DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION
Interim Final 2/5/99

RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA725)

Current Human Exposures Under Control

Facility Name:	ISG - Sparrows Point
Facility Address:	5111 North Point Boulevard; Sparrows Point, MD 21219
Facility EPA ID #:	MDD053945432

1. Has **all** available relevant/significant information on known and reasonably suspected releases to soil, groundwater, surface water/sediments, and air, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

   _X_ If yes - check here and continue with #2 below.
   ____ If no - re-evaluate existing data, or
   If data are not available skip to #6 and enter "IN" (more information needed) status
   ____ code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Current Human Exposures Under Control" EI

A positive "Current Human Exposures Under Control" EI determination ("YE" status code) indicates that there are no "unacceptable" human exposures to "contamination" (i.e., contaminants in concentrations in excess of appropriate risk-based levels) that can be reasonably expected under current land- and groundwater-use conditions (for all

"contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Current Human Exposures Under Control" EI are for reasonably expected human exposures under current land- and groundwater-use conditions ONLY, and do not consider potential future land- or groundwater-use conditions or ecological receptors. The RCRA Corrective Action program's overall mission to protect human health and the environment requires that Final remedies address these issues (i.e., potential future human exposure scenarios, future land and groundwater uses, and ecological receptors).

Duration/Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

2. Are groundwater, soil, surface water, sediments, or air **media** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective risk-based "levels" (applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action (from SWMUs, RUs or AOCs)?

	Yes	No	?	Rationale/Key Contaminants
Groundwater	X			See discussion, below.
Air (indoors)[2]		X		See discussion, below.
Surface Soil (e.g., <2 ft)	X			See discussion, below.
Surface Water	X			See discussion, below.
Sediment	X			See discussion, below.
Subsurf. Soil (e.g., >2ft)	X			See discussion, below.
Air (outdoors)		X		See discussion, below.

____ If no (for all media) - skip to #6, and enter "YE," status code after providing or citing appropriate "levels," and referencing sufficient supporting documentation demonstrating that these "levels" are not exceeded.

X If yes (for any media) - continue after identifying key contaminants in each "contaminated" medium, citing appropriate "levels" (or provide an explanation for the determination that the medium could pose an unacceptable risk), and referencing supporting documentation.

____ If unknown (for any media) - skip to #6 and enter "IN" status code.

Rationale and Reference(s):

GROUNDWATER: Deep groundwater (Patuxent Aquifer below the Arundel Clay) is confirmed to not be contaminated based on sampling and analysis.

[1] "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriately protective risk-based "levels" (for the media, that identify risks within the acceptable risk range).

[2] Recent evidence (from the Colorado Dept. of Public Health and Environment, and others) suggest that unacceptable indoor air concentrations are more common in structures above groundwater with volatile contaminants than previously believed. This is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration necessary to be reasonably certain that indoor air (in structures located above (and adjacent to) groundwater with volatile contaminants) does not present unacceptable risks.

Shallow groundwater above the Arundel Clay is confirmed to be contaminated based on sampling and analysis. Detected site-related constituents primarily include: metals, volatile organic chemicals (VOCs), and semi-volatile organic chemicals (SVOCs) (CH2MHILL, 2002; and SAIC, 2003). This finding is based on the observation of various chemical concentrations in groundwater that exceed Federal Maximum Contaminant Levels (MCLs).

AIR (indoors): Indoor air was confirmed to not be contaminated based on evaluating the potential for volatile organic chemicals (VOCs) present in shallow groundwater to volatilize and intrude upward into worker-occupied buildings within 100 feet of the groundwater plume. This evaluation included the following assessment steps:

1. Identify all monitoring wells at ISG - Sparrows Point that have screened intervals appropriate for assessing shallow groundwater contamination. This process resulted in the identification of over 100 existing wells applicable to the evaluation of vapor intrusion.
2. Query the existing ISG – Sparrows Point groundwater chemistry database to determine which of the wells identified in Step 1 have tested positive for VOCs that EPA has determined represent a vapor intrusion concern. The EPA VOCs of concern are listed in Table 1 of EPA's November 20, 2002 vapor intrusion screening guidance (USEPA, 2002).
3. For all wells and VOCs identified in Steps 1 and 2, compare the measured VOC concentrations to the default EPA screening values (ug/l) listed in Table 2c (target risk of 1E-06 and attenuation factor of 0.001) of EPA's November 20, 2002 vapor intrusion screening guidance (USEPA, 2002); *after* adjusting these default screening values to consider OSHA Permissible Exposure Limit (PEL) requirements for worker indoor air and a site-specific indoor air exchange rate equated with a rate of 1.26 $hours^{-1}$ from Table 7 of EPA's *User's Guide for Evaluating Subsurface Vapor Intrusion Into Buildings* (USEPA, 2003). EPA's default groundwater screening values are derived by EPA by back-calculating from the air criteria to the groundwater criteria, using the Johnson & Ettinger vapor intrusion model. Similarly, the OSHA-based groundwater screening criteria used for the present assessment were back-calculated from the OSHA indoor air PEL values for the VOCs detected in shallow groundwater.
4. Based on the above, the concentration of benzene in groundwater was determined to exceed the OSHA-based groundwater screening value (725.7 mg/l) for the following four wells at the Coke Oven Area: CO02-PZM006, CO16-PZM006, CO18-PZM006, and CO17-PZM005.
5. The benzene isoconcentration contour line corresponding the OSHA-based benzene screening value was mapped proximate to these four wells. Numerous surrounding wells with low benzene concentrations confirm the rather limited extent of the area where the benzene screening value is exceeded.

6. All worker-occupied buildings proximate to the area identified in Step 5 were identified and all of the buildings (two) are located more than 100 feet outside the area where the groundwater benzene concentrations exceed the OSHA-based screening value.
7. It was concluded that human exposures are under control relative to indoor air.

SURFACE SOIL (e.g., <2 ft): On site surface soil was confirmed to be contaminated based on sampling and analysis.

SURFACE WATER: Relevant surface water at ISG-Sparrows Point currently consists of the on site Tin Mill Canal and the following water bodies that surround the ISG-Sparrows Point peninsula (clockwise from the eastern side of the peninsula): Jones Creek, Old Road Bay, Patapsco River, and Bear Creek. Historically, surface water included Humphrey Creek that received industrial waste water discharges, however, it has been backfilled and essentially replaced by the Tin Mill Canal. Currently there is the possibility of impacted shallow groundwater discharge into the Tin Mill Canal, potentially causing Tin Mill Canal surface water impacts. Additionally, surface water adjacent to the Coke Oven Area (COA) is confirmed to contain benzene (COA groundwater constituent of concern) based on sampling and analysis.

The other relevant surface water bodies mentioned above are reasonably suspected to not be contaminated for reasons that include:

1) They do not receive non-permitted waste water discharges.
2) The Tin Mill Canal water is treated at the Humphrey Creek Waste Water Treatment Plant (HCWWTP) prior to discharge to Bear Creek.
3) Other surface water discharges occur at permitted outfalls which are regulated and monitored per the requirements of the National Pollutant Discharge Elimination System (NPDES) Permit that is in effect at the facility.
4) The rate of discharge of contaminated groundwater (such as at the COA) into receiving surface water bodies is low compared to the substantial mixing of groundwater and surface water that subsequently occurs, and
5) The primary groundwater contaminant of concern (benzene) has a relatively short half-life due to is volatility and biodegradability.

SEDIMENT: Sediment is reasonably suspected to be contaminated.

SUBSURFACE SOIL (e.g., >2ft): On site subsurface soil is reasonably suspected to be contaminated based on the discussion in Section 3.0 (Evaluation of Potential Contaminant Sources) of the report titled *Description of Current Conditions* (RE&I, 1998). Also, analytical data associated with past investigation of the Sludge Bins Storage

Area Closure at the Former Rod and Wire Mill confirms contamination of subsurface soil with cadmium and zinc.

AIR (outdoors): Outdoor air is not expected to be contaminated above risk-based levels as a result of *fugitive dust* emissions based on the implementation of dust control measures at the facility in accordance with the facility air operations permit. Air sampling conducted at the COA confirms that air is not contaminated with benzene.

REFERENCES:

CH2M Hill, 2002. *Site-Wide Investigation: Release Site Characterization Study; Bethlehem Steel Corporation; Sparrows Point Division.* June 2002.

Rust Environment & Infrastructure, 1998, *Description of Current Conditions, Bethlehem Steel Corporation, Sparrows Point, MD.* January 1998.

SAIC, 2002. *Site-Wide Investigation; Work Plan to Evaluate the Nature and Extent of Releases to Groundwater from the Special Study Areas; Bethlehem Steel Corporation, Sparrows Point Division.* Septemebr 30, 2003.

USEPA,. 2002. *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils.* November 2002.

USEPA, 2003. *User's Guide for Evaluating Subsurface Vapor Intrusion Into Buildings,* June 19, 2003.

3. Are there **complete pathways** between "contamination" and human receptors such that exposures can be reasonably expected under the current (land- and groundwater-use) conditions?

Summary Exposure Pathway Evaluation Table

Contaminated Media	**Residents**	**Workers**	**Day-Care**	**Construction**	**Trespassers**	**Recreation**	**Food**[3]
Groundwater	**No**	**No**		**No**			
Air (indoors)							
Surface Soil (e.g., <2 ft)	**No**	**Yes**		**No**	**No**		
Surface Water	**Yes**	**No**			**No**	**Yes**	**Yes**
Sediment	**No**	**No**			**No**	**No**	**Yes**
Subsurf. Soil (e.g., >2ft)	**No**			**No**			
Air (outdoors)							

Instructions for Summary Exposure Pathway Evaluation Table:

1. Strike-out specific Media including Human Receptors' spaces for Media which are not "contaminated") as identified in #2 above.

2. Enter "yes" or "no" for potential "completeness" under each "Contaminated" Media--Human Receptor combination (Pathway).

Note: In order to focus the evaluation to the most probable combinations some potential "Contaminated" Media - Human Receptor combinations (Pathways) do not have check spaces ("___"). While these combinations may not be probable in most situations they may be possible in some settings and should be added as necessary.

____ If no (pathways are not complete for any contaminated media-receptor combination) -skip to #6, and enter "YE" status code, after explaining and/or

[3] Indirect Pathway/Receptor (e.g., vegetables, fruits, crops, meat and dairy products, fish, shellfish, etc.)

referencing condition(s) in-place, whether natural or man-made, preventing a complete exposure pathway from each contaminated medium (e.g., use optional Pathway Evaluation Work Sheet to analyze major pathways).

_X_ If yes (pathways are complete for any "Contaminated" Media - Human Receptor combination) - continue after providing supporting explanation.

____ If unknown (for any "Contaminated" Media - Human Receptor combination) - skip to #6 and enter "IN" status code Rationale and Reference(s):

Rationale and Reference(s):

The following discussion is organized by receptor.

RESIDENTS: Groundwater—The following discussion reveals that residential contact with groundwater impacted by site-related chemicals is not occurring. Therefore, this pathway is not complete. Three sources of information were reviewed to assess whether drinking water wells are present within a three mile radius of Sparrows Point: 1) well database maintained by MDE's Groundwater Permits Division, 2) review of engineering drawings from Baltimore County that show the locations of the public water distribution system around Sparrows Point, and 3) review of a summary of the 1990 Census Data which describes whether homes included in the census use groundwater for their drinking water supply. The review of these three data sources confirms the findings prior reported for the site, summarized below.

RE&I (1998; Section 4.2.5.2) solicited information from the Baltimore City Water Engineering Department (BCWED) and the Maryland Department of the Environment (MDE) to identify the sources of drinking water supplied to the communities within a two-mile radius surrounding ISG-Sparrows Point. RE&I (1998) concluded that this area, and the broader Baltimore metropolitan area, receive their potable water from upland reservoirs. The east side of Baltimore (including the local communities of Dundalk, Edgemere, and Fort Howard) is supplied public drinking water from the Montebello Water Treatment Plant (MWTP). The MWTP receives their water from upland reservoirs (Pretty Boy and Loch Raven Reservoirs). RE&I (1998; Sections 5.5.2.1 and 5.5.2.2) also reviewed 1990 census data for the local communities of Edgemere and Dundalk. For Edgemere in 1990, there were 3,523 housing units that obtained their drinking water from a "public system or private company" and five housing units listed as using a "drilled individual well". For Dundalk in 1990, there were 26,448 housing units that obtained their drinking water from a "public system or private company" and 16 housing units listed as using a "drilled individual well". RE&I (1998; Section 5.7.1.2) concluded that nearby residents are unlikely to be exposed to site chemicals in groundwater because: 1) shallow groundwater apparently discharges directly into the surrounding surface water bodies (Bear Creek, Patapsco River, Old Road Bay, and Jones Creek), 2) the deep (Patuxent Aquifer) groundwater system flows inward toward the site,

and 3) public drinking water supplies are derived from upland/inland surface water sources.

CH2MHILL (2001) expanded on the RE&I efforts related to identifying local drinking water sources. CH2MHILL reviewed files maintained by the Baltimore County Department of Environmental Protection (BCDEP) and the MDE. The BCDEP files revealed that there are two residential areas served by potable wells within a two-mile radius of the facility, both up-gradient or side-gradient of ISG-Sparrows Point: 1) the Mighty Acres, Vista Mobile Park off of Seaside Road in Dundalk, Maryland (approximately three miles north-northwest (upgradient) of the COA, and 2) a large group of homes near the Essex Skypark (approximately 5 miles northeast of the COA, on the eastern side of the Back River). Concerning the Vista Mobile Park, the available records provide no information concerning the number of supply wells or any of their construction characteristics (CH2MHILL, 2001). Concerning the homes near the Essex Skypark, records obtained by CH2MHILL (2001) indicate that the homes are served by individual wells (number of wells not specified) ranging from depths of 51 to 206 feet. In addition to these two residential areas, CH2MHILL's (2001) MDE file review efforts revealed eight high-volume production wells within roughly a three-mile radius of the center of the facility. Many of the businesses that operated these wells are no longer in business and, therefore, it is likely that many of these wells are no longer operational. Information summarized by CH2MHILL (2001) for these wells is:

Permitted Business	Distance from COA (miles)	Direction from COA	Gallons Per Day	Number of Permitted Wells	Screened Formation	Total Depth (ft)
Dundalk Marine Terminal	2.5	NW	27,000	6	Artificial Fill	Unknown
Four Roses Distilling Company	3.3	NNW	500	1	Patuxent	350
Joseph Seagram and Sons	3.4	NNW	200	1	Patuxent	450
American Yeast Corporation	4.4	NNE	3,200,000	Unknown	Patuxent	Unknown
Private Residence	4.4	NNE	200	Unknown	Patapsco	Unknown
Phillips Petroleum	4.0	NNE	5,000	7	Talbot	35
Essex Skypark	4.4	NE	100	1	Talbot	60
Riverside Realty	4.4	NE	300	1	Talbot	60

Recent groundwater elevation data (URS 2005) support the RE&I (1998) groundwater flow interpretations. The URS data indicate radial shallow groundwater flow toward: 1) surrounding surface water bodies (Bear Creek, Patapsco River, Old Road Bay, and Jones Creek) and unnamed tributaries to these surface water bodies, and 2) the Tin Mill Canal. Lower zone groundwater flow directions are inferred by URS to be south-southwestward, not toward the populated areas north and east of the site. **Surface Soil (e.g., <2 ft)**: Residents do not have access to the site (except as employees) and, therefore, they do not have direct contact access with surface soil. This pathway is incomplete. **Surface Water and Sediment:** See the "Recreation" receptor discussion. **Subsurface Soil (e.g., > 2ft):** Residents do not have access to the site (except as employees) and, therefore, they do not have direct contact access with surface soil. This pathway is incomplete.

WORKERS: Groundwater: Groundwater is not a source of potable water for workers, therefore, this pathway is not complete. Potable water is purchased from the City of Baltimore and comes from the Montebello Water Treatment Plant. This plant derives its water from upland reservoirs, as previously discussed. Water from this plant is delivered to ISG-Sparrows Point through a 36-inch diameter water main located along Greys Road. Although contaminated groundwater is pumped to the surface for treatment at the Rod and Wire Mill Sludge Bin Remediation Area, slightly increasing the possibility for exposure, this exposure potential is reasonably estimated to not be significant because: 1) the contaminated groundwater remains contained within the treatment system, and 2) Health & Safety procedures require wearing of personnel protective clothing during routine influent sampling. Deep groundwater from the Patuxent Aquifer is used by workers for industrial cooling water purposes (no direct human contact). Sampling and analysis of the Patuxent Aquifer reveal that this water meets drinking water standards at Sparrows Point, with the possible exception of iron. However, iron naturally occurs at elevated concentrations within the Patuxent Aquifer in the Baltimore area. **Surface Soil (e.g., <2 ft):** The results of the surface soil investigation confirm that RCRA constituents are present is surface soil at concentrations suggestive of releases from various SWMUs, AOCs, etc. Worker exposure to surface soil is reasonably expected to occur because there currently are no institutional controls that eliminate worker contact with surface soil. Therefore, this pathway is complete. **Surface Water:** Worker contact with surface water is essentially limited to sampling of the Tin Mill Canal for NPDES purposes (outfall 014 into Bear Creek) and to monitor HCWWTP influent. The frequency and duration of monitoring render this exposure potential irrelevant and, therefore, this pathway is reasonably estimated to not be complete. **Sediment:** There is essentially little or no worker contact with sediments associated with Bear Creek, the Patapsco River, Old Road Bay, or Jones Creek. Also the potential for worker contact with sediments occasionally dredged from the Tin Mill Canal is minimized due to the use of personnel protective equipment. Therefore, this pathway is reasonable estimated to not be complete. **Subsurface Soil (e.g., >2ft):** Worker exposure to subsurface soil is reasonably estimated to not occur because the ISG work force primarily is not engaged in

activities that could facilitate direct or indirect contact with subsurface soil (see "Construction" for the discussion of the possibility of excavation and exposure of subsurface soils).

CONSTRUCTION: Groundwater: Currently there are no construction activities that could cause significant worker exposure to shallow groundwater. Typically, excavation is necessary to possibly expose construction workers to shallow groundwater and this excavation must occur at the few locations where shallow groundwater is impacted by constituents that can be absorbed dermally. The most common type of ISG-Sparrows Point construction activity involving excavation is utilities maintenance. Typical excavations associated with utility maintenance are not deep enough to encounter the groundwater table. If deep excavation is planned at locations where the groundwater table is known to be impacted, then personal protective clothing (i.e., hard hats, gloves, overalls, and respiratory protection if required, etc.) are advised which limit dermal and respiratory contact with the groundwater. **Surface Soil (e.g., < 2 ft):** ISG Sparrows Point maintains an internal policy related to excavations requiring soil disturbances. This policy requires workers or contractors to: 1) notify the ISG Environmental Department by way of an application for an excavation permit that clearly identifies the location and dimensions of the planned excavation, and 2) The excavation permit must be approved by the Environmental Department before any excavation is authorized. The Environmental Department will provide approval of the excavation permit only after it is concluded that the planned excavation is not coincident with environmental areas of concern or, if they are coincident, that necessary personal protective equipment and material handling procedures are identified. **Subsurface Soil (e.g., > 2 ft):** See the surface soil discussion.

TRESPASSERS: Surface Soil: Several factors serve to minimize the likelihood of trespassing at the site, to the point where it is reasonably estimated that relevant exposure to surface soil does not occur at all locations except where there is evidence of trespassing (illegal dumping) at a portion of Sparrows Point referred to as "County Land Parcel 1B—Open Hearth Slurry Disposal Area". Factors that minimize trespassing include 1) Roadway entrances to the property and several of the perimeter areas are posted with "no trespassing" and "private property" signs, 2) Access to active manufacturing areas is controlled by plant security which includes gates with surveillance cameras, and/or pedestrian turnstiles activated by key-cards, 3) ISG-Sparrows Point maintains a private police department who's mission includes minimizing any trespassing, 4) the ISG-Sparrows Point police department is assisted by an additional police force (Burns Security) with staff dedicated to ISG-Sparrows Point numbering on the order of several dozen personnel who also help to minimize any trespassing, and 5) most of the SWMUs and AOCs are within the operational areas of the facility where trespasser access is extremely unlikely. Accordingly, this pathway is reasonably judged to be incomplete except at the Open Hearth Slurry Disposal Area. **Surface Water:** Much of the shoreline at ISG-Sparrows Point is not inviting to trespassers because it

consists of slag and rocks, is very steep, or is thickly vegetated. Past discussions with the facility Police Chief reveal that the primary reason that shoreline trespassing occurs is due to intentional beaching of water craft in distress, a very infrequent occurrence. Non-shore line surface water includes the Tin Mill Canal that trespassers do not enter. Accordingly, the trespasser surface water exposure pathway is reasonably judged to not be complete. **Sediment:** See the surface water discussion.

RECREATION: Surface Water: Per the Section 2 discussion, 1) the Tin Mill Canal may be impacted by shallow groundwater discharge into it, and 2) the Patapsco River adjacent to the COA is impacted by benzene near the shoreline. Recreational exposure to the Tin Mill canal is not possible due to its location on site. Indirect recreational contact with the Patapsco River is possible, most likely occurring as ingestion of fish living in the small area of impacted water adjacent to the COA (also see "FOOD" discussion in the next section). Such fish may swim beyond the localized impacted area, to locations where they could be caught and consumed by recreational fisherman. Accordingly, the recreational surface water exposure pathway involving ingestion of fish is reasonably judged to be complete for the Patapsco River immediately adjacent to the COA. The localized area where benzene is present in surface water adjacent to the COA is not frequented by recreators such as swimmers or water skiers, therefore, direct contact pathways such as dermal contact and incidental ingestion of surface water are incomplete. **Sediment:** The surface water depth at the locations where recreational activities such as swimming and water skiing would most reasonably occur is sufficiently deep so that recreational contact with sediment would not be a common occurrence. Further, the likelihood is small that sediment would remain in contact with skin for a reasonable period of time to cause relevant exposure is very small due to the washing action of the associated surface water. Accordingly, this pathway is reasonably estimated to not be complete.

FOOD: Food (i.e., fish and shellfish) could facilitate indirect human exposure to site chemicals if such chemicals (i.e., metals and PAHs) were present in the surface water or sediments of the various surface water bodies surrounding ISG-Sparrows Point (Bear Creek, Patapsco River, Old Road Bay, and Jones Creek) and these chemicals undergo biouptake by these aquatic organisms. Accordingly, the food pathway is reasonably judged to be complete.

REFERENCES:

CH2M Hill, 2001. *Site-Wide Investigation: Groundwater Study Report; Bethlehem Steel Corporation; Sparrows Point Division*. Decenber 2001.

URS, 2005, *Final, Site Wide Investigation, Report of Nature & Extent of Releases to Groundwater from the Special Study Areas, International Steel Group, ISG Sparrows Point, Inc. Facility, Sparrows Point, Maryland*.

4. Can the **exposures** from any of the complete pathways identified in #3 be reasonably expected to be **"significant"**[4] (i.e., potentially "unacceptable" because exposures can be reasonably expected to be: 1) greater in magnitude (intensity, frequency and/or duration) than assumed in the derivation of the acceptable "levels" (used to identify the "contamination"); or 2) the combination of exposure magnitude (perhaps even though low) and contaminant concentrations (which may be substantially above the acceptable "levels") could result in greater than acceptable risks)?

X If no (exposures can not be reasonably expected to be significant (i.e., potentially "unacceptable") for any complete exposure pathway) - skip to #6 and enter "YE" status code after explaining and/ or referencing documentation justifying why the exposures (from each of the complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

____ If yes (exposures could be reasonably expected to be "significant" (i.e., potentially "unacceptable") for any complete exposure pathway) - continue after providing a description (of each potentially "unacceptable" exposure pathway) and explaining and/or referencing documentation justifying why the exposures (from each of the remaining complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

____ If unknown (for any complete pathway) - skip to #6 and enter "IN" status code.

Rationale and Reference(s):

Each of the complete pathways from Section 3 are individually discussed below.

Residents / Surface Water: See the "Recreation" receptor discussion, below.

Workers / Surface Soil (e.g., < 2 ft): The analytical results from the surface soil monitoring program were screened against EPA Region 3 Industrial Risk-Based Concentrations (RBCs) for informational purposes and to comply with the requirement of Section B of the Consent Decree. Additionally, the results were screened against adjusted EPA Region 3 RBCs for decision-making purposes and to more accurately account for actual current landuse worker activities and exposure. The adjusted RBC's were based on the following standard assumptions: 1) exposure frequency of 250 days per year, 2) exposure duration of 25 years, 3) soil ingestion rate of 100 mg

[4] If there is any question on whether the identified exposures are "significant" (i.e., potentially "unacceptable") consult a human health Risk Assessment specialist with appropriate education, training and experience.

per day, 4) target risk of 1E-06, and target hazard quotient of 1.0. Unlike the default EPA Region 3 Industrial RBCs, the adjusted RBCs considered the frequency and duration of the daily work activities that could result in exposure to surface soil and whether ground cover such as vegetation, asphalt, slag, etc. is present that would influence worker contact with surface soil. The data screening indicates that potential worker exposure to surface soil is not unacceptable (i.e., not significant). Regardless, activities will be contducted at the Coal Tar Area (CTA) to remove impacted materials exposed at the surface and cover the work area with slag.

Recreation / Surface Water: The maximum surface water benzene concentrations were compared to the benzene water quality criterion specified in COMAR 26.08.02.03-2 and were observed to not exceed the criterion. This criterion is based on the protection of humans who may consume organisms that live in the impacted surface water. It is intended to maintain the "wholesomeness of fish for human consumption". Thus, recreators who may be indirectly exposed to surface water constituents (via the consumption of fish living in the impacted water) will not experience unacceptable exposure (i.e., not significant). Additionally, the chemistry results for the portion of the sampled surface water body where recreational swimming theoretically could occur were compared to site-specific recreational screening values based on child/adult surface water dermal contact and incidental ingestion. None of the screening values are exceeded, indicating that a recreational swimming exposure scenario will not produce unacceptable exposures.

The child/adult surface water screening values were calculated based on the following procedures and assumptions:

Procedures followed to calculate the screening values are based on the equations presented in the EPA guidance titled: "*Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Final*, July 2004, EPA/540/R/99/005. Below is a summary of the utilized equations from this guidance and a brief statement of the purpose of the equation:

- Equation 3.1 (page 3-3): Calculate dermal absorbed dose (DAD) for organics in water,
- Equation 3.2 (page 3-4): Calculate dermal dose per event (DA_{event}) for organics in water in circumstances where t_{event} (event duration) is less than or equal to t* (time to reach steady state),
- Equation 3.3 (page 3-4): Calculate dermal dose per event (DA_{event}) for organics in water in circumstances where t_{event} is greater than t*,
- Equations A.1 and A.4 through A.8 in Appendix A of the above-referenced dermal guidance document, used to estimate values for some of the variables in equations 3.2 and 3.3.

Assumptions were site-specific and included:

- Exposure duration of 30 years, partly as a child and partly as an adult
- Event frequency of 1 event per day
- Exposure frequency of 4 days per year
- Event duration of 0.25 hours per event
- Child exposed skin surface area of 13,120 cm2
- Adult exposed skin surface area of 18,150 cm2
- Incidental surface water ingestion rate of 0.05 liters / hour, per page 6-34 of RAGS Part A
- Target hazard quotient of 1
- Target risk of 1.0E-06

Food / Surface Water and Sediment: For the purposes of this assessment "food" includes finfish, crabs, and shellfish (i.e., clams, oysters and mussels). Published data/reports suggest that food proximate to ISG-Sparrows Point has not been unacceptably impacted by the facility. These data/reports are discussed below.

FINFISH

Finfish Sampling Program Background

In 1977 the State of Maryland established a network of sampling stations in the Chesapeake Bay and its tributaries, and a sampling program was initiated. This "Core" sampling program included the annual sampling of water (analyzed for water quality parameters and chemical constituents) and whole fish and shellfish (analyzed for organochlorine pesticides, polychlorinated biphenyls (PCBs) and various metals). The Core program was suspended in 1985 while program data were analyzed and the sampling program was evaluated. The results of that effort are published in *Analysis of Basic Water Monitoring Program Fish Tissue Network Report* (MDE, 1988).

In addition to the annual Core sampling program, separate intensive location- or species-specific studies are frequently conducted in Maryland waters. These studies were continued while the Core sampling program was being evaluated. Unlike the Core sampling program, these intensive studies collected fillet-only samples, which are the most appropriate type for determination of risk to human health from consumption of finfish.

In 1989 several modifications were made to the Core sampling program as a result of recommendations made by the monitoring program report (MDE, 1988). First, three regional watershed sample areas are identified, each to be sampled once every three years:

- Western Maryland
- Chesapeake Bay
- Baltimore/Washington Urban

In addition, several Core monitoring stations are added to the areas previously sampled under the Core program, and frequently visited impoundments (i.e., ponds and lakes) are added as sampling areas. Finally, in order to address human health effects from consuming finfish, the Core sampling program was modified to include fillet-only samples.

Seventeen Core and intensive study sampling stations are located in the tidal portion of the Patapsco River Basin. Twelve of these stations are located in the Back River and two are located in Back Creek. These 14 stations are considered not appropriate for the present finfish assessment because of the significant distance between these stations and the ISG-Sparrows Point site. The remaining three sampling stations are located near ISG-Sparrows Point, and are summarized in Table 1. Station XIE2590 is located west of the COA, proximate to the confluence of Bear Creek and the Patapsco River. A second station, XIF1629, is located southeast of ISG-Sparrows Point site, at the confluence of Old Road Bay and the Patapsco River. Finally, station XIF2929 is located east of ISG-Sparrows Point in Old Road Bay.

Only individual fillet and composite fillet samples are used by MDE for the evaluation of risk to human health from finfish consumption, thus the following finfish sections are based on Core sampling program fillet samples collected after program modifications were made (1989) and fillet samples collected as part of the intensive studies mentioned above. Other sample types (e.g., whole fish) are not discussed further.

If MDE identifies potential risk to human health due to consumption of finfish, a fish consumption advisory may be issued. The State of Maryland does not issue outright finfish bans.

Finfish Sampling Methodology

Finfish were collected using otter trawls and gill nets. Samples were collected as either individual or composite samples, depending on fish availability or study requirements. "In general, Core target species sample collection consists of one game (fillet composite sample) and two accumulator finfish species (fillet and whole fish composite samples) [per sampling location] all of which are of legal size" (MDE, 1998). Each sample was accompanied by a

chain of custody, which detailed the "station location (latitude and longitude, date, species, physical characteristics (length, weight, sex), and tissue type (fillet or whole body)" (MDE, 1998). Though whole fish samples were collected, only fillet samples are used to determine risks to human health from consuming finfish.

Fillet samples were collected by first scaling the finfish, then the "left fillet portion…was wrapped (individual or composite sample) in food grade plastic (bag or wrap), labeled, packed on ice and subsequently frozen for metals analysis. The right fillet portion was used for other analyses" (MDE, 1998). Table 1 details the game and accumulator species samples collected near ISG-Sparrows Point.

Finfish Screening Criteria Development

Thus far, risk-based screening results have been published with respect to metals only. Therefore, the following discussion of finfish tissue screening criteria applies to metals analysis only. Risk-based screening criteria were developed by "a back calculation of human health risk associated with the consumption of finfish tissue using science-based toxicological data and pre-specified human exposure scenarios" (MDE, 1998). Criteria were developed for two receptors – children and adults – using EPA recommended exposure assumptions such as a child body weight of 36 kg, an adult body weight of 70 kg, and a finfish consumption rate of 6.5 grams/person/day for both adults and children (assuming year round availability; MDE, 1998).

Both carcinogenic and non-carcinogenic screening criteria were developed for each analyte, depending on the availability of carcinogenic slope factors and non-carcinogenic reference doses. Carcinogenic screening criteria are based on a target risk of 10^{-5} "to be consistent with Maryland's ambient surface water quality standards program" (MDE, 1998); however it is not known at this time what target hazard quotient was the basis for non-carcinogenic screening criteria.

Finfish samples were analyzed for total arsenic rather than inorganic arsenic, which is carcinogenic. Therefore, total arsenic values are adjusted by 4%, which a conservative estimate of the available inorganic arsenic in finfish tissue (Morrissey et al, 1999). Also, no screening criteria were developed for lead due to lack of toxicity criteria for lead contaminated finfish tissue.

Finfish Sampling Results for the ISG-Sparrow's Point Area of the Tidal Patapsco River Basin

In 1998 MDE published *Risk Based Screening of Metals in Maryland Finfish Tissue, 1985-1997* (MDE, 1998), which evaluated finfish fillet data collected as part of the Core sampling program and the intensive studies through 1997. The 1998 report concluded that "the results from the finfish samples collected within the Baltimore Harbor [which includes the three sampling stations located close to the ISG-Sparrow's Point site] and the non-tidal portion of the Patapsco watershed results are below present-day established screening levels for all metals."

Though no similar report for risk-based screening of organics has been published, the State of Maryland has issued a fish advisory for eel, carp, and channel catfish from the Baltimore Harbor (including the area proximate to the ISG-Sparrow's Point site) due to harmful levels of chlordane. However, at this time it is not possible to determine whether elevated levels of chlordane were detected at the three sampling stations proximate to the site. It is noteworthy that chlordane is not a constituent of concern at ISG-Sparrows Point.

SHELLFISH

Shellfish from the Chesapeake Bay and its tributaries have been sampled for metals and pesticides since the early 1970s. Before 1990, sampling was conducted annually or biannually; however, the sampling frequency was reduced to once every three years due to "low levels of contaminants and negligible yearly changes in those levels" (MDE, 2000). MDE has not yet published a screening level human health risk assessment for consumption of shellfish harvested from the Chesapeake Bay and its tributaries, thus it is not currently possible to discuss the chemical constituent concentrations found in shellfish in the ISG-Sparrows Point area. However, there are no current advisories related to chemical contamination of shellfish in the State of Maryland.

In addition to chemical contaminant monitoring, the State of Maryland regularly samples shellfish for bacteriological analysis. Shellfish are filter feeders, and can trap and harbor disease-causing bacteria, which are introduced to Maryland waters through sewage discharge and surface runoff. Therefore the State of Maryland requires shellfish to be harvested from State approved harvesting waters. Shellfish harvesting from the ISG-Sparrows Point vicinity is currently restricted by MDE due to the threat of bacteria in shellfish, not because of site-related chemical constituents.

CRABS

MDE has not yet published details of their crab sampling program or a screening level human health risk assessment for consumption of crabs harvested from the Chesapeake Bay

and its tributaries. Therefore, it is not currently possible to discuss the chemical constituent concentrations found in crabs in the ISG-Sparrow's Point area. However, a fish advisory is currently in effect for crabs harvested from the Patapsco River due to elevated levels of PCBs. Although PCBs are constituents of interest at ISG-Sparrows Point AOCs A through E, none of these AOCs is judged to be releasing PCBs to the aquatic environment due to their central locations at ISG-Sparrows Point.

The advisory states that "all populations should avoid consumption of mustard or green gland" and adults and children should limit their consumption of blue crabs harvested from the Patapsco River (96 meals of 9 crabs per year for adults, and 24 meals of 4 crabs per year for children) (MDE, 2005).

TABLE 1: Summary of Finfish Fillet Samples Collected Near ISG-Sparrows Point

Sampling Station ID	Station Location	Study Type	Year	Fish Species	Game or Accumulator Species	Fillet Sample Type	Number of Samples	Number of Fish in Sample	Metals Analyzed
XIE2590	391233 latitude 763059 longitude	Intensive	1985	Channel Catfish	Accumulator	Individual	1	--	As, Cd, Cr, Cu, Hg, Pb, Zn
XIF1629	391146 latitude 762701 longitude	Intensive	1985	Channel Catfish	Accumulator	Individual	3	--	As, Cd, Cr, Cu, Hg, Pb, Zn
			1985	White Catfish	Accumulator	Individual	1	--	Hg
			1985	White Perch	Game	Composite	1	10	As, Cd, Cr, Cu, Hg, Pb, Zn
XIF2929	391251 latitude 762707 longitude	Core	1990	Brown Bullhead Catfish	Accumulator	Composite	1	5	Cd, Cr, Cu, Hg, Ni, Pb, Zn

REFERENCES:

USEPA, 2004. *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Final.*

MDE, 1988. *Analysis of basic water monitoring program fish tissue network.* 145 pp. Maryland Dept. of the Environment, Baltimore, MD (D.L. Murphy).

MDE, 1998. *Risk Based Screening of Metals in Maryland Finfish Tissue, 1985-1997.*

MDE, 2000. *Maryland Water Monitoring Strategy*, Maryland Department of Natural Resources 54 pp.

MDE, 2005. *MDE Recommended Maximum Meals Each Year for Maryland Waters*, June 2005.

Morrissey, J.M. and Abernathy, C.O, 1999. Exposure to Inorganic Arsenic from Fish and Shellfish. In: Chappell, W.R., Abernathy, C.O., and Calderon, R.L. (eds). *Arsenic Exposure and Health Effects* pp. 89-98. Elservier Science Ltd, Amsterdam.

5. Can the "significant" **exposures** (identified in #4) be shown to be within **acceptable** limits?

____ If yes (all "significant" exposures have been shown to be within acceptable limits) - continue and enter "YE" after summarizing and referencing documentation justifying why all "significant" exposures to "contamination" are within acceptable limits (e.g., a site-specific Human Health Risk Assessment).

____ If no (there are current exposures that can be reasonably expected to be "unacceptable")- continue and enter "NO" status code after providing a description of each potentially "unacceptable" exposure.

____ If unknown (for any potentially "unacceptable" exposure) - continue and enter "IN" status code.

Rationale and Reference(s):

This section is not applicable because the Section 4 findings reveal that human exposures are under control.

RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA725)

Current Human Exposures Under Control

6. Check the appropriate RCRIS status codes for the Current Human Exposures Under Control EI event code (CA725), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (and attach appropriate supporting documentation as well as a map of the facility):

X YE - Yes, "Current Human Exposures Under Control" has been verified. Based on a review of the information contained in this EI Determination, "Current Human Exposures" are expected to be "Under Control" at the _____ facility, EPA ID #_____, located at_____ under current and reasonably expected conditions. This determination will be re-evaluated when the Agency/State becomes aware of significant changes at the facility.

____ NO - "Current Human Exposures" are NOT "Under Control."

____ IN - More information is needed to make a determination.

Completed by (signature) /s/ Date 9/7/05
(print)
(title)

Supervisor (signature) /s/ Date 9/7/05
(print)
(title)
(EPA Region or State)

Locations where References may be found:

Deleted: ¶ ¶ ¶ ¶ ¶ ¶

Contact telephone and e-mail numbers

(name) Andrew Fan
(phone #) 215-815-3426
(e-mail) fan.andrew@epa.gov

Deleted: ¶ ¶

RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA725)

Current Human Exposures Under Control

FINAL NOTE: THE HUMAN EXPOSURES EI IS A QUALITATIVE SCREENING OF EXPOSURES AND THE DETERMINATIONS WITHIN THIS DOCUMENT SHOULD NOT BE USED AS THE SOLE BASIS FOR RESTRICTING THE SCOPE OF MORE DETAILED (E.G., SITE-SPECIFIC) ASSESSMENTS OF RISK.