTENTIAL RECEPTORS AND EXPOSURE SCENARIOS

This section identifies the current and reasonably anticipated future land use human health and ecological exposure scenarios and receptors considered in the Generalized CSM. Exposure assumptions for each receptor and the use of screening values, benchmarks and guidelines will be discussed in the SSWPs.

This section also identifies additional information to be included in the SSWPs related to the demographics of the area, resource use locations, potential habitat locations, etc., which affects which potential receptors and exposure scenarios are considered on a site-specific basis.

5.1 Refining Exposure Scenarios

Exposure assessments will be conducted on a site-by-site basis as part of the Baseline Risk Assessment (BLRA) discussed in the SSWP. The exposure assessment involves identifying the potential human and ecological exposure pathways for present and reasonably likely potential future-use scenarios. Present conditions will be evaluated in terms of demographics of the area, resource use locations, and the availability of habitat for wildlife. Key factors to be considered for assessing future-use include the current land use, zoning maps, local/municipal development plans, and historical development patterns. These site-specific considerations of present and future land use and availability of wildlife habitat may reduce the exposure scenarios to be considered on a site-by-site basis.

5.2 Potential Receptors and Exposure Routes

Potential receptors considered in the Generalized CSM are summarized on Figure 1 and include:

<u>Human Receptors</u>

– Industrial/Commercial Worker;
– Construction Worker;
– Recreational – Visitor/Trespasser; and
– Residential.

<u>Ecological Receptors</u>

- Small Mammals;
- Birds;
- Fish; and
- Benthic Invertebrates.

These receptors are considered to be the most reasonable receptors to evaluate the range of potential human and ecological risks at the Sites. If appropriate, based on site-specific conditions, additional receptors may be considered.

Potential exposure routes to be considered for a particular exposure pathway considered in the Generalized CSM may include:

- Ingestion;
- Dermal contact; and
- Inhalation.

Considering remedial actions and the current land uses, volatilization of COPCs in soil and groundwater is unlikely to be a concern. However, inhalation of COPCs may be evaluated for the human health receptors identified in Figure 1, to assess the need for additional remedial action or risk management tools under potential future exposure scenarios discussed further in the following sections.

5.3 Human Health – Potential Exposure Scenarios

The following sections describe the potential human health receptors and exposure routes that may need to be evaluated in the BLRA for one or more of the Sites. The selection of exposure scenarios appropriate for a Site takes into account present and potential future land use, existing risk management tools (e.g., institutional controls), and the extent to which the Sites have already been remediated. Remedial action has occurred on the upland portions of several of the Sites. There may be limited exposure at those Sites and fewer pathways that still need to be considered. All Sites will be evaluated as discussed in the SSWP.

5.3.1 Industrial/Commercial Land Use Scenario - Worker

Several of the properties are located adjacent to industrial/commercial land uses or are currently partially industrial or commercial, and some properties may become industrial/commercial. Industrial/commercial land use may include open space that requires maintenance (i.e., lawn mowing) or have parking and other areas covered with asphalt. Incidental ingestion and dermal contact with soils are the major routes by which industrial/commercial workers could be exposed to COPCs at these Sites. If a building is present or reasonably anticipated in the future, air be an exposure route.

5.3.2 Industrial/Commercial Land Use Scenario – Construction Worker

Construction workers may be exposed to COPCs during property re-development or during repairs to subsurface utilities or roads. The construction worker may also be exposed to affected groundwater if the water elevation is sufficiently high. Where appropriate, the Human health Risk Assessment (HHRA) will evaluate the potential exposure of construction workers to COPCs as follows:

- Surface soil: via incidental ingestion, dermal contact, and inhalation;
- Sub surface soil: via incidental ingestion, dermal contact, and inhalation; and
- Groundwater: via dermal contact and inhalation.

5.3.3 Recreational Land Use Scenario – Visitor/Trespasser

Several of the Integrys properties are currently maintained, or have potential plans to become, recreational park areas operated by the municipality in which they are located. Other properties maintain fenced perimeters and private property signs; however, it is possible for trespassers to gain entry to a property or for visitors to access portions of a Site that is not owned by Integrys. Several of the properties also currently maintain or have potential plans to have access to the adjacent water body as part of public boat ramps and parks. It is reasonable to assume that people may be potentially exposed to COPCs in surface water and sediment while swimming, wading, fishing or boating in the water bodies adjacent to the former MGP. The HHRA will evaluate the potential for recreational visitor/trespassers to be exposed to COPCs as follows:

- Surface soil: via incidental ingestion and dermal contact (Upland areas);
- Surface water: via incidental ingestion and dermal contact (water body);
- Air: and
- Sediment along the shoreline and in shallow water where wading is possible: via incidental ingestion and dermal contact (water body).

5.3.4 Residential Land Use Scenario

Integrys intends to either maintain ownership or use risk management tools to manage residential land-use at a site, if necessary. However, Integrys does not own all of the sites and it is possible that some of the sites could be redeveloped as residential property. These sites will be evaluated for potential exposure via ingestion, dermal contact and inhalation, as appropriate.

Several of the Sites are within close proximity to existing residential areas. At these existing residential properties, it is unlikely groundwater will be extracted for drinking and/or potable water as public water supplies are available. In addition, based on previous Site investigations, the soils at the existing residential properties near the Site are not expected to have been affected by the former MGP activities. However, off-site residents may come into contact with surface soil, surface water, and sediment during recreational activities on the Site as described in Section 5.3.3 above.

5.4 Ecological – Potential Exposure Scenarios

The following sections describe the potential ecological receptors and exposure routes they may need to be evaluated in the Baseline Ecological Risk Assessment (BERA) for one or more of the six Sites. All potential ecological exposure scenarios (Figure 1) will be considered in the Screening Level Ecological Risk Assessment (SLERA). A biological habitat evaluation and the SLERA will be used to refine the site-specific conceptual model. This will involve emphasizing the most likely pathways of exposure, deemphasizing some pathways, and may include additional pathways based on the biological habitat evaluation.

Details regarding the biological habitat evaluation and assessment of ecological receptors in the BERA will be discussed in the SSWP. The SSWP will also include a discussion of the biological habitat assessment and present the rationale for carrying select exposure scenarios forward in the SLERA.

5.4.1 Small Mammals (Upland and Aquatic Ecological Receptor)

The potential for exposure to carnivorous, piscivorous, insectivorous, omnivorous, and herbivorous mammals will be considered in the SLERA. Small mammals, such as mice and shrews, are examples of upland ecological receptors. These small mammals live within the soil environment and derive their food from the plants and animals that also live in the surface and sub surface soils. Because of the spatial scale of exposure and close association with Site soils, these small mammals have potential exposure to COPCs in the upland environment.

Small mammals, such as muskrats and beavers, are examples of aquatic ecological receptors that may be exposed to COPCs in sediment and surface water from the water body at the Site. These small mammals live primarily in the aquatic environment, may burrow into sediment, and derive their food from the plants and animals living in the aquatic system. Thus, they may be exposed to COPCs present in the sediments at either near-shore locations (where dens are made) or where there is submerged aquatic vegetation (where muskrats may dig for roots).

If small mammals are chosen as an ecological receptor, then exposure through incidental ingestion of soil, sediment, and/or surface water and ingestion of plant and prey items will be evaluated.

5.4.2 Birds (Upland and Aquatic Ecological Receptor)

The potential for exposure of carnivorous, piscivorous, insectivorous, omnivorous, and sediment-probing birds will be considered in the SLERA. Birds may be exposed to COPCs in soils in the upland areas of the Site or sediment and surface water in the water body of the Site. Birds may nest in floodplain areas and may derive their food from the plants and animals that live in the surface soil, sediment, and/or surface water, and may have potential exposure to COPCs in the upland or water body.

If birds are chosen as an ecological receptor then exposure through incidental ingestion and dermal exposure of soil, sediment, and/or surface water and ingestion of plant and prey items will be evaluated.

5.4.3 Fish (Aquatic Ecological Receptor)

A wide variety of fish species are expected to be present in the water bodies located adjacent to the former MGP properties. These fish species would include species that utilize a variety of different habitats within the aquatic environment, and which feed on macroinvertebrates, zooplankton, phytoplankton and/or other fish. Fish may be exposed to COPCs in the aquatic environments through sediment, surface water or food exposure.

If fish are chosen as an ecological receptor then exposure through incidental ingestion and dermal exposure of sediment and/or surface water and ingestion of food (e.g., other fish) will be evaluated.

5.4.4 Benthic Invertebrates (Aquatic Ecological Receptor)

Benthic invertebrates form the base of many food chains within the water bodies adjacent to the former MGPs. Because these invertebrates spend most or all of their life-cycle burrowed or feeding just at the interface between surface water and sediment, they may come into direct contact with COPCs (if present) in sediment, sediment pore water, and surface water. Benthic invertebrates will be selected as an ecological receptor at the Sites because they are:

- The base of the aquatic food chain;
- Important within the aquatic ecosystem;
- In close contact with COPCs, if present, in sediments; and
- Relatively immobile.

6 REFERENCES

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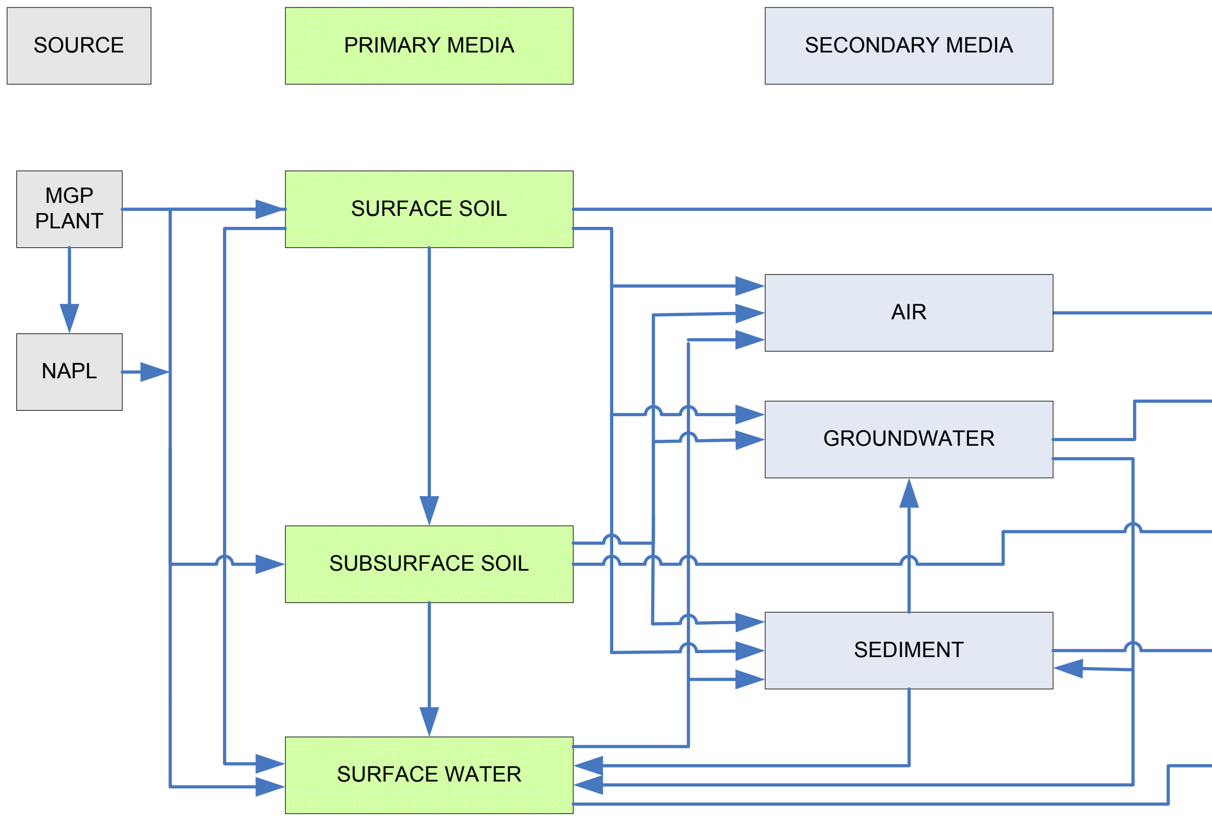
FIGURE



EXPOSURE ROUTE	HUMAN RECEPTORS				ECOLOGICAL RECEPTORS			
	INDUSTRIAL/ COMMERCIAL WORKER	CONSTRUCTION WORKER	RECREATIONAL	RESIDENTIAL	BIRDS	MAMMALS	FISH	BENTHIC INVERTEBRATES
INGESTION	●	●	●	●	◊	◊	NA	NA
DERMAL	●	●	●	●	◊	NA	NA	NA
INHALATION	●	●	●	●	NA	NA	NA	NA
INGESTION	●	○	○	●	NA	NA	NA	NA
DERMAL	●	●	○	●	NA	NA	NA	NA
INGESTION	●	●	○	●	NA	◊	NA	NA
DERMAL	●	●	○	●	NA	NA	NA	NA
INGESTION	○	○	●	○	◊	◊	◊	●
DERMAL	○	○	●	○	◊	NA	◊	●
INGESTION	○	○	●	○	◊	◊	◊	●
DERMAL	○	○	●	○	◊	NA	◊	●

LEGEND:

- ● Pathway potentially complete and warrants further evaluation within the Baseline Risk Assessment. The level of evaluation will be dependant on site conditions.
- ○ Pathway not complete or considered insignificant; No further evaluation is recommended unless warranted based on site-specific conditions.
- ◊ Pathway potentially complete and will be evaluated based on the results of the ecological habitat assessment described in the Site-Specific Work Plan.
- NA: Not Applicable

NOTES:

1. The Generalized Conceptual Site Model will be evaluated on a site-by-site basis. Pathways shown as complete may not be complete at all sites and may be handled qualitatively or quantitatively within the Baseline Risk Assessment.
2. Discussion of exposure assumptions will be included in the Site-Specific Work Plans.
3. Birds and mammals may include aquatic and terrestrial ecological receptors.

Figure 1		GENERALIZED CONCEPTUAL SITE MODEL FOR FORMER MGP SITES INTEGRYS	Drawn By: TJG	Date 08/03/2007
			Checked	MK
Revision 0			Approved	SM