DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION
Interim Final Guidance: 2/5/99
RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA725)

Current Human Exposures Under Control

Today's Date: 12/14/99

Facility Name: ____National Chromium_____
Facility Address: _____Senexet Road, Putnam, CT_____
Facility EPA ID #: _____CTD001160811_____

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

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

_____ If no - re-evaluate existing data, or

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

BACKGROUND

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

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

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

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

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

	Yes	No	?	Rationale / Key Contaminants
Groundwater	_x_	___	___	_____
Air (indoors)[2]	___	_x_	___	_____
Surface Soil (e.g., <2 ft)	_x_	___	___	_____
Surface Water	___	_x_	___	_____
Sediment	_x_	___	___	_____
Subsurf. Soil (e.g., >2 ft)	_x_	___	___	_____
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):

Groundwater. GW at the site is contaminated with chromium which originated from the old plating building, AOC 9. Recent GW data collected from discrete piezometers, P1, P2 and P3 (located immediately upgradient of the AOC 9 extraction well, EW-1 and installed by UConn's Environmental Research Institute (ERI) and analyzed by MIT's Civil and Environmental Engineering Dept.), revealed total (assumed) chromium concentrations at P2 of 54, 41 and 38 *ug*/ml (*mg*/l) at depths of 13, 15 and 17 feet below grade, respectively. May 12, 1998 *Summary of Recovery Well Operation* report at Appendix E. This data demonstrates a reduction in total chromium concentrations at discrete locations based on a comparison with October 1988 GW data collected from MW's 5 and 10 which exhibited maximum total chromium concentrations of 80.00 *mg*/l and March 1989 GW data collected at MW's 11s, 11d and 12 which demonstrated maximum total chromium levels of 63.5 *mg*/l. *See* November 1996 Environmental Indicator Evaluation (EIE) at p. 8. Nickel had also been detected in GW at the site: up to 11.00 mg/l in October of 1988 and up to 6.85 mg/l in March of 1989. These nickel concentrations are apparently in excess of Connecticut Department of Health Services recommended concentration limits of 1.00 *mg*/l for nickel, *Id.*, and are in excess of CTDEP's Surface Water Criteria (SWC) for nickel (0.88 *mg*/l).

AOC 9 Extraction Well. Operation of the AOC 9 Extraction/Recovery Well was initiated on Dec. 11, 1995. Total dissolved-phase chromium concentrations at startup was 230 *mg*/l. As of Dec. 24, 1997, approximately two (2) years later, total dissolved-phase chromium concentration has been reduced to 10 *mg*/l. *Summary of Recovery Well Operation* report at p. 2.

Groundwater Classification. Based on the most recent Environmental Indicator Evaluation (EIE) dated November of 1996, the groundwater at the site is classified as "GB" while "surrounding groundwater is presumed to be classified GA (suitable for potable use without treatment)." EIE at p. 4. Based on a conversation with Maurice Hamel of CTDEP, this statement is correct: apparently, the GW plume was reclassified by CTDEP as a result of the agency's recognition of the site groundwater plume. CTDEP was conservative in classifying the areal extent of the plume: the 1987 GW classification map indicates some 10 to 20 acres is classified as GB whereas the entire facility property is 7 acres.

Potential Receptors. The site is bordered by Senexet Road to the east; Peake Brook Road to the south; woods, marsh, and the Little River to the west and south; and woods and residential homes to the north. EIE at p. 4. The Little River is classified as a Class B surface water, with designated uses of recreation, fish and wildlife habitat, agricultural and industrial supply and other legitimate uses. *Id.* at pp. 4 and 5. The town of Putnam receives its water from various water supplies located upgradient and downgradient from the site; the available information indicates these water supply sources are located upgradient or, if downgradient or side gradient, at least 1.3 miles from the site. National Chromium investigated the location of potential private wells within a one-half mile radius of the facility; no private wells were discovered. *Id.*

Risk to Receptors/Receptor Pathways. The available information indicates that the dissolved-phase chromium (Cr6+) plume is controlled by the AOC 9 groundwater extraction well. UConn and National chromium's consultant recently finished field work which confirmed the effectiveness of the groundwater extraction system; this work, the reporting of which is currently in process at this time, apparently satisfies recent requests by CTDEP to confirm the performance of the extraction well. Personal conversation with Whitby Ellsworth of National Chromium, December 9, 1999. See below for further information regarding the AOC 9 extraction well. In addition, studies conducted by UConn's ERI reveal: "99% of the chromium in the aquifer is bound to the aquifer sediment"; "a slow, kinetically-controlled attenuation mechanism is [] influencing heavy metal mobility at the site"; [e]xperiments show that only a fraction of the total chromium in the soil at the [] site is readily leachable from the subsurface soil under typical environmental conditions"; and "partitioning coefficients for chromium between the wetland sediment and pore water were calculated and [] found to be very high [indicating] the chromium in the wetland sediments is immobile." *Overview of Research Conducted at the National Chromium Inc. by the Environmental Research Institute at the University of Connecticut*, June 1996 at p. 1. ERI's studies have demonstrated that the dominant mechanisms retarding chromium in the groundwater at the site include "adsorption onto organic matter and iron oxide coatings on mineral surfaces." *Id.* at p. 12. Also of particular significance is the site aquifer chemistry: "[r]edox potentials (Eh) ranged from -112 to -192 mV, indicating that the pore water was in a reducing environment.... No hexavalent chromium was detected in any of the 10 [wetland pore water] samples analyzed, indicating that the aqueous phase 'mobile' chromium entering the wetland had been reduced from Cr(VI) to Cr(III). Sulfide was detected in two of the four samples analyzed, indicating the presence of reducing conditions in the wetland. Apparent partitioning coefficients (K_d) for chromium between the sediment and pore water were calculated for three locations. The average K_d for chromium was 317,000 ml/g (for 0-30 cm) and 71,000 ml/g (for 30-40 cm). The high K_d values demonstrate that virtually all the chromium in the wetland is bound to the sediment, and that by comparison, very little chromium is mobile in the pore water." *Id.* at p. 17. The information demonstrates that dissolved-phase chromium (Cr6+) which migrates towards or into the wetland area is reduced to Cr3+ and subsequently tightly bound to the soil. In sum, it is unlikely that the site groundwater plume is contaminating groundwater beyond the immediate GB plume and wetland area.

Surface Soil/Sediments.

AOC 9 (soils beneath and surrounding Old Plating Building). Following decommissioning and removal of the AOC 3/AOC 9 plating tanks and equipment in February of 1999 and various interim measures to remove surface soils at AOC 10 (chrome tank 7 exhaust vent) and AOC 12 (chrome tank number 8 exhaust stack), there still remains surface soil contamination under the AOC 9 old plating building which includes "both the former wood-floored plating area and the soil beneath this area." *See, Stabilization Workplan*, dated February 1999 at p. 7. However, with the recent (Feb. 1999) decommissioning activities at AOC 9, the former wood flooring has been removed and as of December 9, 1999, the floor has been covered with a new plywood floor. Thus, surface soil contamination at AOC 9 is currently considered "to be limited to the soils underlying the plating floor area," *Id.*, which includes a small "'crawl space'" under the building. *Id.* This space is "enclosed within the wall of the building" and "[t]he only access [to this area] is via a hatchway inside the building which is kept locked at all times. There is currently no activity in this portion of the building other than decontamination [activities]..." *Id.*

CTDEP RSR DEC. Incidentally, under Section 22a-133k-1, et seq. of CTDEP's Remediation Standards Regulations (RSR), the soils under the Old Plating Building may be considered "inaccessible soil" per 22a-133k-1(a)(28)(C)(i) since they are located "beneath an existing building". Under 22a-133k-2(b), the RSR Direct Exposure Criteria (DEC) does not apply to inaccessible soils provided that a land use restriction is in effect if such inaccessible soil is less than 15 feet below the ground surface. In addition, since the building constitutes an effective cap, this source of contamination does not constitute a continuing degradation threat to the aquifer which would otherwise mandate remediation under the State of Connecticut's Pollutant Mobility Criteria and established groundwater policy.

CTDEP RSR PMC. This area would likely also constitute "environmentally isolated soil" per 22a-133k-1(a)(15). As environmentally isolated soil, this area appears to satisfy an exception to remediation under the RSR's Pollutant Mobility Criteria (PMC) as described under 22a-133k-2(C)(4) since the area is a GB area. However, this exception requires a land use restriction is in place. Currently, if does not appear that National Chromium has applied for, or obtained, a land use restriction from the CTDEP.

AOC 8 (Little River/Wetland Area). This AOC "consists of the low-lying wetland system associated with the Little River. The area is located approximately 25 to 30 feet below the elevation of the facility building . . ." *Stabilization Workplan* at p. 6. The wetland areas is described as a "combination of naturally-occurring wetlands and man-made wetlands," since the wetlands is partially attributable to historical permitted discharges of treated wastewater from the facility. EIE at p. 5. Permitted discharges ended in 1993 causing "the areal extent of the wetlands [to] decrease[] and the area is now considerably dryer and less diverse than when the discharge [occurred]." *Id.* Sampling results indicate that chromium in surficial soils is "exclusively trivalent" but that said Cr3+ concentrations at "certain locations" exceeds CTDEP's RSR Direct Exposure Criteria (DEC) for residential areas (DEC Cr(III) 3,900 *mg*/kg). *Stabilization Workplan* at p. 6. Only one sample, however, exceeds the RSR DEC for Commercial/Industrial areas (51,000 *mg*/kg). *Id.* Numerous studies conducted by UConn's ERI indicate that the wetlands surficial soils has a high affinity for adsorption of Cr(III), that "chromium detected in the wetlands sediments is very immobile and is strongly bound to the sediments." EIE at p. 5; *also see* the discussion presented above. In addition to continuing academic studies conducted by UConn's ERI, MIT's Civil and Environmental Engineering Dept and the University of Maryland at Collage Park's Department of Natural Resource Sciences, National Chromium has proposed in it's recent Stabilization Workplan to "consolidate all existing soils data and prepare a figure showing sampling locations and compare the available results to CTDEP's soil criteria," and an "updated wetlands survey" to determine the nature and extent of the wetlands areas as a result of the cessation of permitted discharges to the area. EIE at pp. 6-7. As of December 9, 1999, National Chromium indicated that this work has been postponed until a more appropriate time; National Chromium's decision to postpone this work is attributed to the prioritization of Stabilization activities. In particular, EPA recently commented on the Stabilization Workplan which indicated that "while not easily accessible, there are no physical barriers that would prevent access to the area." *Stabilization Workplan* at p. 6. EPA proposed that a fence be installed and notices posted as an institutional land use control interim measure and that this task be considered a priority under the current workplan. National Chromium has concurred with this recommendation. *See* E-Mail Correspondence to John Miller of National Chromium dated 3/1/99 and a letter response from National Chromium dated 3/5/99. On December 9, 1999, EPA visited the National Chromium site and observed that a fence had indeed been erected to surround the entire wetlands area. In addition, the fence is adequately and clearly posted to discourage trespassers.

Subsurface Soils. The presence of chromium in site soils is largely attributable to historical releases at AOC 9 and AOC's 10 and 12. Recent soils data collected from soil borings for discrete piezometers, P1, P2 and P3 (located immediately upgradient of the AOC 9 extraction well, EW-1) installed by UConn's ERI and analyzed by MIT's Civil and Environmental Engineering Dept., revealed total (assumed) chromium concentrations ranging from approximately 100 to 550 *ug*/g (*mg*/kg) over depths of 140 to 210 inches below grade (BG) (approximately 11.5 to 17.5 ft BG). *Summary of Recovery Well Operation* report, dated May 12, 1998 at Appendix E. Depth to groundwater was recently measured at P1, P2 and P3 at 11.06, 11.58 and 9.91 ft BG. *Id.* at Appendix D. Under CTDEP's RSR DEC, Section 22a-133k-1, et seq., the soils at the AOC 9 GW extraction well area may be considered "inaccessible," per 22a-133k-1(a)(28)(A) since it is reasonable to conclude that

chromium contamination impacted soils in this area, having leached from soils within the near vicinity of the Old Plating Building, is "more than four feet below the ground surface" at the AOC 9 plume area (which is located some distance from the AOC 9 building). However, although inaccessible from a human health-DEC perspective, vadose zone sources that do not meet the criteria for environmentally isolated soils per 22a-133k-1(15), provide a continuing threat of degradation to the aquifer and require remediation since such soils constitute a violation of CTDEP's groundwater policy.

National Chromium, however, is working towards remediating this area and, along these lines, has been the focus of numerous studies by academic institutions, such as the University of Connecticut's (UConn) Environmental Research Institute (ERI); these studies have investigated the fate and transport of metals in soils and groundwater. Some of these studies include: An Evaluation of Batch Leaching Procedures for Heavy Metal Mobility Estimates From Soils (May 1996); Chromium Mobility in Freshwater Wetlands (Oct. 1995); Modeling of Multicomponent Transport in Groundwater and Its Application to Chromium Systems (PhD Dissertation, 1996); Enhanced Mobilization of Heavy Metals Using Sequential Extraction (Oct. 1995); An exploratory Study of the Sorption Behavior of Chromate in Glaciated Soils (Masters Thesis, 1995); The Role of Wetlands in the Immobilization of Chromium Contamination (Tech. Report 1994); Sequential Extraction of Chromium from Contaminated Aquifer Sediments (Spring 1994); Vertical Distribution and Partitioning of Chromium in a Glaciofluvial Aquifer (Summer 1994); Equilibrium Studies of Chromate Adsorption on Glacio-Fluvial Aquifer Sediments (Tech. Report, 1994); and, Redox Capacity Analysis and Heavy Metal Sequential Extraction For Site Assessment of Subsurface Contamination (Tech. Report, 1993). In sum, the direction of these studies is towards developing the possibility of remediating the AOC 9 subsurface soils by innovative soil flushing techniques.

Summary: Current Human Exposures Under Control

In summary, the substantial volume of information indicates that little to no human health risk exists to on-site or off-site populations from direct or indirect exposure to metal-contaminated soils or groundwater. The only direct threat that can be reasonably anticipated is a possible, albeit remote, direct exposure threat to a wetlands trespasser; however, National Chromium has mitigated this risk with the installation of the aforementioned fence. Accordingly, at this time, National Chromium should be considered to have met the Current Human Exposures Under Control (CA725) indicator.

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[3]
Groundwater	___	___	___	___			___
Air (indoors)	___	___	___				
Soil (surface, e.g., <2 ft)	___	___	___	_y_	___	___	___
Surface Water	___	___			_y_	_y_	___
Sediment	___	___			_y_	_y_	___
Soil (subsurface e.g., >2 ft)				_y_			___
Air (outdoors)	___	___	___	___	___		

Instructions for Summary Exposure Pathway Evaluation Table: **"n" or blank =no; y=yes**

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

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

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

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

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

_____ If unknown (for any "Contaminated" Media - Human Receptor combination) - skip to #6 and enter "IN" status code

Rationale and Reference(s): **As the above discussion elucidates, the main human health exposure pathways have to do with trespasser and recreational exposures to the wetland area soils. The other potential, albeit remote, exposure pathways have to do with construction exposure to chromium contaminated surface soils and subsurface soils. Of these two, the only probable exposure pathway is from the wetlands area since the facility controls access to construction areas. As noted above, National Chromium has mitigated this risk with the installation of the aforementioned fence. Accordingly, at this time, National Chromium should be considered to have met the Current Human Exposures Under Control (CA725) indicator.**

Note that a groundwater or surface water pathway was not identified since migration of dissolved-phase chromium to drinking water wells in the vicinity is not reasonably expected under current conditions.

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."

__x__ 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):

The only exposures that could be deemed significant are trespasser and recreational exposures from the wetlands area. Again, because National Chromium has erected a fence as described above, this area no longer poses a "significant" risk.

[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?

__x__ 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):

National Chromium erected a fence around the wetlands area.

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 **National Chromium** facility, EPA ID **#CTD001160811**, located at **Senexet Road, Putnam, CT** 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) Raphael J. Cody — Date 3/11/99
(print) Raphael Cody — Revised: 4/28/99
(title) RCRA Facility Manager — 2nd Revision: **12/14/99**

Supervisor (signature) Matt Hoagland — Date 12/22/99
(print) Matt Hoagland
(title) Chief, RCRA Corrective Action
(EPA Region or State) Region I

Locations where References may be found:

____See facility files _____
_____
_____
_____
_____

STATE Contact telephone and e-mail numbers

(name)_____Maurice Hamel_____
(phone #)___860/424-3787_____
(e-mail)____maurice.hamel@PO.State.CT.US_____

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.