DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION
Interim Final 2/5/99
RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA750)
Migration of Contaminated Groundwater Under Control

Facility Name: National Naval Medical Center
Facility Address: 8901 Wisconsin Avenue, Bethesda, Maryland 20889
Facility EPA ID #: MD4 17 002 4687

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

X If yes - check here and continue with #2 below.
_____ If no - re-evaluate existing data, or
_____ if data are not available, skip to #8 and enter"IN" (more information needed) status code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

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

Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

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

2. Is **groundwater** known or reasonably suspected to be **"contaminated"**[1] above appropriately protective "levels" (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

X If yes - continue after identifying key contaminants, citing appropriate "levels," and referencing supporting documentation.

_____ If no - skip to #8 and enter "YE" status code, after citing appropriate "levels," and referencing supporting documentation to demonstrate that groundwater is not "contaminated."

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale:

Background

There are 26 RCRA Facility Investigation (RFI) groundwater monitoring wells at NNMC. Seven (7) of these wells are located upgradient of the permitted SWMUs and AOCs at the facility, the remaining 19 are downgradient of the SWMUs and AOCs. The locations of the monitoring wells with respect to the SWMUs and AOCs are shown Reference 1., Figure 1. Of the 19 downgradient wells, five (5) are expected to measure groundwater contaminant levels at the downgradient facility boundary - MS02-MW02, MS02-MW03, MS32-MW02, MS33-MW01, and MS33-MW02, based on the predominant groundwater flow directions shown on Figure 1. Groundwater samples were collected from each of the RFI monitoring wells in September 2002, December 2002, March 2003, and June 2003. For this EI, groundwater concentrations were compared to federal MCLs and USEPA Region III Tap Water RBCs. Groundwater samples from the first two monitoring events were analyzed for the full list of Appendix IX constituents, dioxins and furans, total petroleum hydrocarbons (TPH), and radionuclides. For the third and fourth monitoring events, TPH, Appendix IX herbicides (with the exception of one well, where an Appendix IX herbicide had been detected) and Appendix IX SVOCs that are not also on the Reduced List of SVOCs were eliminated from the analytical protocol, since these chemicals had not been detected in any of the wells for the first two monitoring events.

Results

As shown in Reference 1., in the four rounds of RFI groundwater sampling, there have been exceedances of Tap Water RBCs and/or MCLs at upgradient and downgradient wells at the facility. Reference 1., Table 5 includes summaries of the results of the background comparison and shows Arsenic, PCE, TCE, gross alpha, and thallium exceeded both MCLs and Tap Water RBCs, in addition to background (upgradient) concentrations at the facility, and are considered chemicals of potential concern (COPCs).

There was only one exceedance of MCLs each for arsenic, PCE and gross alpha through all four monitoring events. There were only two exceedances of the MCL for TCE, both at AOC 11, and there were only two exceedances of the MCL for thallium, both at SWMU 2. There is no observed groundwater contaminant plume for any given constituent. These constituents will be evaluated further as part of the RFI in process at the facility.

Reference(s):

1.- April 14, 2004 NNMC Letter and Documentation of Environmental Indicators Determination.
2.- June 28, 2004 NNMC Response to [EPA] Comments on EI.
3.- NNMC Interim RFI Report, dated July 30, 2003.
4.- NNMC Phase One Priority One RFI Work Plan, dated April 2001.
5.- NNMC Basewide Ecological Risk Assessment Work Plan, dated September 2003.

[1] **"Contamination**" and "**contaminated**" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate "levels" (appropriate for the protection of the groundwater resource and its beneficial uses).

3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within "**existing area of contaminated groundwater"**[2] as defined by the monitoring locations designated at the time of this determination)?

X If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the "existing area of groundwater contamination"[2]).

_____ If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"[2]) - skip to #8 and enter "NO" status code, after providing an explanation.

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale:

The migration of contaminated groundwater is expected to have stabilized with respect to the horizontal and vertical extent of existing contaminated groundwater, as described below:

Horizontal

As shown by data in Reference 1, Table 5, the maximun detected concentrations of COPCs are not significantly elevated (see data, below) above their respective screening criteria or in wells at the perimeter of the property. Two of the chemicals in Reference 1.,Table 5, PCE and thallium, were found at levels exceeding their MCLs at the downgradient facility boundary wells. However, the maximun PCE concentration in the four wells exceeded its MCL in one of the sampling events (5.7 ug/L in December 2002 - 5.0 ug/L is this MCL), and not in any of the other three events. The two exceedances of the thallium MCL (4.4 ug/L versus 2.0 ug/L) occurred at two different wells at SWMU 2 in two different sampling events. Each of these samples was duplicated in the field, and thallium was not detected in the duplicate sample. The groundwater contamination has not been determined to be leaving the facility in excess of MCLs and the horizontal extent of contamination is considered to be stabilized.

Groundwater velocities in the saprolite at the facility were estimated at approximately 1.4 feet/day, based on the results of a series of slug tests performed during the December 2002 groundwater monitoring event. The nearest off-site wells to the NNMC property are located approximately 3 to 4 miles from the facility. These include three domestic water supply wells, two farm-use supply wells, and six industrial-use supply wells. However, none of these wells are located hydraulically downgradient of the NNMC facility. The Washington Suburban Sanitary Commission provides drinking water in the vicinity of NNMC. There are no wells within a 1-mile radius of the facility.

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[2] "**existing area of contaminated groundwater**" is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of "contamination" that can and will be sampled/tested in the future to physically verify that all "contaminated" groundwater remains within this area, and that the further migration of "contaminated" groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

Vertical

Monitoring wells were installed at depth in both upgradient and downgradient locations at the facility. The potentiometric surface of the groundwater was encountered at the top of the fractured bedrock, where the first signs of shallow groundwater were identified. In instances of higher land elevation, the groundwater was not encountered until either the top of bedrock was encountered or it was within the top of the fractured bedrock. Comparison of the fractured bedrock groundwater contour maps with the shallow groundwater contour maps show that vertical groundwater flow direction may vary depending on location. Near the northern facility border and AOC 11, a downward vertical flow direction may exist while near

AOC 12, SWMU 9, and SWMU 32, there may be an upward vertical flow direction. In the area of SWMUs 2 and 3, there may be little vertical movement either direction. Due to the low contaminant concentrations encountered in groundwater at the facility, including the deeper wells installed in fractured bedrock, the vertical extent of groundwater contamination is also considered to be stabilized.

Reference(s): **See Page 2.**

4. Does "contaminated" groundwater **discharge** into **surface water** bodies?

X If yes - continue after identifying potentially affected surface water bodies.

_____ If no - skip to #7 (and enter a "YE" status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater "contamination" does not enter surface water bodies.

_____ If unknown - skip to #8 and enter "IN" status code.

Rationale:

The groundwater in the saprolite and fractured bedrock appear to be hydraulically connected. Shallow groundwater, which is found in both the saprolite and bedrock, moves generally towards the northeast at the facility, with groundwater flow directed towards Stoney Creek at lower land elevations. Groundwater at NNMC is likely to discharge to Stoney Creek before leaving the facility. Stoney Creek flows from the southwest to the northeast across the facility, crosses under Interstate 495 (which is adjacent to the NNMC facility in the northeastern area of the property) and ultimately flows into Rock Creek.

Wells that monitor groundwater which discharges to Stoney Creek are shown on Reference 1., Figure 1 and include the following: MS-09-MW01, MS09-MW02, MW09-MW03, MS03-MW02, MS02-MW04, MS02-MW03, MS05-MW04, and MS05-MW01.

Reference(s): See Page 2.

5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (i.e., the maximum **concentration**[3] of each contaminant discharging into surface water is less than 10 times their appropriate groundwater "level," and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

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X **If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes)**, after documenting: 1) the maximum known or reasonably suspected concentration[3] of key contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.

_____ If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration[3] of each contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations[3] greater than 100 times their appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

_____ If unknown - enter "IN" status code in #8.

Rationale:

For wells located at the facility boundary and within a reasonable proximity of Stoney Creek (MS02-MW02, MS02-MW03, and MS33-MW02), groundwater concentrations from the four groundwater monitoring events were compared to 10 times the Tap Water RBCs, 10 times the MCLs, and 10 times the approved ecological screening criteria for surface water. No chemicals were found to exceed these screening criteria. As shown in Table 6, below, none of the COPCs identified previously are present at concentrations greater than 10 times the MCL anywhere at the facility. Therefore, the discharge of **"contaminated**" groundwater into surface water is likely to be **"insignificant**".

TABLE 6
Summary of COPCs in Groundwater with Surface Water Discharge

Chemical	Max. Concentration	Units	10 X MCL
Arsenic	15.8	ug/L	100
PCE	5.7	ug/L	50
TCE	10	ug/L	50
Thallium	4.4	ug/L	20
Gross Alpha	25.2	pCi/L	150

Reference(s): **See Page 2.**

[3]As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hypothetic) zone.

6. Can the **discharge** of "contaminated" groundwater into surface water be shown to be "**currently acceptable**" (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented[4])?

_____ If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR 2) providing or referencing an interim-assessment,[5] appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

_____ If no - (the discharge of "contaminated" groundwater can not be shown to be "**currently acceptable**") - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.

_____ If unknown - skip to 8 and enter "IN" status code.

Rationale and Reference(s):

[4] Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refuge) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

[5] The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

7. Will groundwater **monitoring** / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

X If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."

_____ If no - enter "NO" status code in #8.

_____ If unknown - enter "IN" status code in #8.

Rationale:

Future groundwater samples will be collected from the wells at the downgradient facility boundary where the exceedances of thallium and PCE took place to confirm that contaminated groundwater has remained within the horizontal dimensions of the existing area of contaminated groundwater. Additional surface water sampling of Stoney Creek is currently(8/04) underway.

Reference(s): **See Page 2.**

8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

X **YE - Yes,** "**Migration of Contaminated Groundwater Under Control"** has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the facility, EPA ID # MD4 17 002 4687, located at National Naval Medical Center. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater" This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

_____ NO - Unacceptable migration of contaminated groundwater is observed or expected.

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

Completed by (signature) _____/s/_____ Date: 8/23/04
(print) Vernon Butler
(title) RPM

Supervisor (signature) _____ /s/_____ Date: 8/24/04
(print) R. Greaves
(title) Chief, RCRA Operations Branch
Region III, Philadelphia, PA

Locations where References may be found: **EPA Region III RCRA Reference Library**

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