7/16/03-03555

UNITED STATES MARINE CORPS
MARINE CORPS BASE
PSC Box 20004
Camp Lejeune, North Carolina 28542-0004

In reply refer to:
6286
BEMD
JUL 16 2003

Ms. Gena Townsend
Remedial Project Manager
US EPA Region IV, Atlanta Federal Center
Waste Management Division
Federal Facilities Branch
100 Alabama Street SW
Atlanta Georgia 30303

Dear Ms. Townsend:

Marine Corps Base, Camp Lejeune is pleased to submit an Interim Final Documentation of Environmental Indicator (EI) Determination package for your review. While final remedies remain the ultimate goal of the Resource Conservation Recovery Act, Corrective Action, EIs are important near-term objectives that are used as a measure of progress for the Government Performance and Results Act. The enclosed package provides our EI determinations and the information used to reach these determinations.

If you have any questions or would like to discuss our EI Determination package, please do not hesitate to contact Mr. Rick Raines of the Environmental Quality Branch, Environmental Management Division, Installations and Environment Department, at (910) 451-5068 or by email at rainesrh@lejenune.usmc.mil.

Sincerely,

for SCOTT A. BREWER, PE
Director, Environmental Management
By direction of
the Commanding General

Enclosure: Documentation of EI Determination

Copy to: (w/encl)
NAVFACENGCOM (Mr. K. Stevens Code 1823)

DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Interim Final 7/8/03

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

Current Human Exposures Under Control

Facility Name: Marine Corps Base, Camp Lejeune
Facility Address: Jacksonville, North Carolina
Facility EPA ID #: NC6170022580

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

__X__ If yes - check here and continue with #2 below.

_____ If no - re-evaluate existing data, or

_____ if data are not available skip to #6 and enter "IN" (more information needed) status code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

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

Definition of "Current Human Exposures Under Control" EI

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

Relationship of EI to Final Remedies

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

Duration / Applicability of EI Determinations

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

EDCL

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

	Yes	No	?	Rationale / Key Contaminants
Groundwater	X			***SVOCs, VOCs, POLs, Metals***
Air (indoors)[2]		X		
Surface Soil (e.g., <2 ft)	X			**SVOCs, VOCs, POLs, Metals, Pesticides, PCBs**
Surface Water	X			**VOCs, Metals, PCBs**
Sediment	X			**Metals, PCBs**
Subsurf. Soil (e.g., >2 ft)	X			**SVOCs, VOCs, POLs Metals, Pesticides, PCBs**
Air (outdoors)		X		

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

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

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

Rationale and Reference(s):
Information pertaining to contamination found on MCB, Camp Lejeune was taken from the following sources:
-Fiscal Year 2003 Site Management Plan
-Phase I and II SWMU Confirmatory Sampling Reports
-Mrs. Nikki Hall, Manager Leaking Underground Storage Tank Program
-Base Background Study
-Land Use Control Assurance Plan / Implementation Plan
-Remedial Investigations, Site Investigations, Feasibility Studies, Long Term Monitoring Data
All the contaminants listed above have exceeded appropriate screening criteria for the indicated media. These screening levels include but are not limited to:
-USEPA Region IX Residential RBCs
-NC DENR, Method I, Category S3:G1 and S3:G3
-Base-specific Background Concentrations
-USEPA Region IX Industrial RBCs
-North Carolina Water Quality Standards / Federal Maximum Contaminant Levels
-USEPA Region IV Sediment Effects (ER-L) and (ER-H)

MCB, Camp Lejeune
Environmental History

MCB, Camp Lejeune has been actively involved with environmental investigations and remediation programs since 1983, beginning with the Navy Assessment and Control of Installation Pollutants (NACIP) Program. An Initial Assessment Study (IAS) was the first investigation of potentially hazardous sites conducted under (NACIP). The IAS, which was conducted in 1983, identified areas of concern that might potentially cause threats to human health and the environment as a result of past storage, handling and disposal of hazardous materials. Based on a review of historical records, field inspections, and personal interviews, 76 areas of concern (AOCs) were identified. The IAS concluded that, while none of the sites posed an immediate threat to human health or the environment, further investigations to assess the potential long-term impacts were warranted at 22 of the 76 sites.

The Department of Navy's IR Program was initiated in 1986 following enactment of the Superfunds Amendments and Reauthorization Act (SARA) legislation. The IR Program, which was implemented to follow the requirements of SARA, replaced the NACIP. MCB, Camp Lejeune was placed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priorities List (NPL) on October 4, 1989 (54 Federal Register 41015, October 4, 1989). The Hazardous Ranking System Score for MCB, Camp Lejeune is 36.84. Following that listing, a Federal Facilities Agreement (FFA) between the United States Environmental Protection Agency (USEPA) Region IV, North Caroling Department of Environment and Natural Resources (NCDENR), and the Department of Navy was signed in February 1991. The original FFA pertained to 23 of the initial sites identified at MCB, Camp Lejeune. The 23 Sites have been investigated in accordance with the NCP, CERCLA, and SARA, under the terms and conditions of the FFA. Based upon the conclusions and recommendations identified by subsequent site inspections, newly identified sites have been added to the original list of 23. To date, 42 Sites have been included in investigations and remedial activities through the IR (CERCLA) Program.

MCB, Camp Lejeune was issued a Resource Conservation and Recovery Act (RCRA) Part B Permit to operate a hazardous waste container storage facility in September 1984. This permit was issued before the enactment of the Hazardous and Solid Waste Amendments of 1984 (HSWA), which under Section 3004(u) empowers the USEPA to order corrective action at treatment, storage, and disposal (TSD) facilities. This section of the HSWA requires corrective action to be taken for all releases of hazardous waste or hazardous constituents from any Solid Waste Management Unit (SWMU). A revised Hazardous Waste Management Permit was issued on January 10, 1997. The permit covered corrective actions for SWMUs.

The USEPA Region IV and the NCDENR conducted an initial RCRA Facility Assessment (RFA) for MCB, Camp Lejeune in January 1989. Their report covered 76 sites, of which seven were determined to require RFA sampling visits, 23 to require a RCRA Facility Investigation, and 46 to require no further action (NFA). MCB, Camp Lejeune took the initial RFA and expanded it to include units such as landfills, surface impoundments, waste piles, tanks, container storage, septic tanks, drain fields, waste water treatment units, and storm water conveyances. The Base's efforts included the preliminary review of site records and a visual site inspection on potential SWMUs. More than 3,500 sites/units were identified during a preliminary review of MCB records. Visual site inspections were conducted on nearly 500 of these sites/units. The findings from this investigation are presented in the document entitled "RCRA Facility Assessment Report for MCB, Camp Lejeune, North Carolina" referred to as the 1996 RFA Report. The 1996 RFA Report categorized each of the potential SWMUs and AOCs into four groups: 1- Units having a release potential, 2-Units addressed under the Installation Restoration Program in accordance with CERCLA, 3-Units addressed under the Leaking Underground Storage Tank (UST) Program in accordance with NCDENR requirements, and 4- Units having a release potential under RCRA corrective action, therefore requiring confirmatory sampling. The 1996 RFA Report identified 41 IR Sites, 112 UST sites, and 56 SWMU sites that required confirmatory sampling and/or corrective measures. Based on further negotiations between the state and MCB, Camp Lejeune, 62 SWMUs were identified as needing confirmatory sampling. In October 1998, the Phase I Confirmatory Sampling Report was completed and summarized the extent of soil contamination at these 62 SWMUs. Based on results of the Phase I Investigation and the addition of 6 new SWMUs, 47 SWMUs were included in the Phase II Confirmatory

Sampling event. The Phase II Investigation involved the sampling and analysis of additional soil and groundwater samples at these 47 SWMUs and determined that 8 SWMUs require a RCRA Facility Investigation (RFI) while 5 SWMUs require Interim Measures (IM). and/or additional sampling. RFIs, IMs, and additional sampling activities will begin in 2003.

In addition to those sites identified above, MCB, Camp Lejeune has also identified 20 other-than-operational (OTO) Ranges. The Department of Defense Military Munitions Response Program has been developed to address all OTO ranges to determine the extent of UXO and explosive constituent contamination. Currently, these OTO ranges are being investigated for closure.

Contaminated Media

Soil (Surface & Sub-Surface)

Soils on MCB, Camp Lejeune often exhibit concentrations of various contaminants, which exceed one or more of the applicable screening levels. Inorganics such as aluminum, calcium, magnesium, and iron are believed to be naturally occurring in soils at Camp Lejuene. Other inorganics such as cadmium, silver, thallium, and others may result from anthropogenic sources but do not appear to be common constituents in soils. These compounds must be carefully investigated to determine if they are in fact anthropogenic contaminants or result from site-specific activities, in which case, they must be addressed in remediation. Occurrences of all organic compounds, such as VOCs, SVOCs, POLs, Pesticides, and PCBs are considered a result of past or continuing site-specific activities and must be addressed in remediation of the site. See Table 1 for a summary of all identified soil contamination on MCB, Camp Lejeune IR Sites. See Table 2 for a summary of all identified soil contamination on MCB, Camp Lejeune SWMU Sites.

Groundwater

Groundwater in the MCB, Camp Lejeune area is naturally rich in iron and manganese. Iron and manganese concentrations, both for total and filtered samples, in groundwater at Camp Lejeune often exceed their respective North Carolina Water Quality Standards. These inorganics, as well as some others, are often considered naturally occurring and their presence is not associated with site operations and therefore not addressed in remediation. Groundwater contamination identified at IR Sites and SWMUs are summarized in Tables 3 and 4 respectively.

Surface Water / Sediment

Surface water and sediment contaminants at concentrations exceeding appropriate screening levels have been identified on MCB, Camp Lejeune IR Sites. IR Site 41, Camp Geiger Dump, exhibited concentrations of metals above regulatory limits in surface water and sediment. Sites 35 and 36 are located along Brinson Creek, just north of Camp Geiger. Lead and Mercury were identified in the surface water and sediment of Brinson Creek; however, this contamination has not been associated with Site 35 or 36 specifically. Ongoing investigations may link this contamination to either of these sites, to an off-base source, or to a natural source. IR Site 7, Tarawa Terrace Dump, had low level pesticide contamination identified in the sediment of Northeast Creek. IR Site 89, Camp Geiger DRMO borders Edwards Creek. VOCs were found in surface water and sediment along Edwards Creek. IR Site 84, Building 45 Area, includes a small man-made lagoon, which has exhibited PCB contamination above regulatory levels in both surface water and sediment.

Indoor Air

Historically, indoor air contamination has been identified on MCB, Camp Lejeune within several buildings in the Hadnot Point Industrial Area. Several buildings lie above POL contaminated groundwater and have reported problems regarding contaminated indoor air in the past. In response to these reports, indoor air

monitoring was initiated and continues at several buildings. No indoor air contamination has been detected over the last two years of monitoring. MCB, Camp Lejeune is currently evaluating all buildings that are in the proximity of contaminant plumes for indoor air concerns. Indoor air monitoring and personnel monitoring were started in 2002. To date there is no evidence to suggest that vapors from contaminant plumes are entering buildings.

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

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

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

Summary Exposure Pathway Evaluation Table

Potential **Human Receptors** (Under Current Conditions)

Contaminated Media	Residents	Workers	Day-Care	Construction	Trespassers	Recreation	Food
Groundwater	No	No	No	No	N/A	No	N/A
Air (indoors)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Soil (surface, e.g., <2 ft)	No	No	No	No	N/A	No	N/A
Surface Water	No	No	No	No	N/A	No	N/A
Sediment	No	No	No	No	N/A	No	N/A
Soil (subsurface e.g., >2 ft)	No	No	No	No	N/A	No	N/A
Air (outdoors)	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Instructions for Summary Exposure Pathway Evaluation Table:

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

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

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

__X__ If no (pathways are not complete for any contaminated media-receptor combination) skip to #6, and enter "YE" status code, after explaining and/or referencing condition(s) in-place, whether natural or man-made, preventing a complete exposure pathway from each contaminated medium (e.g., use optional Pathway Evaluation Work Sheet to analyze major pathways).

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

_____ If unknown (for any "Contaminated" Media - Human Receptor combination) - skip to #6

and enter "IN" status code.

Rationale and Reference(s):

Contaminated Media

MCB, Camp Lejeune entered into a Memorandum of Agreement with the USEPA, NCDENR, and Department of Navy that established a Land Use Control Assurance Plan, which provides a method to implement and maintain controls to prevent human exposure to contaminated areas. Land Use Control Implementation Plans are developed, and included as part of the Record of Decision, on a site by site basis and may include restrictions on site access, aquifer use, intrusive activities, and land use. In order to prevent unacceptable exposures from occurring the Environmental Quality Branch (EQB) began Intrusive Activity Training. This training targeted base employees who may be required to work in areas where contamination has been identified. During training, Base employees were provided with a background of EQB, Base maps illustrating all areas of contamination (IR, SWMU, UST) and given procedures to follow when working (or managing contracts which involve work) in or near these areas to eliminate the chance of exposure to contaminated media. Due to the LUCAP and Intrusive Activity Training, Base employees, and construction workers are not likely to encounter contaminated media. OTO Ranges are in the process of bing investigated for closure which will verify the absence of contamination. However, due to their locations within areas of past intrusive activities (construction, grading/paving), any potential Unexploded Ordnance (UXO) found in the area would have been addressed at that time. There are no known past or present incidents involving UXO at OTO ranges. It is also highly unlikely that explosive constituent contamination is a risk to human health on OTO ranges, as much of the range area is either capped by construction or vegetated for non-residential uses preventing potential exposures from occurring. Plans for construction, maintenance, and training in these OTO Ranges include stipulations restricting certain activities from taking place and thus preventing exposures. Also, MCB, Camp Lejeune is a secured military facility with limited public access and no agricultural activities, therefore, food and trespasser receptors are not considered viable receptors.

Soil (Surface & Sub-Surface)

Exposure pathways for soils (surface & sub-surface) are not complete for any receptors at Sites that have undergone assessment. All identified soil contamination that was found to pose an unacceptable risk has been addressed through Removal Actions or through the implementation of controls, which preclude the exposure pathway from becoming complete.

Base housing facilities, recreation areas, and daycare facilities on Camp Lejeune are not located on identified soil areas of concern and any identified sites within close proximity of base housing units (IR Sites 44 and 89) have been fenced to prevent any base housing residents from coming into contact with contamination.

Much of MCB, Camp Lejeune can be considered an industrial area due to the nature of activities on Base. Contaminated soils in these industrial areas are often remediated to levels indicative of industrial land use. These industrial screening levels should prove protective of both general Base workers as well as construction workers. Several soil areas of concern have undergone remediation with industrial RBCs as the target remediation level. A soil removal action was implemented at Site 21 to remove pesticide and PCB contaminated soils in 1995. A Time Critical Removal Action (TCRA) was conducted in 1994 at IR Sites 6&82 for the removal of debris and drums of DDT and associated soil. A second TCRA was performed in 1995-6 to address drums, batteries, communication wire, and POL contaminated soils. IR Site 2 underwent a TCRA in 1994 for pesticide-contaminated soils. A total 1,049 tons of pesticide-contaminated soils were excavated and sent for off-site disposal. PCB contaminated soils at IR Site 36 were removed in 1998. Metallic debris and associated soils were removed from IR Site 43 in 1995. IR Site 54 underwent a removal action for POL contaminated soils in 2000. A soil removal was conducted in 1995 at IR Site 35 to address POL contaminated soils. In 2000, IR Site 35 underwent two removal actions to address buried drums and an abandoned fuel line that were discovered during construction of the NC Hwy 17 By-pass. A TCRA completed at IR Site 80 during 1996, included the removal and disposal of pesticide

contaminated soils. Removal of POL and SVOC contamination at IR Site 3 was concluded in 2000. IR Site 89 underwent a TCRA to address VOC contaminated soils. Almost 30,000 tons of soil were excavated, treated through Low-Temperature Thermal Desorption and returned to the excavation at IR Site 89. Battery piles and associated soils were removed at IR Site 85 in 1999. In 2001, SWMUs 358 and 359 underwent RCRA Interim Measures (IM) for removal of batteries and associated soil. Removal of PCB and POL impacted soils were completed as part of a non-TCRA at IR Site 84 in 2002. Additional soil removals at IR Site 36, 43, 44, and 84 will be undertaken in 2003 as part of the selected remedy for OU6.

In general, the soil contamination at the remaining IR Sites and SWMU Sites is limited in nature, does not pose a threat to human health, or exposures are limited through some control. SWMU Sites, which posed an immediate risk to human health, have been addressed through IM. The soil contamination at the remaining SWMUs does not present unacceptable risks. Fencing at IR Sites 41, 74, 43, and 84 restricts access to unauthorized personnel and prevents potential exposures to contaminated soils and potential chemical warfare materials. Soil contamination at IR Site 88 is beneath a paved parking lot and Building 25, therefore exposure is unlikely. Other IR and SWMU Sites have some limited soil contamination that does not present an unacceptable risk to human health.

Groundwater

Groundwater in regions beneath MCB, Camp Lejeune has been impacted by past activities and concentrations of certain contaminants have been found that exceed applicable regulatory screening levels. In general, controls have been implemented that prevent any exposure to contaminated groundwater. Camp Lejeune is located in a hydrogeologic area that consists of several individual aquifers, which are separated by confining units in some areas and freely interact in other areas. Contamination has been identified in the uppermost of these aquifers, the surficial and Castle Hayne aquifers.

The surficial aquifer ranges from 0 to 73 ft below ground surface (bgs) but is generally found above 25ft bgs. It consists mainly of intermingled sand, clay, and silt with some peat and shells. The surficial aquifer is not used as a potable water source on MCB, Camp Lejeune due to its low production potential. A semi-confining unit of clay, sandy-clay, and silt beds separate the surficial aquifer from the Castle Hayne aquifer. However, the beds are sporadic in nature and there is some interaction between these aquifers. The principal water supply aquifer for MCB, Camp Lejeune is the Castle Hayne aquifer. This aquifer consists of sand, cemented shell, and limestone. The aquifer becomes increasingly limy with depth and ranges in depth from 10 to 400 ft bgs. Over 100 water supply wells have been constructed on Base to supply the needs of residents, employees, and marines. Prior to distribution, all water is treated at one of Camp Lejeune's water treatment plants.

In order to prevent exposures to contaminated groundwater, MCB, Camp Lejeune has implemented controls through the Land Use Control Assurance Plan that restrict use of aquifers within 1500ft of known groundwater contamination and prohibit intrusive activities which may impact contaminated groundwater. Sites where groundwater contamination is present are also included in the Long Term Monitoring (LTM) Program. Production wells in the vicinity of these sites have been closed and permanently abandoned. Through LTM, data related to the contaminant plumes are updated on a quarterly, semi-annual, or annual basis and any changes in plume characteristics are reflected in appropriate modifications to the controls to prevent any exposure from occurring.

Indoor Air

Indoor air contamination was identified in 2000 on MCB, Camp Lejeune within several buildings in the Hadnot Point Industrial Area. Several buildings lying above POL contaminated groundwater have reported problems regarding contaminated indoor air in the past. MCB, Camp Lejeune immediately evacuated all permanent employees from these buildings and initiated an indoor air quality-monitoring program. In addition, MCB, Camp Lejeune demolished three buildings (1102, 1103, 1113) in this area that had experienced indoor air concerns. Other buildings in this area are currently used as storage warehouses and are sampled weekly to ensure that indoor air does not present a risk to any employees working in these

areas. MCB, Camp Lejeune is currently evaluating all buildings that are in the proximity of contaminated plumes for indoor air concerns. Indoor air monitoring and personnel monitoring were started in 2002. To date there is no evidence to suggest that vapors from contaminant plumes are entering buildings.

Surface Water / Sediment

Surface water and sediment contaminants at concentrations exceeding appropriate screening levels have been identified on MCB, Camp Lejeune IR Sites. IR Site 41, Camp Geiger Dump, exhibited concentrations of metals above regulatory limits in surface water and sediment. However, the site has been fenced to prevent access to the area surrounding the contaminated portions of the creek. IR Site 7, Tarawa Terrace Dump, had low-level pesticide contamination identified in the sediment of Northeast Creek; however, these pesticide levels did not pose a risk to human health. IR Site 89, Camp Geiger DRMO has contaminated Edwards Creek with VOCs. The impacted portions of Edwards Creek have since been fenced and an aeration basin has been installed to preclude any persons from coming into contact with contaminants and prevent contamination from migrating downstream. Sites 35 and 36 are located along Brinson Creek, just north of Camp Geiger. Lead and Mercury were identified in the surface water and sediment of Brinson Creek; however, this contamination has not been associated with Site 35 or 36 specifically. Ongoing investigations may link this contamination to either of these sites, to an off-base source, or to a natural source. IR Site 84, Building 45 Area, includes a small man-made lagoon, which has exhibited PCB contamination above regulatory levels in both surface water and sediment. Site 84 has been fenced to prevent any unnecessary exposures to contaminants.

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

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

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

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

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

Rationale and Reference(s):

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

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

_____ If yes (all "significant" exposures have been shown to be within acceptable limits) –continue and enter "YE" after summarizing and referencing documentation justifying

why all "significant" exposures to "contamination" are within acceptable limits (e.g., a site-specific Human Health Risk Assessment).

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

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

Rationale and Reference(s):

_____

_____

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

__X__ YE - Yes, "Current Human Exposures Under Control" has been verified. Based on a review of the information contained in this EI Determination, "Current Human Exposures" are expected to be "Under Control" at the **MCB, Camp Lejeune** _____ facility, EPA ID # **NC6170022580**, located at **Jacksonville, NC** under current and reasonably expected conditions. This determination will be re-evaluated when the Agency/State becomes aware of significant changes at the facility.

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

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

Completed by (signature) _____ Date _____
(print) _____
(title) _____

Supervisor (signature) _____ Date _____
(print) _____
(title) _____
(EPA Region or State) _____

Locations where References may be found:
MCB, Camp Lejeune
Environmental Quality Branch
Environmental Management Division
_____
_____

Contact telephone and e-mail numbers
(name) Richard Raines P.E.
(phone #) 910-451-5068
(e-mail) rainesrh@lejeune.usmc.mil

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

DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Interim Final 7/8/03

RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA750)

Migration of Contaminated Groundwater Under Control

Facility Name: Marine Corps Base, Camp Lejeune
Facility Address: Jacksonville, North Carolina
Facility EPA ID #: NC6170022580

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 and
Reference(s):
Information pertaining to contamination found on MCB, Camp Lejeune was taken from the following sources:
-Fiscal Year 2003 Site Management Plan
-Phase I and II SWMU Confirmatory Sampling Reports
-Mrs. Nikki Hall, Manager Leaking Underground Storage Tank Program
-Base Background Study
-Land Use Control Assurance Plan / Implementation Plan
-Remedial Investigations, Site Investigations, Feasibility Studies, Long Term Monitoring Data
All the contaminants listed in Table 4 have exceeded appropriate screening criteria for groundwater These screening levels include but are not limited to:
-North Carolina Water Quality Standards
-Federal Maximum Contaminant Levels

Groundwater in the MCB, Camp Lejeune area is naturally rich in iron and manganese. Iron and manganese concentrations, both for total and filtered samples, in groundwater at Camp Lejeune often exceed their respective North Carolina Water Quality Standards. These inorganics, as well as some others, are often considered naturally occurring and their presence is not associated with site operations and therefore not addressed in remediation. Groundwater contamination identified at IR Sites and SWMUs are summarized in Tables 3 and 4 and are being addressed through remedial actions. Groundwater in the vicinity of OTO Ranges has not been evaluated for contamination.

Footnotes:
[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 and
Reference(s):

Areas of identified groundwater contamination at IR and SWMU Sites are routinely evaluated to assess contaminant migration and plume location. IR Sites are included in the long-term-monitoring (LTM) program, which involves sampling and analysis of wells located within, up-gradient, down-gradient, and side-gradient to the known extent of plumes. Long-term monitoring plans are developed on a site-specific basis and typically include quarterly, semi-annual, or annual monitoring requirements. LTM Reports are submitted to both NCDENR and USEPA. The Phase II SWMU Investigation identified groundwater contamination at 8 SWMUs. These SWMUs will be further evaluated during the RFIs at each of these SWMUs.

In general, groundwater movement at Camp Lejeune is very slow due to a relatively flat topography and low permeability in the surficial aquifers. As evidenced through the monitoring programs, contaminant plumes in the surficial aquifer have not exhibited sufficient migration in the lateral or vertical directions and can be identified as stabilized plumes. While deeper contaminant plumes have exhibited a capacity to migrate, pump and treat systems have successfully limited this migration and contained the plumes. Though some groundwater movement is expected and inherent, MCB, Camp Lejeune's monitoring programs will track any movement and ensure remedial actions will be taken prior to any impact to human or environmental acceptors.

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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.

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

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

__X__ 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 and Reference(s): Several IR Sites are located near surface water bodies. However, sampling data and hydrologic modeling have been used to show that groundwater contamination is not entering surface water bodies. Sampling data from groundwater and surface water are compared with regard to contaminants of concern and site-related COCs in the groundwater are not found in surface water bodies. Hydrologic models are also used to show groundwater flow directions and illustrate whether a surface water body is acting as a groundwater source or groundwater discharge point. Evaluations of this type have been performed at IR Sites 35, 36, 41, 73, 82, 84, 86, and 89. At each of these sites, surface water bodies do not contain groundwater contaminants of concern and/or act as a groundwater source rather than a discharge point.

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5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (i.e., the maximum concentrations 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)?

_____ If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentrations[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 concentrations[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 and
Reference(s):_____

[3] As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) 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 refugia) 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 and
Reference(s):_____

IR and SWMU sites with contaminated groundwater are continuously monitored and evaluated for changes in plume characteristics. LTM events are scheduled on a recurring basis and the results of these events made available to the regulatory and local community. The LTM program allows MCB, Camp Lejeune to predict plume movement and address potential problems before they are realized.

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 **MCB, Camp Lejeune**, EPA ID # **NC6170022580**, located at **Jacksonville, NC**. 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) _____ Date _____
(print) _____
(title) _____

Supervisor (signature) _____ Date _____
(print) _____
(title) _____
(EPA Region or State) _____

Locations where References may be found:
MCB, Camp Lejeune
Environmental Quality Branch
Environmental Management Division

Contact telephone and e-mail numbers
(name) Richard Raines PE
(phone #) 910-451-5068
(e-mail) rainesrh@lejeune.usmc.mil