

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5**

**FINAL DECISION AND RESPONSE TO COMMENTS
FOR SELECTION OF REMEDIAL ALTERNATIVE**

FOR

**BASF FACILITY
HOLLAND, MICHIGAN**

August 2009

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FOR
BASF Facility
Holland, Michigan**

Introduction

This Final Decision and Response to Comments (FD/RC) is presented by the U.S. Environmental Protection Agency for the BASF Facility located at Holland, Michigan. This FD/RC includes (Attachment I) the previously issued Statement of Basis. The Statement of Basis outlined potential remedial alternatives at the facility as well as the EPA's proposed remedy and was made available for public review and comment from November 24, 2008 to January 13, 2009. This FD/RC selects the final remedy to be implemented at the BASF Facility based on the Administrative Record and public comments. EPA's Response to Comments addresses substantive comments received on the Statement of Basis during the 30 day public comment period.

Assessment of the Site

The response action documented in this FD/RC is necessary to protect human health and the environment.

Selected Remedy

EPA has selected the following remedial components as the remedy to address contamination soil, groundwater, surface water and sediment at the BASF Facility and adjacent Lake Macatawa:

For PCBs in soil at SWMU 2, SWMU 4, and SWMU 12: The alternatives considered for soil contamination and not selected such as soil vapor extraction and enhanced bioremediation were considered to be less effective in treating the PCBs in the soils. For these reasons, soil vapor extraction and enhanced bioremediation were not selected. Excavation and offsite disposal and institutional control were selected because they can effectively isolate impacted soil, reduce infiltration and prevent direct contact exposure. To the extent that excavation does not adversely impact the structural integrity of Building 14 (SWMU 4 is near the west wall of the building), BASF will excavate and dispose all offsite PCB contaminated soils at SWMUs 2, 4, and 12 exceeding the media cleanup standards (approximately 2000 cubic yards or 300 tons). BASF will implement an institutional control to prevent the constituents of concern remaining at the site from creating unacceptable exposures to on-site industrial workers and construction workers. In addition, all contaminated soil that cannot be excavated due to concerns for the structural integrity of Building 14, shall be removed and disposed of in the future when Building 14 is abandoned and demolished. BASF shall place a deed restriction on the land in the area of Building 14 to limit future land use for commercial and/or industrial purposes.

BASF shall submit to EPA a corrective measures design for the excavation and off-site treatment/disposal of PCB-contaminated soils to meet the selected media cleanup standards in these SWMU areas. The design must be submitted for EPA's review and approval within 60 days after the Final Decision. The design work consists of the design plans and specifications, construction cost estimate, construction quality assurance objectives, waste disposal requirements, project schedule, quality assurance project plan, sampling and analysis plan, and a health and safety plan. BASF shall implement the approved final design, incorporating EPA comments. Remedy construction must be completed within one year of issuance of this Final Decision, and a Construction Completion Report and O&M Plan must be submitted to EPA for review and approval at that time. In the report, a registered professional engineer and the BASF Project Manager shall certify that the remedy for PCB-contaminated soil from these SWMU areas has been conducted in accordance with the EPA approved final design and specifications, to the best of their knowledge, and that the remediation objectives have been attained. The report shall include as-built drawings signed and stamped by a registered professional engineer. BASF shall also implement any approved final O&M Plan, incorporating EPA comments.

For soils in the OPSA 5-Former Settling Basin Area: Soils at OPSA 5 contaminated by toluene, ethylbenzene and xylenes at concentrations above the selected media cleanup standards (approximately 200 cubic yards or 300 tons) must be excavated and disposed properly of off-site.

BASF shall submit to EPA, for review and approval within 60 days of issuance of this Final Decision, a workplan for excavating and the offsite disposal of soils contaminated with toluene, ethylbenzene and xylene that exceed the media cleanup standards at the OPSA 5- Former Settling Basin Area. The workplan shall propose grid sample locations to adequately delineate the area requiring remediation. The workplan consists of construction quality assurance objectives, a project schedule, reporting requirements, waste disposal requirements, quality assurance project plan, sampling and analysis plan, and a health and safety plan. BASF shall implement the approved workplan, incorporating EPA comments.

Remedy construction must be completed within one year of issuance of this Final Decision, and a Construction Completion Report and O&M Plan must be submitted to EPA for review and approval at that time. In the report, the BASF Project Manager shall certify that remediation objectives have been attained. BASF shall implement any approved final O&M Plan, incorporating EPA comments.

For On-site Groundwater: Chemical oxidation and extraction of contaminated water and treatment in a waste water plant were considered for treatment of the onsite contaminated groundwater, but were not selected. Based on the ground water extraction modeling, the predicted amount of contaminants that would ultimately be removed did not justify selecting the ground water extraction and treatment alternative. The chemical oxidation alternative was not selected at this time; however, it was retained for future consideration. Air sparging and monitored natural attenuation were selected as the preferred treatments for contaminated groundwater. The selected remedy provides the best balance among the alternatives with respect to the evaluation criteria, including long-term reliability and effectiveness, ability to implement

and cost. BASF will continue to operate the air sparge system as the principal means of removing contaminants from the groundwater, and preventing the discharge of contaminated groundwater to Lake Makatawa. BASF shall provide to EPA for review and approval a copy of the final design and Operation and Maintenance (O&M) Plan for the air sparging system within 60 days of approval of this Final Decision. BASF shall implement the approved workplans, incorporating EPA comments.

In addition, Monitored Natural Attenuation (MNA) will be implemented as the principal means of restoring the on-site contaminated groundwater (between the former OCS Building and the air sparge curtain) to its maximum beneficial use in the long term. MNA must demonstrate natural degradation of contaminants of concern, in areas upgradient of the air sparge curtain. The air sparging must: (1) achieve cleanup levels for groundwater specified in Table 1 within 10 years of this Final Decision; and (2) when followed by MNA, achieve cleanup levels for groundwater specified in Table 1 within 15 years of this Final Decision. Within this reasonable time frame (15 years), EPA expects that monitored natural attenuation will restore the on-site groundwater such that it would be available for use as a source of commercial or residential drinking water.

In conjunction with the implementation of air sparging, BASF shall develop a more comprehensive groundwater monitoring program that will include an expansion of the existing monitoring network, with additional monitoring wells located within and immediately downgradient of the air sparging area. This additional groundwater monitoring program shall be used to demonstrate the continued effectiveness of airsparging. The media cleanup standards outlined in Table 1 will be used to determine success of the remediation.

MNA is the preferred remedy for the groundwater contamination that exist upgradient of the air sparging system, and the concentrations of those contaminants will decrease over time. Once the contaminant levels upgradient of the air sparging system are low enough to protect Lake Macatawa, the air sparging system will no longer be needed. Accordingly, the operation of the air sparging equipment can be terminated when the media cleanup standards for surface water in Table 1 on page 9 are achieved in the groundwater upgradient of the air sparging system. After the air sparging is stopped, the monitored natural attenuation will extend to the shore of Lake Macatawa. The operation and termination of the air sparging system, and the terms of the MNA and potential implementation of the contingent remedy must be described in the Corrective Measures Implementation (CMI) workplan to be submitted by BASF for approval by EPA.

Every 2 years, BASF must submit to EPA a report assessing whether air sparging and MNA is progressing satisfactorily. In the CMI workplan, BASF will propose the criteria for measuring satisfactory progress. The CMI workplan is subject to EPA approval. If the comprehensive groundwater monitoring program does not demonstrate that MNA is progressing satisfactorily toward achieving the long-term cleanup goal, or if the monitoring shows that air sparging is not performing as expected, then BASF must implement a contingent remedy to achieve the corrective action objectives for this project. The monitored natural attenuation can be terminated when the groundwater samples throughout the plume show that the long-term groundwater

cleanup goals (Table 1 on page 9) have been achieved consistently, in accordance with terms described in the approved CMI workplan.

Other alternatives, including **chemical oxidation**, might be as effective as or more effective than MNA in areas where heavily contaminated soils act as source zones for the groundwater contamination. However, the effectiveness of these alternatives is not known, and would require pilot testing to fully evaluate their effectiveness. BASF shall submit a field pilot-scale test workplan to EPA for review and approval within 60 days of the issuance of this Final Decision for the **chemical oxidation alternative**. BASF shall implement the approved workplan incorporating EPA comments. BASF shall submit a report that contains, at a minimum, the methods, procedures, and results of the pilot test, a discussion of the results, conclusions regarding the effectiveness and implementability of the chemical oxidation to treat the groundwater contaminants. If the results from the pilot testing indicate that this technology will be more effective in treating the source areas beneath the former OCM Building, **chemical oxidation** shall be the contingent remedy for the contaminated on-site groundwater.

For Off-site Groundwater: There was no groundwater contamination found in any of the Pinecrest residential wells. However, the remedy selected for onsite groundwater will also protect offsite groundwater by capturing contaminants and prevent any offsite migration.

Institutional Controls: The soils at the site are safe for industrial land use, but not for residential land use. Further, the groundwater cannot be used as a source of drinking water as long as it remains contaminated. On September 30, 2009 or before July 24, 2010, BASF must record a Declaration of Restrictive Covenant, acceptable to the Michigan Department of Environmental Quality (MDEQ), which will prevent the property from being converted to residential land use in the future. The Restrictive Covenant must also assure that the contaminated groundwater beneath the site will not be used as a source of drinking water, as long as it remains contaminated.

Lake Macatawa: Sediments adjacent to the Facility are contaminated by benzene, chlorobenzene, xylene, PAHs and barium at concentrations above Region 5 Ecological Screening Levels (ESLs). BASF shall submit a workplan to EPA and MDEQ for review and approval within 180 days of this Final Decision to delineate the nature and extent of sediment contamination and to conduct site specific toxicity testing to determine whether potential risks exist to aquatic habitat and biota. The workplan consists of the objectives, project schedule, reporting requirements, quality assurance project plan, sampling and analysis plan, and a health and safety plan. BASF shall implement the approved workplan, incorporating EPA and MDEQ comments. Within 60 days of completion of the sampling and analysis program and any tests, BASF shall submit a report that presents and discusses the sampling results, defines the full extent of contaminated areas requiring remediation, provides the final remedy design, and includes a project schedule and cost estimate. BASF shall implement the remedy as approved by EPA and MDEQ.

Remedy construction must be completed within three years of this Final Decision, and a Construction Completion Report and O&M Plan must be submitted to EPA for review and approval at that time. In the report, a registered professional engineer and the BASF Project Manager shall certify that the remedy for contaminated sediment has been conducted in accordance with the EPA and MDEQ approved final design and specifications, to the best of their knowledge, and that all identified remediation objectives have been attained. The report shall include as necessary, as-built drawings signed and stamped by a registered professional engineer. BASF shall implement any approved final O&M Plan, incorporating EPA and MDEQ comments.

Other Certification, Monitoring, Reporting, Institutional Control, and Financial Assurance Requirements.

- Provide certification by a responsible corporate officer or duly authorized representative of all documents submitted pursuant to this Final Decision, as required in the Administrative Order on Consent (AOC).
- Implement institutional controls for the land, soil, and groundwater portions of the BASF Facility that are the subject of this Final Decision. The institutional controls shall ensure that BASF property use remains industrial/commercial; the soil and groundwater at the facility are not disturbed in a manner that poses a risk to workers or interferes with the implementation of the final remedy; groundwater monitoring wells are maintained until cleanup levels are achieved and the wells are approved for abandonment by EPA, and on-site groundwater exceeding cleanup levels is not used for portable purposes until groundwater cleanup levels are achieved. BASF shall send to EPA a copy of the restrictive covenant within 30 days of its recording.
- Obtain financial assurance for completion of the final remedy, including O&M, within 90 days of the Final Decision. Provide an updated detailed estimate of capital costs for implementing the final remedy.
- Submit CMI monthly progress reports to EPA during the design and construction phases detailing work performed to date, data collected, problems encountered, project schedule, and percent project completed. Progress reports are due by the 10th day of each month following the Final Decision. Submit CMI progress reports semiannually for O&M activities upon approval of the Construction Completion Report.

The final remedy selected by EPA meets the threshold criteria that reflect the performance standards that must be achieved, including:

- Protect Human Health and the Environment
- Attain Media Cleanup Standards Set by EPA
- Control the Sources of Releases
- Comply with Any Applicable Standards for Management of Wastes.

The final remedy also considers balancing criteria that represent a combination of technical measures and management controls that helped identify the best remedy, including:

- Long-term Reliability and Effectiveness.
- Short-term Effectiveness
- Reduction in the Toxicity, Mobility, or Volume of Wastes
- Implementability
- Cost.

Public Participation

A forty-five (45) day public comment period was held from November 24, 2008 to January 13, 2009. Comments were received from BASF and MDEQ during the public comment period.

Public Comments and EPA's Response to Comments

Comments received on the proposed remedy from the BASF facility and MDEQ, Waste and Hazardous Materials Division were considered and addressed in the final remedy. As a result, the proposed remedy was modified by EPA to address concerns regarding the contamination in Lake Macatawa to ensure remediation of the impacted sediments bound to the BASF facility.

The following narrative summarizes written comments on the proposed remedy and EPA's response to each comment. Each comment is numbered and presented in italicized capital type. Comments were provided by:

BASF facility, J. Douglas Reid-Green (Project Manager)
MDEQ, Waste and Hazardous Material Division

J. Douglas Reid-Geen, BASF facility

Summary of Facility Risks – Soil

Comment 1 *EPA indicated that PCBs were detected in soil at SWMUs 2, 4 and 12 at concentrations that exceed the Part 201 risk-based standard of 16,000 µg/kg. However, the Corrective Action Objectives specify that the Media Cleanup Standard for PCBs in shallow soil is 10,000 µg/kg. BASF recommends that the Media Cleanup Standard for PCBs in shallow soil should be 16,000 µg/kg, which are the Part 201 Soil Direct Contact Criteria for Industrial and Commercial II sites.*

Response We agree that the appropriate risk-based cleanup standard for PCB contamination in surface soils at this facility is 16,000 ppb. This is based on the MDEQ's Part 201 Direct Contact Criteria for Industrial and Commercial II sites. See corrected table for Media Cleanup Standards in our response to comment 4.

Interim Measures Implemented Since the 1998 AOC

Comment 2 *EPA provided an estimate of the mass of contaminants removed from groundwater by the air sparge curtain as of March 2007. Based on performance groundwater monitoring conducted in November 2008, the air sparge curtain has removed approximately 29.7 pounds of contaminants from groundwater since the Interim Measure was implemented in September 2006. Analytical results of groundwater samples collected in November 2008 from perimeter monitoring wells located downgradient of the air sparge curtain and OPSA 5 indicate that the Interim Measure has achieved proposed Media Cleanup Standards at all wells except PZ-1R, where 1,4-dichlorobenzene at 180-200 parts per billion (ppb) only slightly exceeds the proposed short-term cleanup standard of 170 ppb, and PMW-4D where chlorobenzene at 1,700 ppb exceeds the proposed short-term cleanup standard of 250 ppb due to recent increases resulting from degradation of dichlorobenzenes. The attached trend plot shows that chlorobenzene at PMW-4D now exhibits a consistent decreasing trend (based on monitoring over the past year).*

Response At the time the Statement of Basis was published for public comment, the available information regarding the amount of contaminants removed from the groundwater through the air sparge was based on the monitoring report as of March of 2007. Based on that account, the 12 pounds of contaminants were removed six months after the air sparging operations began. However, based on the recent monitoring data submitted by BASF, analytical results of groundwater samples collected in November of 2008 from perimeter monitoring wells located downgradient of the air sparge curtain and OPSA 5 indicate that 29.7 pounds of contaminants have been removed from the groundwater. As indicated from the recent results air sparging is expected to be effective in achieving site-specific media cleanup standards.

Summary of Facility Risks – On-site Groundwater

Comment 3 *In the third sentence of the first full paragraph, EPA indicated that historic operation of four groundwater supply wells located west of the OCM Building had drawn the groundwater plume northwest of the OCM Building, however “Migration of the plume to the northwest is no longer occurring as the water supply wells currently only produce 45,000 to 90,000 gallons per month compared to the 100,000 gallons per day produced historically”. BASF notes that the water supply wells have not been used to produce groundwater by the current facility owner since January 2007 and recommends that this sentence be revised accordingly.*

Response This section was stating some historical facts. The plume of chlorobenzenes in groundwater extending southeastward from northwest of the former OCM Building, which is the original source area was the result of plume draw down northwest of the former OCM Building. The updated information has been noted.

Corrective Action Objectives – Media Cleanup Standards

Comment 4 BASF proposes the following corrections or revisions to proposed Media Cleanup Standards. The Media Cleanup Standard for PCBs in surface soil should be revised from 10,000 parts per billion (ppb) to 16,000 ppb consistent with the Michigan Part 201 Soil Direct Contact Criteria for Industrial and Commercial II sites. EPA recommends Media Cleanup Standards for total chlorobenzenes in groundwater, which could be interpreted to include the sum of trichlorobenzenes and dichlorobenzenes as well as chlorobenzene. Total chlorobenzenes should be corrected to reflect the single compound chlorobenzene (mono). The Michigan Part 201 Program does not provide groundwater cleanup criteria for total chlorobenzenes, only chlorobenzene.

Response We agree that the media cleanup standard for PCBs in surface soils should be 16,000 ppb, consistent with the Michigan Part 210 program. We also agree that the media cleanup standard of 100 ppb and 47 ppb should apply to the single compound chlorobenzene rather than total chlorobenzenes. Accordingly, the table of Media Cleanup Standards, which appeared on page 8 of the November 2008 Statement of Basis, is hereby corrected as follows:

The Media Cleanup Standards are as follows:

Contaminant of Interest for SWMUs 2,4 & 12 and OPSA 5	SURFACE SOIL	SUBSURFACE SOIL
PCBs	16,000 ppb	100,000 ppb
Toluene	250,000 ppb	250,000 ppb
Ethylbenzene	140,000 ppb	140,000 ppb
Xylene	150,000 ppb	150,000 ppb

Contaminant of Interest	Long-term groundwater cleanup goal (drinking water)	Short-term groundwater cleanup goal at groundwater/surface water interface	Surface Water
1,3-Dichlorobenzene	6.6 ppb	38 ppb	280 ppb
1,4-Dichlorobenzene	75 ppb	13 ppb	170 ppb
3,3-Dichlorobenzidine	1.1 ppb	0.3 ppb	0.3 ppb
1,2,4-Trichlorobenzene	70 ppb	30 ppb	30 ppb
Chlorobenzene	100 ppb	47 ppb	250 ppb
Tetrachloroethene	8.5 ppb	78 ppb	680 ppb
Barium	2000 ppb	2,000 ppb	40,000 ppb
Arsenic	50 ppb	150 ppb	150 ppb
Lead	4.00 ppb	4.00 ppb	
Zinc	2400 ppb	2,400 ppb	22,000 ppb

Comment 5 *BASF recommends that only long-term groundwater cleanup goals be established for 3, 3-dichlorobenzidine, barium, lead and zinc to protect future off-site groundwater use.*

Response We have reviewed all available data collected to date and EPA does not agree with the BASF facility. Both long term and short term goals will be required to protect the surface water in Lake Macatawa.

Comment 6 *EPA recommends both long-term and short-term groundwater as well as surface water Media Cleanup Standards for arsenic. However, arsenic has not been detected in onsite or off-site monitoring wells above Michigan Part 201 residential drinking water criteria. Therefore, BASF recommends that arsenic be removed from the list of COI requiring Media Cleanup Standards.*

Response Based on our review of arsenic data collected for groundwater and soil, arsenic was detected at various times above the Michigan Part 201 standards. Therefore, arsenic has been included to the list of COIs requiring media cleanup standard. Arsenic will not be removed from the list.

Description of Preferred Alternative for Soils in OPSA 5 – Former Settling Basin

Comment 7 *EPA indicated that soils at OPSA 5 contaminated by toluene, ethylbenzene and xylenes must be excavated and disposed properly off-site. BASF recommends that only soils containing toluene, ethylbenzene and xylenes at concentrations above the proposed media cleanup standards be excavated and disposed properly off-site.*

Response We agree that only soils containing toluene, ethylbenzene and xylenes at concentrations above the proposed media cleanup standards be excavated and disposed properly off-site.

Description of Preferred Alternative for On-site Groundwater

Comment 8 *BASF recommends that no changes be made to the existing groundwater monitoring program. Analytical results of groundwater samples collected in November 2008 from perimeter monitoring wells located downgradient of the air sparge curtain indicate that proposed Media Cleanup Standards have been achieved at all downgradient wells except PZ-1R and PMW-4D.*

Response Termination of the air sparging system and the potential implementation of the contingent remedy largely depend on the complete success of the air sparging to meet all goals. The purpose of developing a more comprehensive groundwater monitoring program including additional monitoring wells located within and downgradient of the sparging area allows for the proper evaluation of the effectiveness of the air sparging system and the adequacy of the current downgradient monitoring wells.

MDEQ, Waste and Hazardous Material Division

Comment 9 *In the fall of 2008, MDEQ and USEPA-Great Lakes National Program Office (GLNPO) collected additional sediment data in Lake Macatawa off BASF-Holland for the purposes of off-site contaminant investigation. The purpose of the sampling was to investigate if off-site contamination issues existed in the sediments of Lake Macatawa near the BASF-Howard Avenue facility. Sediment samples were analyzed by the Michigan Department of Environmental Quality's Environmental Lab for VOCs, PAHs, PCBs by aroclor, and Metals. A preliminary review of the analytical results indicate that a portion of sediments off of the BASF facility are impacted by VOCs (benzenes, chlorobenzenes, xylene), PAHs (naphthalene), and Metals (Barium) that exceed Region 5 Ecological Screening Levels (ESLs) by orders of magnitude. Remedial investigation of the off-site contamination is warranted.*

Response The GLNPO 2005 Lake Macatawa sediment study concluded that the BASF facility may not have contributed significantly to sediment contamination in the Lake. The study also concluded that, with the exception of one of the study areas (Heinz/ petroleum storage), the probable effect concentrations for current sediment quality guidelines were not exceeded. The 2005 sediment investigation was a lake wide study involving the investigation of contaminant discharges from 6 industrial facilities. BASF was one of these 6 facilities. However, at the time of the publication of the BASF Statement of Basis, EPA was unaware of the MDEQ's 2008 Lake sediment investigation which specifically focused on BASF's contaminant contribution to the Lake. In light of this new information, EPA will revise its conclusion that the BASF facility is not contributing significantly to sediment contamination in the lake, and that remedial investigation of the offsite contamination in the lake sediment near the BASF facility is warranted.

Corrective Action Complete Determination

Once BASF has met its corrective measures obligations, it may send a request to EPA Regional office for consideration for a Corrective Action Complete Determination (CACD). This request should include a written explanation justifying how BASF has satisfied the criteria for the CACD, based on the information outlined in the February 23, 2005, EPA guidance on CACD.

Administrative Record

The Administrative Record upon which the final remedy was selected is available at the Herrick District Library, 300 S. River Avenue, Holland, Michigan and the 7th Floor Records Center at U.S. EPA Region 5, 77 W. Jackson Blvd., Chicago, IL.

Declaration

Based on the Administrative Record compiled for this corrective action, EPA has determined that the selected remedy for the BASF Facility is appropriate and is protective of human health and the environment.

for 

Margaret M. Guerriero
Director
Land and Chemicals Division
U.S. Environmental Protection Agency
Region 5

Date 8/20/09

Attachments