



December 19, 2005

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Re: Comment from the Glynn Environmental Coalition on the Office of Inspector General Ombudsman Report, Appropriate Testing and Timely Reporting Are Needed at the Hercules 009 Landfill Superfund Site, Brunswick, Georgia, Report 2005-P-00022, September 26, 2005.

Mr. McKechnie,

The Glynn Environmental Coalition (GEC) is submitting the following comments on the Office of Inspector General's (OIG) Report, Appropriate Testing and Timely Reporting Are Needed at the Hercules 009 Landfill Superfund Site, Brunswick, Georgia, Report 2005-P-00022, September 26, 2005 (Report). We trust the Report will be improved as comments solicited from EPA Region 4 and other parties are considered by the OIG. We understand that the opinion and findings of the OIG as stated in the Report do not necessarily represent the final EPA OIG position. We trust the OIG will take the following comments into consideration in formulating the final OIG position.

Sincerely,
Bill Owens, President

General Comments

1. The GEC agrees with the OIG position that the toxaphene analytical method used since 1993 by EPA Region 4 is not effective for detection of toxaphene in environmental samples, including soil, water, and fish.
2. The method of toxaphene analysis used by EPA Region 4 and Hercules, commonly called the Toxaphene Task Force (TTF) method and Hercules Protocol, failed to identify and measure toxaphene at levels meaningful to protection of public health and the environment. Data produced since 1993 for

the Hercules 009 Landfill Superfund Site (Site) is not appropriate for remedial decision-making. Areas were delineated for removal or solidification at the Site were based upon data of insufficient quality, which call into questions protectiveness of the remedy. Data produced by the TTF method either failed to identify toxaphene present, or seriously underestimated the amount present.

3. The GEC agrees with the OIG that if human health at the Hercules 009 Landfill Superfund Site and/or surrounding areas was threatened because the analytical method used to test for toxaphene underestimated the amount of toxaphene, then all areas sampled by the TTF or Hercules Protocol methods should be re-sampled by Negative Ion Mass Spectroscopy (NIMS).

Chapter 1 - Introduction

4. Demonstrating an understanding of the Hercules 009 Landfill Superfund Site's (Site) history and landfill contents is a very important step in preparing to make a determination about the protectiveness of the removal actions and containment activities. The following comments are made to correct inaccurate information presented in the OIG Report concerning the Site.

Site Information

*Part of the Hercules 009 Landfill was also used for disposing **empty toxaphene drums** and toxaphene-contaminated glassware, rubble, and trash. (emphasis added)*

5. Full drums were encountered during In-Situ Stabilization of the Site. Workers present reported that many of the full drums encountered were breached during the remedial action, and a few were over packed and removed. Off-grade toxaphene was reportedly disposed in the Site. The observations of the workers present during remedial activities are consistent with reported disposal of off-grade toxaphene at the Site. The OIG Report should be corrected to reflect that empty and full drums were disposed of in the Site, which is documented in the Site record.

The GEPD monitored the Hercules 009 Landfill while it operated.

6. The OIG report acknowledges that the Georgia Environmental Protection Division (GEPD) monitored the Site but fails to mention sampling results, and the reason for revocation of the Site Hazardous Waste Disposal Permit, and listing as an EPA Superfund Site. The GEPD reported

toxaphene sampling results from their Site monitoring in the April 22, 1980 Report - Off-site Contamination.

	3-6-80		3-6-80		3-14-80
	Soil		Water (surface)		Water (surface)
Perimeter ditch #1	65.5 PPM		0.005 mg/l		0.0076 mg/l
Perimeter ditch #2	55 PPM		0.005 mg/l		N/A
Culvert	435 PPM		0.1 mg/l		0.025 mg/l

The Site was closed due to migration of toxaphene from the landfill cells to ditches, culverts, and surface waters. Areas of concern that led to the National Priority List listing of the Site and identified for removal in the Record of Decision remain at the Site. Most notable are the culvert bank that adjoins the Site and toxaphene manufacturing sludge located below the water table.

The site is a 16.5 acre property, although the landfill occupies only 7 acres on the north end of the property.

7. A Superfund site is defined by the extent of contamination above remedial action goals, and not property boundaries. The Site includes the Benedict Road neighborhood, Altama Elementary School, and areas along Spur 25. These areas will need to be included in soil sampling to evaluate the removal action based upon data produced by the TTF and Hercules Protocol methods (a.k.a. August 17, 1997 method).

*In the forested area in the southeastern part of the site, **outside of the protectively capped area**, is a storage shed near a small pond. (emphasis added)*

8. No data has ever been produced to support the statement that the Site is protectively capped. To the contrary, the Record of Decision (ROD) mandated cap was never constructed, nor was the cap mandated in the Explanation of Significant Differences (ESD). The Site cover that was constructed is

composed of toxaphene contaminated soil from removal actions in the Benedict Road neighborhood, Altama Elementary School, along Spur 25, and previously excavated soils from drainage ditch maintenance, which was placed on the cells and mixed with a little cement. Protectiveness of the Site cover is questionable since no confirmation sampling has been conducted. Toxaphene in soil consolidated during removal actions and used to cap the Site was analyzed by the method the OIG has identified as inappropriate, and actual levels of toxaphene were likely under-reported.

The remedial action involved stabilizing the site and constructing a landfill cover, which was then covered with clean fill material that was graded to promote adequate drainage, and seeded with grass. (emphasis added)

9. The remedial action was far greater in scope than stabilizing the Site and constructing a landfill cover. The remedial action included soil removal of toxaphene-contaminated areas to the east that included Altama Elementary School and the Benedict Road neighborhood; areas to the south that included the entry road to the landfill cells and Benedict Road to Altama Avenue; and areas to the west along Spur 25. Migration of toxaphene was extensive around the Site. The mechanism of toxaphene transport and migration identified by Hercules was sloppy handling of manufacturing sludge during landfill construction. The TTF method found toxaphene at 1800 ppm on Altama Elementary School property, several hundred feet from the landfill cells. Of particular concern is how toxaphene migrated across a culvert and hundreds of feet onto Altama Elementary School property. The findings of the OIG should include recommendations to retest all areas previously tested by the Toxaphene Task Force (TTF) method, with Altama Elementary School identified as a priority.

Background Information on Toxaphene

As manufactured, the original toxaphene pesticide was a mixture of more than 200 closely related chlorinated organic compounds.

This original toxaphene pesticide mixture is commonly known as “technical” toxaphene. Technical toxaphene consists mainly of polychlorinated bornanes with between six to nine chlorines attached.

10. The Report fails accurately to define toxaphene and becomes embroiled in a discussion of technical toxaphene, weathered toxaphene, and degraded toxaphene. Toxaphene is one of the names by which

Hercules marketed their invention of a Polychlorinated Camphene (PCC) that was awarded patent number 2,565,471 on August 28, 1951. The patent clearly defines what constitutes PCC that was marketed under many names including toxaphene.

The PCC mixture patent protected by Hercules included, “Any polychloro camphene containing from about 40 to about 75% of chlorine ...,” or any camphene compounds with between 3 and 9 chlorines, and identified these compounds as the toxic ingredients of the invention. Regardless of the term used to describe freshly manufactured toxaphene, weathered toxaphene, or degraded toxaphene, all are the polychlorinated camphene (PCC) that comprised the toxic component that was patent protected. Only after camphene contains less than 3 chlorines can it be described as a degradation product.

Literature describes toxaphene or PCC as camphene with an average of 67% to 69% chlorine by weight, and is a complex mixture of over 670 separate chemicals. [\[1\]](#),[\[2\]](#),[\[3\]](#) The numerous names and definitions used in the OIG Report are all the PCC patent protected by Hercules, unless the camphene contains less than 3 chlorines.

The chemical of concern at the Site is PCC remaining in the manufacturing waste and off-grade product disposed in the Site. A discussion that attempts to differentiate technical toxaphene, degraded toxaphene, or weathered toxaphene are inappropriate since they all are toxaphene and are the chemical of concern at the Site, which is PCC. To infer that toxaphene is mainly polychlorinated bornanes with 6 to 9 chlorines attached is inconsistent with the product patented by Hercules.

PCC is known to produce an almost endless pattern of peaks when analyzed by Gas Chromatograph/Electron Capture Detector (GC/ECD). The variability of GC/ECD peak patterns for PCC can be observed between laboratory calibration standards purchased from different suppliers, yet they all are PCC. Variations in GC/ECD peak patterns can be observed between Electron Capture Detectors (ECD), yet they all are indicating the presence of PCC. GC/ECD temperate settings can produce variability in peaks, but the peak patterns still indicate PCC. GC/ECD patterns can also vary because PCC is known to undergo dechlorination, making some peaks smaller, most notably in the back half of the chromatogram, and larger in the front half of the chromatogram, but the compounds being observed are still PCC. Dechlorination of the most chlorinated camphene compounds, most notably camphene with 8 or 9 chlorines, is well known and has been documented numerous times in literature. Dechlorination can take place for a number of reasons but the decrease in back, and increase in front, chromatogram peaks do not indicate a different compound but rather a change in PCC ratios.

These breakdown products are a different mixture than the original mixture, so it appears different to the testing instruments.

11. How PCC mixtures appear to instruments is irrelevant to identification and quantification. Regardless of the ratio of the 670 plus variations of PCC present, it is still PCC. Hercules patent-protected a general recipe of polychlorinated compounds and did not specify any ratio of individual congeners. For this reason, the relative height of individual peaks in the standard is irrelevant to the peaks in the sample being analyzed and identified as PCC. All PCC with a chlorine content from between about 40% and about 75%, or between 3 to 9 chlorines, are the PCC compounds patented by Hercules and can be called toxaphene. PCC compounds that contain less than 3 chlorines can be called degraded PCC or degraded toxaphene.

Chapter 2 - The Groundwater Should be Tested for Toxaphene Breakdown Products

12. General Comment – The title of Chapter 2 should read “The Groundwater Should be Tested for Toxaphene and Toxaphene Breakdown Products.” As long as the PCC contains 3 or more chlorines attached to camphene, it is toxaphene or PCC. PCC with less than 3 chlorines attached to bornanes, or camphene, would constitute a toxaphene breakdown product. The GEC agrees that the Site monitoring program should identify any potential toxic transformation products and toxaphene. Since very little toxicological information is available about the 670 plus compounds that comprises PCC, and even less about any potential toxaphene transformation products, a very conservative approach should be used.

Until EPA knows whether the groundwater is contaminated by toxaphene breakdown products, it will be unable to definitively determine if the cleanup for the Hercules 009 Landfill protects Human Health.

13. The Report does not differentiate between cleanup and containment at the Site. Cleanup, or soil removal-action activities, took place outside the 7-acre area where the landfill cells were located. Containment, or Ex-Situ Stabilization, took place in the 7 acre area where PCC manufacturing wastes, off-grade product, and trash were disposed in the former Spur 25 borrow pit. The Report is confusing in that it implies that the testing the groundwater within the 16.5-acre Site will determine if the cleanup, or soil removal actions, of areas outside the Site property boundary are protective of human health.

Both soil cleanup and containment activities were based upon PCC analysis that the Report identified as inappropriate. The EPA will be unable to determine definitively if removal actions in the Benedict Road neighborhood, Altama Elementary School, and other areas protect human health until soil sampling takes place. The data that were used to delineate removal actions relied upon the same analytical method the OIG has identified as inappropriate. All data produced since 1993, which included the decision-making data for the soil removal actions, remedial design, remedial action, and delineation of areas for Ex-Situ Stabilization are of no value in making a determination about protectiveness to human health and the environment.

In the case of Hercules 009 Landfill, the surrounding groundwater is being periodically tested for the original toxaphene mixture put in the site between 1975 and 1980.

14. The original toxaphene mixture placed in the Site has not been definitively identified. What is now being described, as weathered or degraded toxaphene, could be what the original waste mixture looked like on a chromatogram when disposed in the Site. The Report appears to be stating that Site groundwater has been periodically tested, but fails to state that the TTF and Hercules Protocol methods were used, which the OIG has now identified as inappropriate. The TTF and Hercules Protocol methods based identification on the presence of at least four peaks in the back half of the chromatogram with ratios the same as the analytical standard being used. PCC was not identified or quantified unless at least four peaks were present. OIG Report Figures 1, 3, 4, and 5 graphically demonstrate that four peaks in the same ratio were not present in the sample and standard, and therefore PCC was not reported as present. The quantification methods used are not the same as EPA Method 8081. A trained chemist can confidently state that PCC is indicated and quantify “total toxaphene” or “apparent toxaphene”, even if there have been decreases in late PCC peaks and increases in early PCC peaks, when EPA Method 8081 is properly applied. The underlying problem at the Site is that the TTF and Hercules Protocol methods were used to indicate the presence of PCC instead of EPA Method 8081. Numerous laboratories flag analysis with TTF or Hercules Protocol instead of Method 8081 since they recognize the methods are different and consistently produce very different results. The Agency for Toxic Substance and Disease Registry is specific as to why the TTF and Hercules Protocol methods are not the same as EPA Method 8081.

Testing for Toxaphene Breakdown Products Is Needed

EPA’s Method Fails to Identify Toxaphene Breakdown Products in Groundwater

15. General Comment – While testing for toxaphene breakdown products is needed, the primary problem at the Site, and underlying reason there are concerns about the protection of human health, is the TTF and Hercules Protocol methods fail to identify toxaphene. Repeatedly, methods used at the Site have been demonstrated either to fail to detect or to underestimate seriously the amount of PCC present in soil, seafood, and water.

Using a Different Method Would Identify Breakdown Products

When the OIG looked at the groundwater monitoring data for evidence of toxaphene breakdown products, the OIG found some evidence suggesting that toxaphene breakdown products may be in the groundwater surrounding the Hercules 009 Landfill site.

16. The OIG's observation that PCC was present when none was reported by the TTF and Hercules Protocol methods is the same conclusion other studies have reached and confirmed through analysis. The OIG suggesting that the observed compounds might be "toxaphene breakdown products" is inappropriate since the compounds observed are most likely part of the PCC mixture patented by Hercules. The patent did not specify a particular ratio of individual PCC compounds as patent protected toxic components. Many of the prominent PCCs found in the front half of the chromatogram are associated with unmodified toxaphene or PCC as manufactured by Hercules. [\[4\]](#),[\[5\]](#),[\[6\]](#),[\[7\]](#)

Without such definitive data, any determination on the effectiveness of the cleanup remedy is inconclusive.

17. The GEC agrees with the OIG that definitive data is needed to evaluate the cleanup of the Benedict Road neighborhood and Altama Elementary School, and other areas where soil removal actions took place. Likewise, the effectiveness of the containment remedy will be inconclusive until definitive data is produced that demonstrates the action levels specified in the Record of Decision (ROD) have been obtained at the Site. Without completion of the confirmation sampling specified in the ROD, attainment of remedial action goals cannot be demonstrated.

A new analytical method using Negative Ion Mass Spectroscopy (NIMS, or called the new method hereafter) should be used to test for toxaphene breakdown products in groundwater.

18. The GEC agrees with the OIG Report in that NIMS should be used to test for PCC breakdown products in groundwater. In addition, NIMS should be used to test for PCC and PCC breakdown products wherever the TTF and Hercules Protocol methods were used to analyze soil, air, seafood, surface water, and groundwater.

Therefore, the use of the new techniques for groundwater monitoring at the Hercules 009 Landfill site provides the certainty needed to determine whether the groundwater is contaminated by toxaphene breakdown products.

19. Use of NIMS is also needed to provide the certainty needed to determine if PCC and PCC breakdown products are still present in areas where soil removal actions took place, particularly the Benedict Road neighborhood, Altama Elementary School, and the culvert adjoining the school.

Region 4 Is Concerned about Using the New Method

Region 4 officials are concerned about using the new (or NIMS) method to test groundwater at the Hercules 009 Landfill because the method is not approved by EPA.

20. The two methods used at the Site, TTF and Hercules Protocol methods, were not SW-846 approved for use by the EPA. EPA-approved methods are set forth in EPA publication SW-846, and the prescribed method was Method 8081. The NIMS method has been used and documented in peer reviewed scientific journals numerous times since at least 1987.

The EPA conventional method (method 8081) was validated. Consequently, EPA knows the results will be accurate when Method 8081 is used to test for the original toxaphene mixture.

21. While the statement is true that EPA Method 8081 was validated, it is not the analytical method used at the Site. Method 8081 has been used for many years to test for PCC and quantify the indicated total or apparent PCC present. When Method 8081 and the TTF or Hercules Protocol methods are compared side-by-side, Method 8081 reports toxaphene present and at substantially higher levels than the TTF and Hercules Protocol methods, which either fail to detect or substantially under-quantifies PCC present. The TTF and Hercules Protocol methods are NOT Method 8081.

The OIG agrees that using an EPA-approved method is better than a method not approved by the EPA. However, EPA has no approved method to identify toxaphene breakdown products.

22. The GEC agrees that EPA-approved methods should be used. The use of NIMS will eliminate the ambiguity, doubt, and confusion associated with the TTF and Hercules Protocol methods. The inherent weakness with EPA Method 8081 was an inability to definitively identify the compounds present. In order to compensate, Method 8081 recommends confirmation by Mass Spectroscopy (MS). Utilization of NIMS in conjunction with Method 8081 is consistent with established EPA SW-846 protocols and would definitively identify PCC and PCC breakdown products.

Recommendations

23. General Comments – The GEC agrees with the OIG’s recommendation to test groundwater at the Site for PCC. But OIG recommendations must go further to protect human health. Testing Site groundwater is a limited measurement of the containment part of the remedy but does not address the soil removal action parts of the remedy. The same shortcomings identified with groundwater testing apply to the data used for the decision-making process for soil removal actions. Data collected by the TTF and Hercules Protocol methods have been documented to significantly underestimate or to fail to identify PCC present.

The OIG should recommend that all soil, surface water, groundwater, and seafood samples analyzed by the TTF or Hercules Protocol methods be analyzed by an appropriate method such as NIMS. If PCC compounds are found at the Site, appropriate action as specified in the ROD should be taken to protect human health.

Agency Comments and OIG Evaluation

Region 4 later provided results of analytical testing they had performed using EPA method 8081. Their results showed significantly more toxaphene in one well (N-11) at the site.

24. EPA Region 4 has stated that no toxaphene has been detected in groundwater at the Site and has repeatedly cited this as the reason the ROD mandated remedy need not be implemented. Toxaphene has been found historically and continues to be found in groundwater at the Site.

As discussed in Appendix C, the quality control does not adequately show that the substances to be measured were not destroyed when the samples were prepared.

25. Sample preparation and GC/ECD injector temperatures are suspected to remove, dechlorinate, or even destroy PCC in the samples.

Region 4 proposed two interim strategies to assess the risk to human health posed by the toxaphene breakdown products, which they called weathered toxaphene.

26. Region 4 has failed to demonstrate an understanding of PCC and has developed a wide range of terms, words, and definitions for the PCC mixture patented by Hercules. The PCC Region 4 calls by numerous descriptive terms fall under the patented product. PCC breakdown compounds, which are chlorinated camphene with less than 3 chlorines, should be clearly defined as such. The term “weathered toxaphene” used by Region 4 is ambiguous, and should not be used.

We evaluated the proposed strategies, and believe the strategy using toxicity criteria for toxaphene is inappropriate because the toxicity of weathered toxaphene could be significantly different.

27. The GEC agrees with the OIG in that different ratios of PCC compounds will have different toxicological properties, and the precautionary principle should be applied. The term “weathered toxaphene” is very ambiguous and appears to be linked to an undefined peak profile for PCC. The definition of toxaphene, as stated in the Hercules patent for their PCC invention, is any peak ratio of camphene with 3 to 9 chlorines; and all PCC that falls within this definition should be simply called toxaphene or PCC.

Chapter 3 – Reporting on the Cleanup’s Effectiveness Was Not Timely

28. General Comments - The OIG identified the need to determine if the remedy is operating as intended and still protects human health and the environment. The soil removal actions took place outside the Site property boundary, and sampling groundwater will not, by itself, provide information needed about the soil removal actions that were originally based, it should be recalled, upon soil data analyzed by a method the OIG has identified as inappropriate. This fact undermines the conclusions of the OIG Report that the remedy is operating as intended.

Review Must Occur Every 5 Years

... the purpose of the 5-year review was to evaluate, through data gathering and observation, how well the site's remedy is working.

29. The OIG correctly found that the TTF and Hercules Protocol methods used to analyze the Site were inappropriate. Without reliable data to make scientifically sound evaluations, questions regarding the Site remedy working will not be answerable. Appropriate sampling and analysis of soil and groundwater are needed to complete the Five-Year Review.

Question A – Is the remedy operating as intended by the decision documents?

Question B – Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used when the remedy was selected still valid?

Question C – Has any other information come to light that could call into question if the remedy protects human health?

30. The OIG focused on Question B, and concluded that remedial action objectives would not have been met if toxaphene is found in the groundwater. The same is true if soil remediation goals were not met in the soil removal actions, which were based upon analytical methods now known to be inappropriate. However, key to meeting the remedial objectives is answering Question A regarding implementing the decision documents, and Question C regarding information that could call into question protectiveness of remedy to human health and the environment. The data that formed the basis of decision-making for the Remedial Design and Remedial Action were seriously flawed, the reality of which the OIG has identified as a significant problem. Based upon the flawed data, EPA Region 4 made a decision not to implement the ROD. Specific deviations from the ROD in conjunction with PCC analysis by the TTF and Hercules Protocol methods call into question protectiveness of the remedy to human health and the environment. The following components of the ROD must be evaluated in order to determine if the remedy is working as intended.

A. Performance Standards

The Performance Standard of 76 PPM toxaphene for subsurface soils was established as a remedial action goal for the source areas to protect surface water and groundwater at the Site. [\[8\]](#), [\[9\]](#) It was

anticipated that contaminants at the Site which do not have cleanup levels presented in the ROD would be reduced to acceptable levels when cleanup levels were met for the most toxic and most mobile contaminants for which cleanup levels have been established.[\[10\]](#) The EPA assured the community that the cleanup goal of 76 ppm toxaphene for subsurface soils would be met by either stabilization or chemical extraction.[\[11\]](#) The treatment method, In-situ Stabilization, was selected because it would reduce the incremental risk associated with current Site conditions by permanently treating all affected solids having constituent concentrations exceeding remedial action levels.[\[12\]](#) In addition, by treating the soil in place, or In-Situ, the public and the school children at Altama Elementary School adjoining the Site would be further protected from fugitive emissions during the Remedial Action. The EPA specifically and repeatedly assured the community that In-Situ would be conducted without excavating the contents of the landfill at the pre ROD meeting.

The EPA has made a fundamental change in the scope and performance of the subsurface soil Performance Standard of 76 ppm toxaphene by changing the Performance Standard to the water table; and has fundamentally changed the cost of treatment by reducing volume to be treated. Furthermore, the Performance Standard change was fundamental since it does not enhance its protectiveness, or effectiveness.[\[13\]](#) The OIG Report failed to evaluate colloidal transport of toxaphene to neighboring properties, or discuss the implications of leaving untreated toxaphene sludge and contaminated soils below the groundwater table. Areas adjoining the Site, such as the culvert bank, identified for soil removal actions have not been remediated.

EPA Region IV contends that when the regional groundwater table is reached, they have met the intent of the ROD and the ROD did not contemplate extensive groundwater de-watering which would be necessary to treat below the regional groundwater table.[\[14\]](#), [\[15\]](#), [\[16\]](#), Contrary to contentions of the EPA, de-watering was contemplated and discussed in the Feasibility Study.[\[17\]](#) The Remedial Investigation clearly shows the sludge extended into the observed groundwater table.[\[18\]](#) The authors of the ROD understood the sludge extended into the groundwater table,[\[19\]](#) and the Site was deeper than historical records indicate.[\[20\]](#) It is accurate to say the ROD did contemplate treatment below the water table but left the engineering specifications to be worked out in the Treatability Study using the Performance Standard of all subsurface soils exceeding the Performance Standard of 76 ppm toxaphene. The EPA has concluded previously that In-Situ Stabilization is an effective remedial technology and would achieve the performance criteria specified in the ROD for this Site.[\[21\]](#)

The OIG Report did not mention that toxaphene sludge depth data from the Treatability Study and Supplemental Soil Analysis could be used to estimate the volume of source areas that were left untreated. Data concerning the amount of sludge and contaminated soil left untreated will be needed to evaluate the potential for continued colloidal transport of toxaphene to neighboring properties.

B. Treatment Volume

The change to subsurface soil Performance Standard fundamentally reduced the treatment volume. Eliminating source areas to be treated as determined by the methodology specified in the ROD fundamentally changes the volume to be treated and is a fundamental change in scope, performance, and cost. Subsurface soil target concentrations were used to establish treatment boundaries for subsurface soil and wastes for cost estimating purposes and a sampling program was conducted to determine the actual volumes of surface soil and subsurface soil requiring remedial action.[\[22\]](#) The ROD specified a sampling program to determine the actual volumes of the source areas to be treated, and not the groundwater table. If the groundwater table was to be used as the remedial boundary, all necessary data to determine source area volume would have been present at the time the ROD was written. The use of soil-driven standards was further clarified in the ROD; "Sludge and soil containing toxaphene exceeding remedial action target concentrations will be treated in-situ in conjunction with stabilization of consolidated surface soil". By their own admission, the EPA did not expect excavation to meet the Performance Standard or use the methodology specified in the ROD to determine treatment boundaries of source areas.[\[23\]](#) The ROD is clear: the subsurface soil target concentrations were to be used to establish vertical and horizontal treatment boundaries for subsurface soils and waste, and a sampling program conducted to determine the actual volumes of surface soil and subsurface soil requiring remedial action.[\[24\]](#) A sampling program, not the water table, was to be used to determine the boundaries of the source areas designated for treatment. Sampling required under the ROD was conducted to determine the vertical and horizontal boundaries of the source area to be treated during the Treatability Study.[\[25\]](#) Discarding the delineated source areas identified for treatment in the Treatability Study, a decision document for the Site, is a fundamental change to the scope, performance, and cost of the remedy selected in the ROD.[\[26\]](#)

The Five-Year Review did not consider the Treatability Study or the Summary Report for Supplemental Soil Analysis at the 009 Landfill. [\[27\]](#) Treatability studies and the Remedial Investigation consistently and repeatedly found toxaphene sludge deeper than the historical descriptions of the landfill cells. It is conspicuous that the OIG did not mention that significant source

areas did not undergo the remedy specified in the ROD. The OIG conclusion that the remedy is protective is based upon a very limited subset of documents supporting contentions that the Site Remedial Action is protective. When the Administrative Record is examined as a whole, data refutes contentions in the OIG Report that the Site is not a continuing hazard and risk to human health and the environment.

C. Treatment Method

Fundamental changes were made to the ROD specified treatment method of In-Situ Stabilization, to stabilization of only source areas above the water table to form a cap over the site.[\[28\]](#), [\[29\]](#) The fundamental change in the treatment method made by the EPA also changed the performance and scope of treatment because of the limitations identified with excavation at the site.[\[30\]](#) In addition, cost of treatment changed by a reduction in the soil volume determined during the Treatability Study using the ROD guidelines. An amendment to the ROD is required when changes do not enhance protectiveness or effectiveness, reduce scope, performance, cost, and are a fundamental reconsideration of the basic remedy selection decision on which comment was taken.[\[31\]](#)

The EPA called the treatment method In-Situ and assured the community that stabilization would take place below ground, while remedy actually excavated the entire contents of the Site down to the water table. All descriptions of the Remedial Action by the EPA describe Stabilization with extensive excavation, contrary to the assurances given to the community.[\[32\]](#), [\[33\]](#), [\[34\]](#), [\[35\]](#) Inherent problems identified with excavation at this Site in the RI/FS re-emerged.[\[36\]](#)

Contrary to the contention of the EPA, all toxaphene sludge was not treated because sludge extends below the regional groundwater, and treatment was stopped before, or when, the groundwater table was reached. Water table elevations at the site range from 14 to 17 feet MSL (Mean Sea Level)[\[37\]](#) and the sludge extends down below 10 feet MSL.[\[38\]](#) The water table Performance Standard and capping the Site alters scope, performance, and cost.

The cap will not prevent transport of contamination into the groundwater because source areas exist in soils above Performance Standards over 12 feet below the water table. In addition, horizontal groundwater flow will continue to allow colloidal migration of contamination from source areas throughout the subsurface soils.[\[39\]](#) A "Cap" is a fundamental change to the remedy selected in the

ROD that does not enhance performance or effectiveness, and changes the scope, performance and cost.

D. Confirmation Sampling

Confirmation sampling to confirm compliance with the ROD and protectiveness of the remedy was mandated by the ROD, but changed to only if excavation did not reach the water table.[\[40\]](#) Elimination of confirmation sampling specified in the ROD is a fundamental change in the scope, performance, and remedy selection decision process in which public comments were taken. The change does not enhance protectiveness or effectiveness and cannot be handled by an Explanation of Significant Differences.[\[41\]](#)

The EPA magnified uncertainties already associated with In-Situ. Uncertainties associated with In-Situ stabilization are the variability of the treatment throughout the treatment zone and incapability of the contractor to monitor treatment results. These concerns were addressed in the ROD by requiring sufficient overlap between treated areas and by post-treatment sampling of the treated zone and underlying soil.[\[42\]](#) The Remedial Action did not conduct the ROD specified post-treatment sampling required and further expands the uncertainties associated with the selected treatment. The OIG Report contends that the remedy is protective based upon opinion, speculation and hearsay, not the data specified in the ROD to evaluate the completed Remedial Action.

Changes in treatment volume and treatment method resulted in the underlying soil, for a depth of up to 12 feet, not meeting Performance Standards. [\[43\]](#) Levels up to 2600 PPM remain in the soils below groundwater level.[\[44\]](#) Fundamental changes to confirmation sampling do not enhance protectiveness or effectiveness and fundamentally change the scope and cost.

The draft Five-Year Review confirms that colloidal transport of toxaphene is taking place at the Site, but did not discuss the migration rate or how untreated sludge and soil could contribute to continued colloidal transport off-site to neighboring properties. Failure of the OIG to evaluate past and current colloidal transport leaves considerable doubt about protectiveness of the remedy to neighboring properties. Extensive migration of toxaphene took place on and around the Site. The PRP identified the transportation mechanism responsible for migration on site and off site to the Benedict Road neighborhood, and to Altama Elementary School, as handling techniques used during landfill construction and dredging of the adjoining culvert. The ROD included the culvert adjoining the Site in

the areas identified for remedial action, which has not been done. The area between the landfill cells and the culvert are a significant source area that has not been remediated.

E. Landfill Cap

Elimination of the clay component of the cap is a fundamental change that does not enhance protectiveness or effectiveness and cannot be handled by an Explanation of Significant Differences because it is a fundamental change in the scope, performance and cost of the remedy selected in the ROD.[\[45\]](#), [\[46\]](#) Furthermore, the treatment of consolidated contaminated soils with 3% Portland cement is a fundamental change from formulations approved in the Treatability Study (TS). No Treatability Study was performed on the 3% Portland cement formulation. The proposed treatment is in non-compliance with the Treatability Study, a Decision Document for the Site. Therefore, the treatment is a fundamental change in the remedy and treatment methodology specified in the ROD. The cap treatment does not enhance performance or effectiveness and changes the scope, performance, and cost of the selected remedy.

The OIG Report should have mentioned that the ESD mandated Site cap of consolidated off-site removal action soils that were to be screened and mixed in a pug mill before being applied to the site was never implemented. In actuality, contaminated soil was placed on top of the Site and mixed with some cement. No confirmation sampling has been done to evaluate the ability of the contaminated soil placed on the landfill to resist rainwater infiltration. The placement of soil over the site and mixing cement, which is in non-compliance with the ESD, could result in a significant decrease in effectiveness. Significant also is that the OIG Report failed to note that neither the ROD nor ESD specified covers were constructed at the Site. To the contrary, the OIG states the site is protectively capped, which is not supported by any data.

F. Explanation of Significant Differences

The draft Five-Year Review Summary Form, under Issues, states that the August 1998 Explanation of Significant Differences (ESD) provided adequate explanation for the changes made to the ROD concerning depth of excavation. The ESD states that there will be “hydrostatic inflow”, “blow-in”, “unsafe working conditions”, and “side sloping”, if the remedy specified in the ROD is followed. Presumably the safety concern stems from a reported upwelling of water under the site. The EPA requested study and quantification of this reported phenomenon by Hercules that was so

dangerous in 1996. **No data has been produced to support the contention that water upwelling occurs under the Site. The premise of the ESD is not supported by Site data.** To the contrary, the EPA and RP have never explained how toxaphene migrated deep into soils underlying the Site against upwelling water. The OIG Report relies heavily on the EPA Region 4 hydrologist's evaluation of the Site, which does not indicate in any way that water upwelling is occurring or has occurred at the Site.

Under CERCLA, supporting documentation for an ESD must be placed in the Repository for public reading. No documentation has been produced by the EPA or PRP to support the claims made about potential disastrous construction conditions described in the ESD. The ESD is no more than a collection of rumors and hearsay that are not supported by Site data. A more likely scenario is that the ESD was written in support of agreements made between the EPA and Hercules during 1996, 1997, and 1998. There is documentation in the Administrative Record to support this scenario, whereas there is none to support the ESD.

The ESD fundamentally changed In-Situ remedy specified in the ROD to excavation and treatment, which reintroduce the need for dewatering with excavation identified in the Feasibility Study. The draft 5-Year Review accurately reports the Remedial Action for the Site as excavation, a fundamental change in the ROD.

EPA Region IV contends that when the regional groundwater table is reached, they have met the intent of the ROD; the ROD did not contemplate extensive groundwater de-watering which would be necessary to treat below the regional groundwater table.[\[47\]](#), [\[48\]](#), [\[49\]](#). Contrary to contentions of the EPA, de-watering was contemplated and discussed in the Feasibility Study.[\[50\]](#) The Remedial Investigation clearly shows the sludge extended into the observed groundwater table.[\[51\]](#) The authors of the ROD understood the sludge extended into the groundwater table,[\[52\]](#) and the Site was deeper than historical records indicate.[\[53\]](#) It is accurate to say the ROD did contemplate treatment below the water table but left the engineering specifications to be worked-out in the Treatability Study using the Performance Standard of all subsurface soils exceeding the Performance Standard of 76 PPM toxaphene. The EPA has concluded previously that In-Situ Stabilization is an effective remedial technology through onsite stabilization with vertical augers that did achieve the performance criteria specified in the ROD for this Site.[\[54\]](#) The EPA agrees that the remedy implemented at the Site was Ex-Site Stabilization, and not the In-Situ stabilization required under the ROD. [\[55\]](#)

The extensive changes to the effectiveness, protectiveness, scope, and performance of the Site remedy leaves considerable doubt about the efficacy of the remedy, which is further exacerbated by the analytical methodology used during the decision-making process that the OIG has identified as inappropriate.

Further Definite Information is Needed

Between the first draft report of the 5-year review and the most recent one, the conclusion on the cleanup's effectiveness changed; we agree with the Corps' original conclusion that additional information is needed to responsibly make a determination.

However, it also stated that the data being collected was not appropriate to determine if the cleanup is functioning.

31. The GEC agrees with the OIG that additional information is needed to make a determination about the cleanup's effectiveness, and if the on-site containment is operating as intended. Data used to complete the Treatability Study (TS), Remedial Design (RD), Remedial Action (RA), and follow-up confirmation sampling for off-site removal actions were based upon data produced by the TTF and Hercules Protocol methods. The OIG report correctly identifies the need for additional information, but did not recommend sampling and analysis needed to evaluate the TS, RD, and RA decision-making process, or protectiveness of the off-site removal actions.

However, the subsequent sentences in the first paragraph of the determination (draft 5-year review) were deleted, including the caveat about the data: ...data being collected is not appropriate to determine if the remedy is functioning as intended by the ROD. Groundwater data from the monitoring well network at the site does not appropriately represent the concentration of total toxaphene present in the ground water.

32. The findings of the Corps underscores that the TTF and Hercules Protocol did not report total toxaphene results needed to evaluate protectiveness of the remedy to human health and the environment. Efforts of EPA Region 4 to delete this section indicates that Region 4 understood that the TTF and Hercules Protocol methods were not equivalent to EPA Method 8081, which is used to report total toxaphene and apparent toxaphene. The EPA Region 4 chemist, who also participated in the

development of the TTF method, noted that the "latter peaks" in samples were decreased and the "early peaks" were increased in environmental samples from Brunswick, and that the TTF method may seriously underestimate the true concentration of toxaphene. [56],[57] The Georgia Environmental Protection Division chemist that participated in development of the TTF method noted that unknown peaks not quantified may have been toxaphene related and the total area method was not used when the TTF method was applied. [58] It is very unusual that analysis is conducted and chemical compounds present are not reported, as with the TTF method. Sound analytical methods, intended to protect human health and the environment, include the reporting of unidentified compounds when they are encountered.

However, since additional actions were taken to ensure that the community around the site is not exposed to groundwater, we agree that the remedy is effective.

33. The GEC disagrees with the OIG solely using groundwater as the measure of the remedy's effectiveness. The remedial decision-making process was based upon data the OIG has identified as inappropriate, which was also used to delineate areas for soil removal actions and to confirm the soil remedial action goals had been achieved. The toxicologist with the Agency for Toxic Substance and Disease Registry (ATSDR) noted that use of the "back half" peak method (TTF method) is likely to result in significant underestimation of PCC concentration, and the estimated dose could be 10 times higher if historical data are taken into account for dose estimation. [59] The interview with Dr. Keith Maruya for the Hercules 009 Landfill Superfund Site Five-Year Review resulted in an estimation of toxaphene levels up to 10 times higher than reported by the TTF analytical method. The OIG Report does not discuss how a determination that the remedy is protective could be made with admittedly questionable data that was used for the soil removal actions, RD, and RA decision-making.

Agency Comments and OIG Evaluation

We removed the second (deed restrictions) and third (threat to residential wells) of the three recommendations because Region 4 provided documentation that (1) the consent decree was recorded in the records of Glynn County...

34. Institutional controls such as deed restrictions are an important part of the decision-making process at site where the remedy is containment and Monitored Natural Attenuation (MNA), and were

mandated as part of the ROD for this Site. The failure to record deed restrictions for the Site could have prevented the excavation, drilling, and subsequent severe erosion that took place at the Site during parking lot construction in the Spring of 2005. The OIG should recommend deed restrictions be recorded for the Site since recording of the consent decree has been demonstrated as insufficient to meet the intent of the ROD, which is to prevent reintroduction of contained wastes into the environment. Also notable is that the EPA did not receive or approve Site construction plans prior to commencement of work, which underscores the need and importance of deed restrictions.

A Region 4 hydrologist evaluated the perimeter monitoring well system and concluded it is sufficient to evaluate migration of contaminants.

35. The OIG relied upon the EPA Region 4 hydrologist for an evaluation of the Site perimeter monitoring well system. Site hydrology is very important since it determines the placement of monitoring wells and was the stated basis of the decision-making process that led to a fundamental change in the remedy that reduced the scope, performance and cost, and formed the basis of an Explanation of Significant Differences for the Site. The GEC reviewed data that the EPA Region 4 hydrologist used to determine monitoring wells were sufficient and that was used by the OIG to support the conclusion that the remedy is protective.

The following are quotes from Attachment 4, the December 17, 2004 Memorandum from the EPA Region 4 hydrologist.

Toxaphene has not been detected in ground water at the site and remains a non-detect following the implementation of the remedy.

36. Toxaphene, or PCC, was routinely detected at the Site as noted in the Remedial Investigation (RI), Treatability Study (TS), and post remedy sampling. The OIG noted that recent testing had detected PCC in the groundwater. The OIG's Report identified chromatogram peaks suspected to be PCC in groundwater in Figure 5 when the TTF method was used. The Region 4 hydrologist incorrectly reported that PCC has not been detected in the past or present sampling events. After the TTF method was adopted, the PCC quantification limit was also raised from .001 mg/l to .005 mg/l. Implementation of the TTF method is suspected by the GEC to be the primary reason PCC has not been reported in groundwater samples, but a five fold increase in quantification limits is also a significant contributing factor. Combining the opinion of the ATSDR toxicologist that the TTF method reports 10 times less

PCC than is present, and a five fold increase in quantification limits, significant doubt exists concerning the accuracy and usability of the water monitoring data for decisions concerning protection of human health and the environment.

Explain how the water level contours were constructed. I drew contours of my own both by hand and using Surfer and could not duplicate RMT's map. A discussion of the head perturbations (see Figure in the next page) in the intermediate and deep zones needs to be discussed in support of the ability of the monitoring system (sic) to detect contamination if it existed.

37. The Region 4 hydrologist could not take the hydrological data presented and duplicate the Site hydrology as the Hercules' consultants reported conditions at the Site. The data was insufficient to support the ability of monitoring wells to detect contamination. Basic scientific principles mandate that experimental designs produce data that are reproducible. Data used by the Region 4 hydrologist did not meet minimal standards of scientifically sound data.

RMT concludes that the monitoring system is sufficient to detect contamination. In support of that statement the cross-sections on Sheets 1 and 2 should include the monitoring wells in order to depict that clearly.

38. The Region 4 hydrologist recognized that further information needs to support the Hercules consultant's opinion that the monitoring system is sufficient to detect contamination. It appears that the Region 4 hydrologist is supporting the conclusion that the monitoring wells are properly located upon the consultant's opinion and not scientifically sound data.

A discussion of the vertical ground water velocity should be included in the groundwater monitoring results section. This information is valuable in substantiating that migration of contamination would be reflected in the monitoring system if it was indeed occurring.

39. The ability of the monitoring system to detect contamination is questioned due to the lack of data concerning vertical groundwater velocity. Lack of vertical groundwater velocity data continues to be a problem at the Site. The EPA has asked for data supporting vertical groundwater flow repeatedly before the Remedial Action, and has asked for it again now to support their contention that the monitoring wells system is sufficient to detect contamination migrating from the Site. An Explanation of Significant Differences (ESD) was based upon a reported vertical groundwater upwelling. The ESD states that there will be "hydrostatic inflow", "blow-in", "unsafe working conditions", and "side

sloping”, if the remedy specified in the ROD is followed. Presumably the safety concern stems from a reported upwelling of water under the site. The EPA requested study and quantification of this reported phenomenon by Hercules that was so dangerous in 1996. No data has ever been produced to support the contention that water upwelling occur under the Site. The premise of the ESD is not supported by Site data. To the contrary, the EPA and Hercules have never explained how toxaphene migrated deep into soils underlying the Site against upwelling water. Under CERCLA, supporting documentation for an ESD must be placed in the Repository for public reading. No documentation has been produced by the EPA or Hercules to support the claims made about potential disastrous construction conditions from vertical groundwater velocity described in the ESD.

Support for disastrous hydrological blow-in conditions at the Site, if they existed, would have been encountered during construction of the landfill. Notable is that a much larger and deeper borrow pit was constructed a few hundred feet to the west of the Site during the period remedial activities took place. If hydrological blow-in conditions existed, they would have precluded construction of the Site borrow pit and the nearby borrow pit. Interestingly, effects from an extended period of pumping at the nearby borrow pit are not noted in Site hydrology documents.

The EPA Region 4 hydrologist’s opinion that the remedy is protective and the monitoring system functioning as intended is not supported by data that meets minimal scientific standards. Rather, it appears that the hydrologist is repeating Hercules consultant’s opinion while asking for supporting data. The request for data quantifying the vertical velocity of groundwater that supported the ESD has remained unanswered for over 9 years.

The OIG appears to put great emphasis on the Region 4 hydrologist’s opinion that the monitoring wells are sufficient since it is quoted. The OIG needs to be sure to differentiate between opinion and an evaluation supported by scientifically sound data, and the Region 4 hydrologist’s opinion is not supported by sound data. Furthermore, the OIG should recommend that a hydrologist outside Region 4, and preferably independent of the EPA, review Site hydrological data, determine sufficiency of the monitoring well system, and make recommendations for any identified Site data needs.

Appendix A - Technical Discussion on Toxaphene

Both Hercules Incorporated and the U.S. Environmental Protection Agency (EPA) use EPA's analytical method 8081 to test for the original toxaphene pesticide mixture in the groundwater.

40. Hercules and the EPA did NOT use EPA method 8081 to analyze for toxaphene in groundwater and soil, which fact is supported by numerous studies that compared the TTF and Hercules Protocol methods used at the Site side-by-side with EPA Method 8081. The TTF method was designed to identify and quantify toxaphene and some other product which would remain unidentified and not quantified, which was agreed to at a September 30, 1991 meeting with the EPA, GEPD, Hercules, and representatives of Law Environmental. [60] Instead of "total toxaphene" or "apparent toxaphene" quantified by EPA Method 8081, which is used by toxicologists in determining the potential risk to human health and the environment, an agreement was made to develop another method for identification and quantification of PCC. Prior to developing another method for the identification and quantification of toxaphene, the September 30, 1991 meeting participants agreed that methods used to date had reported apparent toxaphene, also called total toxaphene, which is produced by correctly applying EPA Method 8081. The report of TTF, released June 4, 1993, was described as a very limited study of toxaphene analysis of real samples collected at the Hercules facility in Brunswick, Georgia. [61]

EPA Method 8081 was intended to report total toxaphene and the four peak method was intended to produce results comparable to the total area method. The TTF and Hercules Protocol methods do not produce results comparable to the total area method.

The following examples demonstrate the differences between the TTF and Hercules Protocol methods and EPA Method 8081.

Example 1

Samples were analyzed by the TTF method, and by the U.S EPA approved Contract Laboratory Program (CLP) method 8081. Because early and disproportionate peaks are eliminated from the quantification in the TTF method, it produces much lower PCC quantification results than the EPA CLP analytical Method 8081. U.S. EPA Region 4 Environmental Services Division Laboratory analyzed split samples by the TTF method and a contracted laboratory by the U.S. EPA approved CLP method 8081. Results showed that the TTF method either failed to detect PCC or only identified as little as 3.2% of the PCC present. [62]

Example 2

The GEPD laboratory analyzed soil samples from the Goodyear Elementary School playground and reported that toxaphene was not present in the soil samples. [63] When analysis was conducted by SW-846 8080 and quantified using the total area method (total toxaphene), toxaphene was reported up to 64.6 ppm. [64]

ATSDR evaluated the data produced by the TTF method and found many concerns over its use. [65] The Hercules Protocol method failed accurately to identify and quantify a known amount of the PCC in the calibration standard. [66] ATSDR has extensively discussed why the TTF and Hercules Protocol methods are not equivalent to EPA Method 8081.

As noted in the OIG report, the TTF method also failed to identify PCC in seafood samples. EPA approved methods have routinely found PCC in fish, whereas the TTF and Hercules Protocol have consistently failed to detect or significantly under-quantify PCC present in the samples.

Throughout the Report the OIG should replace reference to EPA Method 8081 with TTF and Hercules Protocol methods, which were actually used at the Site.

Basics of Toxaphene Chemistry

41. See Comments 10, 11, and 14 for comments about the basics of toxaphene chemistry and what is toxaphene and what constitute toxaphene degradation products.

Technical Toxaphene Degrades in the Environment

Therefore, technical toxaphene is expected to degrade in the environment and its degradation is mediated primarily by microbes living in the soil.

42. The GEC agrees that PCC will degrade in the environment under conditions noted by the OIG. Unfortunately, the Site has not been analyzed for microbial activity, which would provide useful information about the efficacy of the MNA remedy.

Evaluating the Potential Risk to Humans from Toxaphene Exposure

Conducting a detailed and comprehensive risk assessment for the potential exposure to toxaphene from the Hercules 009 Landfill site is a complex task that is beyond the scope of this OIG review.

43. Even though the OIG admits risk assessments are complex and beyond the scope of this review, the OIG goes on to speculate and make sweeping and unsupported assumptions in this section. Specific concerns about the OIG's conclusions follow.

In general, a major factor needed to evaluate the level of risk to human health is to determine the major exposure pathways to toxaphene's degradation products and to determine all potential sources. The Hercules 009 Landfill site is just one off the potential exposure routes. ...The remaining exposure routes (i.e. air and soil) are practically negligible.

44. The GEC agrees that all major exposure pathways and sources need to be identified, but the OIG fails to do so, and incorrectly speculates that air and soil exposure are practically negligible. While the GEC agrees with the OIG that local fish consumption is a very significant risk factor, PCC levels higher than at the Site are spread throughout the community. The following sources of PCC should be considered by the OIG before discounting other significant chronic exposure routes:

- Hercules Plant: PCC levels in the plant site soils exceed 7% and are a significant air and soil exposure risk.

- Areas surrounding the Hercules Plant: As previously noted, toxaphene was found above 64 ppm on an elementary school playground. Significant source areas are suspected to be present in neighborhoods surrounding the Hercules plant site.

- Terry Creek Site: Between 2 and 3 million pounds of PCC manufacturing wastes are estimated to have been released into the estuary, some of which is in dredge spoil areas that are a potential air exposure source.

- PCC was reported to be disposed of in the T Street Dump that is located in the estuary, 4th Street Landfill next to the Glynn Schools Stadium, and Old Sterling Landfill.

- Hercules has taken depositions from workers concerning distribution of toxaphene to employees, purchase by Glynn County Parks and Recreation, and Glynn County Schools for use throughout the community.

The OIG should clarify that toxaphene and toxaphene degradation products are the potential chemicals of concern. As previously noted, the PCC patent protected by Hercules encompasses the vast majority of PCC in Glynn County.

However, five toxaphene congeners (i.e. p26, p50, p40, p41, and p44) are not readily metabolized and excreted and, thus, can accumulate in the human body. ... To evaluate the level of risk to human health, EPA needs to know the concentration of these five congeners and their metabolite precursors in the environment.

45. The GEC agrees that compounds that bio-accumulate need to be identified.

Since these five toxaphene congeners represent the long-term chronic toxaphene exposure problem to humans, the toxicity of these five individual congeners and/or mixture of these five congeners needs to be determined in more detail than is currently available in the scientific literature.

46. The GEC agrees that there should be concern about these five congeners and more information would be desirable, but the entire PCC mixture is of concern for long-term chronic exposure. As the OIG noted, the toxicology of PCC is not well understood. The OIG presents no data in support of ignoring the other 670-plus compounds in the PCC mixture manufactured by Hercules. To the contrary, and borne out by discussion of Dr. Olson's study, short term exposures can have profound effects on offspring, and the exposure duration during the study was not long enough to produce effects attributable to bioaccumulation. Potential endocrine disruption by PCC compounds or metabolites must remain under consideration as toxic components of PCC, as well as other potential adverse health effects noted in the ATSDR Toxicological Profile for Toxaphene. Synergistic effects of the PCC compound in Glynn County could be much different than those noted in studies since both PCC and PCC manufacturing wastes are the chemicals of concern.

Dr. Gill's and Dr. Barr's studies discussed by the OIG are interesting, but the OIG failed to note that the source was airborne transport to Canada in Dr. Gill's study and the general population in Dr. Barr's study, and not exposure to PCC and manufacturing waste products. Sampling of the local Glynn County population will be needed to confirm any applicability between the results Dr. Gill and Dr. Barr

presented and the far different situation in Glynn County. By no means should the need for additional studies or information be used as an excuse not to take action to protect the citizenry of Glynn County from PCC that is widely distributed.

Superfund's Remedy requires the Evaluation of Toxic Degradation Products

Since toxaphene is known to degrade in the environment and these degradation products are thought to be toxic, EPA must evaluate the groundwater at the Hercules 009 Landfill site for toxaphene's degradation products, specifically, the Hx-Sed and Hp Sed congeners, but also the p26, p50, p40, p41, and p44 congeners.

47. The OIG has made sweeping conclusions about which compounds in the PCC mixture manufactured by Hercules are of toxicological concern, and is making inappropriate recommendations to limit PCC analysis to a few selected compounds. The OIG previously stated, *“Conducting a detailed and comprehensive risk assessment for the potential exposure to toxaphene from the Hercules 009 Landfill site is a complex task that is beyond the scope of this OIG review.”* The sweeping recommendations for limited sampling and analysis do require a comprehensive health assessment and evaluation of literature far greater in scope than presented in the OIG Report.

The OIG should clearly recommend that all PCC and PCC degradation products are analyzed, identified, and reported in samples from the Site.

EPA Method 8081 Tests for Technical Toxaphene

48. As previously commented upon, the method used at the Hercules 009 Landfill Site was the TTF and Hercules Protocol methods, and the OIG should identify the methods used as such. The OIG report does a very good job of describing how and why the TTF and Hercules Protocol methods do not accurately identify PCC but calling the methods used EPA Method 8081 detracts from the Report. ATSDR has done a very good job of articulating why the TTF and Hercules Protocol methods are not equivalent to EPA Method 8081, and the OIG report would benefit from taking the same

approach. The difference between Method 8081, and the TTF and Hercules Protocol, and the very different results the methods produce has been well documented repeatedly with consistent results.

No Immediate Human Health Risks at the Hercules 009 Landfill

49. The OIG correctly identifies the analytical method used at the Hercules 009 Landfill Site as inadequate, but fails to note that the analytical method was used in the decision-making process for the soil removal action, RD, and RA, which brings into question the protectiveness to human health. Ongoing exposure to PCC contaminated soil is a very real possibility at the Site, which will remain a significant uncertainty until sampling and analysis by a reliable method such as NIMS takes place.

OIG Technical Conclusions

The chronic health risk to humans is from exposure to toxaphene's persistent degradation products (e.g. p26, p50, p40, p41, and p44) and not the original technical toxaphene mixture.

50. The risk to human health is from all the 670 plus compounds at the Site, including all PCC compounds and PCC degradation products. The OIG noted that, *“Conducting a detailed and comprehensive risk assessment for the potential exposure to toxaphene from the Hercules 009 Landfill site is a complex task that is beyond the scope of this OIG review.”* The OIG should limit the scope of recommendations to advocating that a reliable and appropriate analytical method be used that detects all PCC compounds and PCC degradation compounds. Analysis and evaluation of the resulting data should be used to produce an ATSDR Health Assessment by a toxicologist familiar with all potential ramifications to human health and the environment.

The GEC agrees with the OIG in that an analytical method that identifies PCC compounds and PCC degradation compounds is needed, and NIMS being inserted into SW-846 is an appropriate recommendation.

The OIG identified the need for further research into carcinogenicity and embryotoxicity, but the scope of the research should not be limited to only five congeners. The toxicology of PCC is not well enough understood to limit the scope of research at this time, and the toxicology of PCC degradation products is even less understood. Regardless of any recommendations for further research, measures should be taken to determine the current human health risks through appropriate testing and the precautionary principle applied until research results are produced, reviewed, and published in a recognized peer reviewed scientific journal.

Technical Assistance Report

51. The GEC provides technical assistance to our community through an EPA Technical Assistance Grant. The OIG Report was reviewed by our technical advisor, Dr. R. Kevin Pegg. The technical assistance report is the product of Dr. Pegg and reflects his professional opinion about the OIG Report, and does not necessarily reflect the views of the GEC Board, members, or other citizens of Glynn County. Here is the Technical Assistance Report on the OIG Report:

EPA Toxaphene Testing Method Found Inappropriate

Overview

The Environmental Protection Agency's Office of Inspector General recently issued a report entitled "Appropriate Testing and Timely Reporting Are Needed at the Hercules 009 Landfill Superfund Site, Brunswick, Georgia" dated September 26, 2005. This document, developed by EPA's Ombudsman, refutes Region 4 EPA's methods for analyzing toxaphene at the 009 Superfund Site and the Terry Creek Disposal Superfund Site, and at other areas around Glynn County, Georgia. Nearly 15 years of data collected on soil, air, water and biological samples tested in Brunswick are now in doubt.

Each department in the United States administration has an Inspector General office to provide oversight for the agency. Several years ago the Glynn Environmental Coalition formally requested an investigation on items ranging from toxaphene testing in Glynn County to questions regarding lack of compliance in the cleanups in Brunswick. This first report mainly investigates the issue of toxaphene

analysis. The Office of Inspector General has concluded that the methods used by Region 4 have not and could not precisely determine the form of toxaphene found in Glynn County.

Background

The 009 Superfund Site is a former road construction borrow pit refilled with waste from pesticide manufacturing at Hercules Inc. Toxic sludge, off-grade product, and contaminated soil were deposited into the pit, some of which was below the water table at least part of the year. Although the Record of Decision—the legally mandated cleanup goals for the site--stated that all contaminated soils above 76 parts per million (ppm) would be stabilized *in situ* the EPA allowed a much simpler cleanup of merely covering the waste with a soil/cement mixture using above-ground mixing techniques. At question are the legalities of changing cleanup plans without seeking community input, and whether or not the cleanup achieved any of the goals of the original Record of Decision.

The Terry Creek Disposal area is a marshy region at the confluence of Terry and Dupree Creeks in Glynn County that receives industrial runoff from the Hercules plant. Decades of dumping into the creek system and a series of dredging operations widely distributed toxaphene within the marshes. The main issue at this site is if toxaphene is accurately measured in seafood since the area is part of the local fishery.

In addition to the EPA regulated sites, “toxaphene-like” substances were found in the soils of local public schools and other public and private properties. Based on this Report by the EPA Ombudsman, these “toxaphene-like” materials are toxaphene congeners subject to EPA regulation. Overall, there is the major question of whether or not the EPA permitted testing giving false data on toxaphene. There are many scientific studies showing toxaphene can be measured more accurately than the techniques used by EPA in Glynn County.

Toxaphene and its breakdown products are poisons, mutagens, possible cancer agents and they do bioaccumulate.

Toxaphene

Internationally recognized scientific studies show there are usually three different types of toxaphene: technical, weathered and biological. Technical toxaphene is the type made at the factory and sold worldwide for agricultural pest control. Technical toxaphene is not one chemical, it is a mixture of

about 200 different chemicals produced by adding chlorine to camphene, a chemical made from tree resin. Different manufacturing processes produce slightly different mixtures. Although the chlorination of camphene can produce any of about 600+ different chemicals (called congeners) most technical grades have about 200 chemical congeners. Weathered toxaphene occurs after toxaphene is used. Environmental processes such as air drying, sunlight and bacteria degrade toxaphene. Since each of the more than 200 chemicals in technical toxaphene breaks down differently, weathered toxaphene varies in the types of chemicals present. Some chemicals appearing in weathered toxaphene are not found in the original technical grade of toxaphene, but they are still some of the 600+ different types of chlorinated camphenes, they are just produced from technical toxaphene by environmental processes. Biological toxaphene occurs when plants and animals absorb toxaphene from the environment. Every bacteria, plant, or animal has a different ability to absorb toxaphene congeners. Fish tissues have a different set of toxaphene chemicals from humans. Some toxaphene congeners are found often and in high concentrations (a process known as bioaccumulation), other congeners rarely occur in animal tissues. Biological toxaphene is very different from technical toxaphene, but all of the compounds found in biological toxaphene are still members of the same set of 600+ congeners found in toxaphene.

Note that Glynn County, Georgia has a fourth and fifth type of toxaphene. Off-grade product, material that was not toxic enough to sell, and residue from manufacturing, were dumped locally both in the 009 landfill and into Terry Creek. This material was not the same as technical toxaphene, but was still toxic, mutagenic and potentially carcinogenic. It is only found near the sites of manufacture, such as Brunswick, Georgia. Off-grade product toxaphene and manufacturing residue toxaphene will still weather and bioaccumulate, just like technical toxaphene.

Types of toxaphene measurements

All of the methods for analyzing toxaphene use gas chromatography or “GC.” GC separates all 600+ possible toxaphene compounds so that they can be seen and measured. There are several different measurement methods and technologies.

Total Area Method

This is the basic method required by the US EPA for chemicals with multiple congeners. It detects technical, weathered and biological grades of toxaphene, as well as the off-grade product and

manufacturing residue forms. Basically, all of the possible toxaphene chemicals are detected and added together to quantify total toxaphene. This method was not used by the EPA in Brunswick, Georgia, but is used at other EPA sites in the United States and by other governments and researchers around the world.

Toxaphene Task Force Method

This method was developed by EPA Region 4 in Atlanta, Georgia, with Hercules Inc., and the State of Georgia. While gas chromatography is still used, only a few of the chemicals specific for technical toxaphene are used in the analysis. Even if other toxaphene chemical congeners are present, they are ignored. The toxaphene task force method (referred to as EPA Method 8081) detects technical grade toxaphene as well as the total area method; however 8081 does not detect all off-grade products, does not detect some forms of manufacturing residue toxaphene, and can only detect weathered toxaphene in the first few years after placing in the environment. The TTF method does not detect toxaphene after it has been in the environment for several years, and it does not detect biological toxaphene. The TTF method is apparently used only in Glynn County Georgia and nowhere else in the world. The method is not recognized by other governments or by researchers as a useful method because it under-reports the actual toxaphene concentration.

GC negative ion mass spectroscopy

This technique, called the NIMS method, can detect all forms of toxaphene and is a widely respected method with a high degree of scientific merit regarding the interpretation of results. It is especially useful for detecting biological forms of toxaphene accumulation. This is the method favored by the EPA Inspector General; however, it could be a long time before the methodology is adapted and approved by the EPA for use in Glynn County.

Discussion

Quoting from page 5 of the Ombudsman's report section titled "**EPA's Method Fails to Identify Toxaphene Breakdown Products in Groundwater**": "... *the groundwater monitoring data collected at the site, using EPA's method, only identified the original toxaphene mixture in the groundwater.*" Further, same page: "*When the OIG looked at the groundwater monitoring data for evidence of toxaphene breakdown products, the OIG found some evidence suggesting toxaphene breakdown products may be in the groundwater surrounding the Hercules 009 Landfill Site.*"

In Appendix A of the report the OIG shows by example chromatograms and states, in the section titled **“EPA Method 8081 Does Not Identify Toxaphene Degradation Products”**: “...*EPA Method 8081 fails to detect toxaphene degradation products (i.e., “weathered” toxaphene or individual toxaphene congeners) in environmental samples.*” Method 8081 is the method produced by Region 4 EPA’s Toxaphene Task Force using the subset of toxaphene congeners.

The Ombudsman report also notes that EPA is required to monitor toxaphene degradation products. On page 21 in the section titled **“Superfund’s Remedy Requires the Evaluation of Toxic Degradation Products”**: “*Therefore, the Superfund’s MNA [Monitored Natural Attenuation] guidance requires EPA to anticipate and to test for the presence of potentially toxic degradation products at hazardous waste sites. Since toxaphene is known to degrade in the environment and these degradation products are thought to be toxic, EPA must evaluate the groundwater at the Hercules 009 Landfill site for toxaphene’s degradation products...*”

The Ombudsman report noted other problems with the conduct of sampling by the EPA in Brunswick. An addendum to the report discussed potential problems with the cleanup of environmental samples using sulfur, and a second problem with heat settings on the instrument. Sulfur can interfere with the analysis, some instrument temperature settings fail to detect toxaphene. In combination with the inability of methods used by EPA to quantify weathered toxaphene, the potential biases of the cleanup and column temperature means that much of the data used by EPA to design and verify Superfund cleanups are doubtful.

The Report also cites comprehensive toxicology and body burden studies on toxaphene congeners conducted at a variety of laboratories. Notable among these is the MATT study (Investigation into the Monitoring, Analysis and Toxicity of Toxaphene in Marine Foodstuffs, 2000) describing the bioaccumulation of specific toxaphene environmental end-products in commercial fish species. EPA Region 4 should have been aware of these studies—it is their responsibility to follow the scientific literature. Region 4 should have responded to the growing body of literature regarding toxaphene years ago. In addition to criticizing toxaphene analysis the OIG report also faults EPA on lack of timely reporting, failure to make key decisions, and notes unacceptable modifications to “independent” third-party reviews before release to the public.

Concluding Remarks

For more than a decade EPA Region 4 used the toxaphene task force method (EPA Method 8081) in Glynn County despite research showing the method does not give valid data on environmental toxaphene. At this point it is not clear if cleanups at the 009 landfill and Terry Creek Outfall meet the legal remediation goals. It is not clear because EPA has used an unreliable method that cannot measure the types of toxaphene found in water and soil.

It is fair to say much of the data on toxaphene occurrence and exposure is “inconclusive” for samples taken in Brunswick and tested by method 8081. Not all of the thousands of samples examined so far are in error—obviously many observed both technical toxaphene and some forms of weathered toxaphene. However, virtually all of the groundwater and soil samples need retesting to verify the presence or absence of weathered toxaphene.

EPA is proposing developing new methods using the NIMS method advocated by the Inspector General. While there may be some confusion over methods, one thing is crystal clear: EPA Region 4 should not be the agency to produce and validate any new toxaphene method. The Atlanta, Georgia EPA office is far too biased to be trusted with developing toxaphene methods.

Written by R. Kevin Pegg, Ph.D.; edited by Dr. Mary S. Saunders. Copies of the newsletter are available from the GEC, at the Glynn County library, or at www.enviro-issues.net on the Internet.

HERCULES LANDFILL SUPERFUND SITE - TECHNICAL ASSISTANCE REPORT

This project has been funded wholly or partly by the U.S. Environmental Protection Agency under Assistance Agreement Number V994050-92-0 to The Glynn Environmental Coalition, Inc. The contents of this document do not necessarily reflect the views and policies of the U.S. Environmental Protection agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use. Volume 14, Number 1, October, 2005

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- [15] EPA Superfund Fact Sheet, Hercules 009 Landfill Site, April 1998.
- [16] EPA Superfund Fact Sheet, Hercules 009 Landfill Site, August 1998.
- [17] Feasibility Study, Hercules 009 Landfill Site, Page 8-7, Section 8.2.2.
- [18] Remedial Investigation, Hercules 009 Landfill Site. Plate 3.
- [19] Record of Decision, Hercules 009 Landfill Site, Page 7, Figure 5-1.
- [20] Remedial Investigation, Hercules 009 Landfill Site, Appendix C, Page 6, Section 4.0.
- [21] Letter from Alan Yarbrough, Remedial Project Manager, South Superfund Remedial Branch; to Timothy Hassett, Senior Environmental Engineer, Hercules Incorporated. April 16, 1996.
- [22] Record of Decision, Hercules 009 Landfill Site, Page 27, Section 7.4.
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[48] EPA Superfund Fact Sheet, Hercules 009 Landfill Site, April 1998.

[49] EPA Superfund Fact Sheet, Hercules 009 Landfill Site, August 1998.

[50] Feasibility Study, Hercules 009 Landfill Site, Page 8-7, Section 8.2.2.

[51] Remedial Investigation, Hercules 009 Landfill Site. Plate 3.

[52] Record of Decision, Hercules 009 Landfill Site, Page 7, Figure 5-1.

[53] Remedial Investigation, Hercules 009 Landfill Site, Appendix C, Page 6, Section 4.0.

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