行政院所屬各機關因公出國人員出國報告書

（出國類別：　考察　　）

美國在台協會「文化交流計畫」邀請赴美國參訪出國報告

服務機關：行政院環境保護署土污基管會

出國人　職　　稱：薦任第九職等科長

　　姓　　名：鄭介松

出國地點：美國

出國期間：九十年七月二十七日至九十月八月二十六日

報告日期：九十年十二月二十日

系統識別號:C09006041

公 務 出 國 報 告 提 要

頁數: 22 含附件: 是

報告名稱:

美國在台協會「文化交流計畫」邀請赴美國參訪出國報告

主辦機關:

行政院環境保護署

聯絡人／電話:

／

出國人員:

鄭介松　行政院環境保護署　廢管處　科長

出國類別: 考察

出國地區: 美國

出國期間: 民國 90 年 07 月 28 日 -民國 90 年 08 月 25 日

報告日期: 民國 90 年 12 月 20 日

分類號/目: G14／環境工程 ／

關鍵詞: 土壤及地下水污染,整治基金,整治場址,超級基金,superfund,褐地

內容摘要: 本次參觀訪程係美國在台協會「文化交流計畫」邀請赴美國參訪。主要與參訪有關土壤及地下水污染的研究機構、場址等。

本文電子檔已上傳至出國報告資訊網

目　錄

壹、參觀訪問行程說明

一、 訪問時間：九十年七月二十七日至九十年八月二十六日

Environmental Protection Policy
An Individual Grantee Project
July 30- Augst 24, 2001

Washington, DC
July 28-August 2, 2001

Philadelphia, Pennsylvania
August 2-5, 2001

New York City, New York
August 5- 8, 2001

Buffalo, New York
August 8-13, 2001

Cincinnati, Ohio
August 12- 15, 2001

Houston, Texas
August 15- 19, 2001

Seattle, Washington
August 19- 22, 2001

San Francisco, California
August 22- 25, 2001

二、會見人士

編號	姓名	單位	職稱
1	JOHN A.ANDEREGG	INTERNATIONAL VISITOR PROGRAM	
2	PAYAL SAMPAT	WORLDWATCH INSTITUTE	RESEARCH ASSOCIATE
3	Damon V. Woods	Phelps Stokes FUND	Program Officer
4	Albert C.Gray	Water Environment Federation	Deputy Executive Director
5	Angela Logomasini	Competitive Enterprise Institute	Director of Risk and Environmental Policy
6	Guy A.Tomassoni	Environmental Protection Agency, Corrective Action Programs Branch, Office of Solid Waste	Environmental Scientist
7	James L. Maas	Environmental Protection Agency	
8	Stephen D.Luftig	Office of Emergency and Remedial response	Director
9	Tracy W.Hopkins	U.S.Environmental Protection Agency, Office of Emergency and Remedial Response	Environmental Engineer
10	Susan E. Bromm	U.S.Environmental Protection Agency, Office of Site Remediation Enoforcement	Deputy Director
11	Sam Parry	Sierra Club,Associate Washington Representative International Program	
12	ED Hopkins	Sierra Club,Senior Washington D.C. Representative Environmental Quality Program	
13	Francesca Di Cosmo	U.S.Environmental Protection Agency Region III, Office of the Deputy Regional Administrator	International Program Manager
14	Thomas C. Voltaggio	U.S.Environmental Protection Agency Region III	Deputy Regional Administractor
15	Lonnie Goldiner	Philadelphia Water Department Operations Division	Inspecvor,Industrial Waste Unit
16	Jack P. Siderer	City of Philadelphia	Director of Engineering and Environmental Planning
17	Morris Fine	City of Philadelphia, Department of Public Health	Director
18	Lawrence M. Moy	City of Philadelphia, Department of Streets	Deputy Streets Commissioner
19	Clarena I.w. Tolson	City of Philadelphia, Department of Streets	Deputy Streets Commissioner

20	Edward J.Linky	U.S. EPA	Senior Energy Policy Advisor
21	David R.Specca	The State University of New Jersey	Director of Developmental Program
22	Harry W. Janes	The State University of New Jersey	Director
23	Christopher Meier	The Center for Responsibility in Business	Manager,Social Research
24	Jessica Palmiotti	The Center for Responsibility in Business	Research Analyst
25	Lee Ilan	The City of New York	Senior Environmental Planner
26	Gregory R.Belcamino	The City of New York	Deputy Director
27	Laurence K. Rubin	County of Erie Department of Environment & Planning	Commissioner
28	Christorpher S. Pawenski	County of Erie Department of Environment & Planning	Coordinator,Industrial Assistance Program
29	Kenneth J. Swanekamp	County of Erie Department of Environment & Planning	Director of Business Assistance
30	Paul B.Kranz	County of Erie Department of Environment & Planning	Associate Engineer Environmental Compliance
31	Donald R.Tubridy	Millier Springs Remediaition Mangement INC.	Western New york Operations Manager
32	Brian D. Downie	Millier Springs Remediaition Mangement INC.	Environmental Data Management
33	Daniel K. king	New York State, Department of Environmental Conservation	Regional Hazardous Weaste Remediation Engineer
34	Kent R.Mcmanus	MALCOLM PIRNIE Independent Environmental Engineers,Scientist & consultants	Senior Associat
35	James J. Richert	MALCOLM PIRNIE Environmental Engineers,Scientists & Planners	Senior Project Hydrogeologist
36	John R. Whitney	U.S. DEPT. of Agriculture Natural Resources Conservation Service	District Conservationist
37	Mark W. Rebstock	Internatinal Visitors Council	Assistant Executive Director
38	J. Steven Justice	TAFT, Stettinius & Hollister LLP	Attorney at Law
39	Randy L.Welker	Greater Cincinnati Chamber of Commerce	Director, Business Retention
40	Eugene M. Langschwager	Greater Cincinnati Chamber of Commerce	Director Environmental Projects

41	Andrew L.Kolesar	THOMPSON HINE LLP	Attorney at Law
42	Dave Strayer	The Payne Firm, INC. Environmental Consultants	Senior Project Manager
43	Donald A.Fay	The Payne Firm, INC. Environmental Consultants	Principal
44	David L.Nutini	Hamilton County General Health District	Director, Waste Management Service
45	Jack P.Wachter	Office of Environmental Mgt. Environmental Compliance Division	Senior Environmental Safty Specialist
46	Frank Robertson	Ohio Environmental Protection Agency	Supervisor, VAP
47	Joseph C. Chow	City of Houston	Assistant Director
48	Clyde R. Smith	City of Houston	Assistant P.W. Operations Manager
49	Gurdip Hyare	City of Houston	chief Engineer
50	Cahrles Goode	Gulf Coast Waste Disposal Authority	Manager,General Operation
51	Bob White	City of Houston Metropolitan Transit Authority Texas Department of Transportation	Management Analyst IV
52	Linda Vasse	Texas Natural Resource Consrvation Commission	Technical Specialist Waste Section
53	James A.Rice	Texas Natural Resource Consrvation Commission	Environmental Investigator Water Section
54	Leonard H.O. Spearman	Texas Natural Resource Consrvation Commission	Regional Director Field Operations Division
55	Don Thompson	Texas Natural Resource Consrvation Commission	Assistant Regional Director, Field Operations Division
56	Richard E. Flannery	Texas Natural Resource Consrvation Commission	Assistant to Air Section Manager, Field Operations Division
57	Huyen D.Luu	Texas Natural Resource Consrvation Commission	Team Leader, Water Section
58	Timothy C.Croll	City of Seattle	Community Service Director
59	Deborah Brockway	Environmental Market Development, Dept. of Natural Resources	Manager
60	Laura Belt	Solid Waste Division, Dept. of Natural Resources, King Street Center	Engineernig Service

61	Kim Ducote	Rabanco Recycling	Director of Public affairs and Bussiness Development
62	Roger G. Anderson	Battelle Putting Techonolgy to Work	Technical Group Manager, Environmental Policy & Management
63	Ann M.Lesperance	Battelle Putting Techonolgy to Work	Senior Research Scientist,Environmental Policy & Planning Group
64	Robert C. Swan	Dewberry & Davis LLC	Associate
65	Robert M. Clegg	Law Center of James Robert Deal	Attorney at Law
66	Petrina Grube	International Diplomacy Council	Senior Program Officer, Resource Manager
67	Nick Mills	University of California,Center For Biological Control	Associate Professor
68	Sally K.Fairfax	Henry J. Vaux Distinguished Professor of Forest Policy College of Natural Ressource	
69	Leo F. Kay	U.S. Environmental Protection Agency, Region IX	Narthern California Media Liaision
70	周仁章 Jen-Chang Chou	Taipei Economic and Cultural Office in S.F.駐舊金山台北經濟文化辦事處	Director Science Division 科學組組長
71	曹冬柏 Justina Tsao	Taipei Economic and Cultural Office in S.F.駐舊金山台北經濟文化辦事處	副處長
72	Jim Chien	Solid Waste Management Program Administrative Service Dept.	Assistant to the Director & Public Outreach Coordinator
73	Cynthia C.Kang	Solid Waste Management Program Administrative Service Dept.	Senior Adminstratir
74	Marjaneh Zarrehparvar	Hazardous Waste management program, Solid Waste Management Program Administrative Service Dept.	Busıness Program Manager
75	Marj Westlund	SF Environment	Public information Officer

貳、參觀訪問心得

一、 Sierra Club

408 C St., NE
Washington, DC
Contact: Mr. Sam Parry
Telephone: (202) 547-1141
E-mail: sam.parry@sierraclub.org

The Sierra Club

The Sierra Club is one of the oldest and largest environmental protection organizations in the United States. Founded in 1892 by the legendary conservationist John Muir, the organization has since expanded to over 700,000 members and a preeminent place in the U.S. environmental community. It uses its considerable clout to support the fight against pollution and exploitation of natural resources.

該自然保育團體有 700,000 members 會員，其會員多數不僅捐助經費，亦積極參與自然保育活動。The Sierra Club 分布全國各地，分支單位公分四級如下：一：四百多個 groups，依每個 city 城市設置，其工作人員多為自願性服務，非專任全職工作。二：七十五個 sharper，原則上依每州 state 設置，惟加州較為特殊，有將近五十個，其工作人員中有一、二位全職人員。三：三十五個 field office，依區域分布，其工作人員中有七、八位全職人員。四、二個 national office 位於華府和舊金山。

美國國會遊說有公開規範，惟 The Sierra Club 與其他環保團體差異在於其屬 c-4 organization（一般為 c-3 organization，此為稅法上差異），故該自然保育團體可直接將經費捐助國會議員（每年有 4000 萬經費，但須向 faderoal ellectional commission 申報捐助

情形），並可進入國會 lobby 遊說。故透過上開遊說，再加上全國為數眾多之分支機構與會員，The Sierra Club 對環境保護法律與政策有極大影響力。

目前 The Sierra Club 主要注重四個環境議題一：大農場之農業廢棄物問題例如密西西比河的水污染問題 。二：大城市與衛星城市不斷擴張對周遭綠地之衝擊。三：森林保護，尤其在國家森林 national forest 對抗伐木業之林木砍伐，其最終目標希望禁止伐木業進入 national forest。四、環保特殊議題如最近眾議院有意同意石油公司進入阿拉斯加鑽井探油，但 The Sierra Club 則持反對立場，並遊說參議院應不予通過。

二、Environmental Protection Agency (EPA)

The Environmental Protection Agency (EPA) was established in the executive branch as an independent agency pursuant to Reorganization Plan #3 of 1970, effective December 2, 1970. The EPA was created to permit coordinated and effective governmental action on behalf of the environment. The EPA endeavors to abate and control pollution systematically, by proper integration of a variety of research, monitoring, standard setting, and enforcement activities. As a complement to its other activities, EPA coordinates and supports research and anti-pollution activities by State and local governments, private and public groups, individuals, and educational institutions. The EPA also reinforces efforts among other Federal agencies with respect to the impact of their operations on the environment, and it is specifically charged with making public its written comments on environmental impact statements and with publishing its

determinations when those hold that a proposal is unsatisfactory from the standpoint of public health or welfare or environmental quality. In all, EPA is designed to serve as the public's advocate for a livable environment.

本次會談共有五位美國環保署同仁與會如下，會談內容以美國超級基金制度與褐地政策為主：

姓　　名	單　　位	職　　稱
Stephen D.Luftig	Office of Emergency and Remedial response	Director
Guy A.Tomassoni	Environmental Protection Agency, Corrective Action Programs Branch, Office of Solid Waste	Environmental Scientist
James L. Maas	Environmental Protection Agency	
Tracy W.Hopkins	U.S.Environmental Protection Agency, Office of Emergency and Remedial Response	Environmental Engineer
Susan E. Bromm	U.S.Environmental Protection Agency, Office of Site Remediation Enoforcement	Deputy Director

（一）按美國目前依 RCRA 法案執行列管之特殊場址有 5000 個（非超級基金列管場址），其中 1714 個較為嚴重而列入優先處理名單，然上開 1714 個較為嚴重場址中，有 50 至 60 個場址由超級基金提供經費進行清理，清理工作一般區分 short-term 、long-term 兩種。

至於超級基金法案執行面檢討方面，美國環保署認同由於向來對超級基金列管場址之整治工作，過於注重程序致使

整治之結果反受忽視，故超級基金法案有改革之必要，各項改革方案中以簡化程序較受矚目。另，超級基金列管場址經清理告一段落後，一般將場址移請地方州政府繼續執行監控計劃（post construction），並由地方政府自行負擔監控所需經費，中央則每五年審視上開計劃之執行狀況。惟目前地方州政府怠為執行監控計劃之案例有增加趨勢，尚待進一步溝通協調。

（二）褐地的相關問題

美國聯邦環保署於一九九五年特別頒定了一項「褐地」行動綱領（Action Agenda），以資因應。一九九五年一月二十五日，美國聯邦環保署署長 Carol Browner 頒布了一項 Brownfields 行動綱領（Actionc Agenda），概述並描繪出聯邦環保署之行動與未來之計劃，並協助州政府和地方政府了解的美意而熱心參與。目前美國全國約有四十五萬至六十萬個褐地（Brownfields），主要原因為超級基金法案對潛在污染責任人（PRPs）之法律責任要求過於嚴格，以致銀行於受理舊工業用地之貸款案件時，往往考量此類案件存有較高之風險而拒絕貸款。然褐地如不能再利用或再開發，不僅衝擊未開發綠地（Greenfields）遭受開發之壓力，褐地長期荒廢亦嚴重影響地方之經濟發展。然而，由於褐地均屬有主之用地，且非超級基金之列管場址，故超級基金在不能代為清理情形下，代以褐地行動綱領 Brownfields Program 法案促使地方政府執行褐地再利用或再開發。目前 Brownfields Program 執行情形經費分支狀況如下：一、pilot money：Brownfields

Program 提供地方政府每個褐地 Brownfields 二十萬美金（目前有四百個案例）規劃再利用或再開發。二、其經費來自超級基金，自 1987 年以來共支應 162million（包括 200000×400 及其他給地方貸款），上開計劃執行成果業已為地方創造 2.2billion 之開發利益與 14000 個工作機會（例如褐地再開發為購物商店 shopping mall）。三、超級基金提供每年歲入百分之五經費給 Brownfields Program（1.3billion/year×5%=90million/year）。

（三）收費之相關課題

有關美國超級基金法案原授權政府徵收相關費用，如 Chemical Tax、Petroleum Tax、Environmental Income Tax 等，目前均因國會授權屆至（1995.12）而尚未通過新的授權徵收法案，致目前尚未持續向業界徵收費用。然因超級基金列管場址之整治經費龐大，致使政府之預算規模亦因上開費用停徵而逐年增加。事實上超級基金列管場址之清理整治經費，有 70%為責任人自行清理，僅 30%由基金支應，惟相關整治經費仍屬龐大。此項整治經費如由間接污染之業者負擔，轉由全體納稅人負擔，其社會公平性課題，深值探討。

（四）執法人力議題

目前 EPA 本部有六分之一人力執行超級基金業務，約 3200 人。而各分部與地方約 18000 人。

三、**competitive enterprise institute**

本協會為業界籌組，針對各項環保政策提出企業界之看法並進行國會遊說。該協會對褐地（Brownfields）政策立法草案之看法主要有二：一、美國超級基金法案對於潛在污染責任人PRPs之責任規範過於嚴峻（可無限追溯），業界普遍認為連帶責任（joint-and several liability）有違公平原則，蓋多數人負連帶責任時，常使得有支付能力責任人為無支付能力責任人支應整治廢。此現象亦使很有財勢之財團或個人（deep pocket），當面臨污染整治責任時，與其花費巨資清理整治場址，寧可高薪聘請律師進行冗長訴訟以規避清理責任。二、污染場址整治基準要求太過嚴苛，致所有可能污染之用地不論污染輕重，均造成恐慌，業界不敢觸碰關場用地，害怕成為列管場址，這也是Brownfields產生主因。雖然有些州政府試圖解決上開疑慮，而願意發給私人清理土地後一份證明文件，但此項文件並非超級基金法案所授權之規範，致上開清理證明文件無法律保證效果。如該場址未來經確認仍為污染場址者，則此時土地使用人仍未能於前次清理後致免除之此時之整治責任規範。以上二點協會對褐地（Brownfields）政策立法草案之看法，亦為業界反對目前Brownfields法案通過之主因。

四、**World Watch Institute**

The Worldwatch Institute is dedicated to fostering the evolution of an environmentally sustainable society--one in which human needs are met in ways that do not threaten the health of the natural environment or the prospects of future generations. The Institute seeks to achieve this

goal through the conduct of inter-disciplinary non-partisan research on emerging global environmental issues, the results of which are widely disseminated throughout the world.

該協會自 1974 年成立，除依賴私人基金捐助外，主要 40%經費來自著作版權(包括翻譯)及發行刊物所得。為維持協會中立持平立場，協會拒絕來自私人企業與政府之支助。該協會並無其他分會，但有多達四十多國之翻譯版本。由於該協會較重視全球性議題，故多以未來影響人類及地球為出發觀點，探討相關課題，如人口暴漲、糧食缺乏、政府資源濫用及基因改造作物等問題。

對於基因改造作物問題看法，該協會引用 brian halweil 見解，認為人類不應以糧食缺乏為理由鼓勵基因改造作物。相反的，由於目前對基因改造作物之長遠影響未知下，政府應以民眾知的權利為考量，強制「標示」規定，尤其當該基因改造作物含有其他物種基因時（如含魚基因之蕃茄）更應強制「標示」為妥。

五、EPA Region3

美國超級基金場址分布於十個分區（EPA Region）中，以芝加哥（Region 5）轄區最多，其次為紐約（Region 2）。而超級基金列管場址中，如由聯邦政府（EPA）執行清理整治者，均由各分區執行。目前費城（Region 3）約有二百位技術人員（其中 60~70 人負責緊急應變措施，20~30 人負責確認列管轄區場址，70~75 人負責清理整治計劃，50 人負責調查污染並追查責任人）及八十位律師執行超級基金列管之二百處場址。故一般而言每位專責執行超級基金場址清理整治計劃之人員，平均約同時負責 3~5 處場址。

每一超級基金場址之清理整治計劃平均約需 5~20million，但也有超過者，例如紐約 Hudson river 之整治費目前既需 400million。

六、EPA region 2 & 紐約市市長辦公室

由於 superfund 法案對污染責任人之定義範圍過大 PRP's，致二種現象發生：1.褐 地發生 2.保險市場（大保險公司如 Zurich Aig Remper 等）積極發展各種保單，分別針對土地買受人、土地開發人及銀行，均有不同之保險單，以分散持有或開發舊工廠土地之風險，此種現象在工業發展歷史已久之城市如紐約尤其明顯。紐約市政府甚至因 superfund 法案而儘量拍賣市有地，不願持有多餘土地。另外，EPA 針對 brownfield 提供之補助計劃，市政府為取得二十萬美金之補助，需要向 EPA 提出周詳調查計劃（該計劃並無確實之場址，故為類似污染調查計劃），經同意補助後仍要執行並據以向 EPA 報告，如調查發現應清除而非屬 superfund 場址者，則由州政府負責執行，非 EPA。

七、Erie County 愛略郡政府

愛略郡政府環保計劃室主任針對 brownfield 問題，敘述該郡三點看法，提供參考

（一）整治基準不應過嚴，如該地之地下水並非供飲用或無人使用，且該褐地經整地後，可能僅作為停車場等使用者，則不應一味以飲用水標準要求整治。且紐約州州政府對整治基準均以個案認定，故無統一標準，如本郡臨湖之一舊工廠用地

bethlehem steel， 由於紐約州州政府堅持對地下水整治基準採飲用水標準，而不問其未來用途，致造成郡政府開發此褐地案極大困境。但僅隔一線之外可能有不同之標準。

（二）政府應該給未來土地使用者法律上保證（證明文件），才能避免人民甚或地方政府不敢持有褐地之現象，而此現象存在，亦對綠地開發造成壓力，對大環境並無益處。

（三）政府應主動清理 brownfield 之一般污染，因 brownfield 並非有害場址，或存有有害廢棄物，亟待清理。如美國工業發展已久大城市內舊大樓或工廠到處皆是，

八、Miller's spring 整治機構 (Love canal containment site)

目前該場址已完成封閉措施，並持續監控。相關費用由 Hooker 化學公司之既受者 occidental 化學公司提供 300million 美元，委託整治機構執行控制計劃，而先前該公司已支付 139million 給政府，該場址內仍存有 22000 噸廢棄物（多為含氯污染物），且離本場址不遠之臨湖處有另一處非法棄置場，目前亦已完成封閉措施，並持續監控。本場內共有 112 個整治井及數百個監測井，每年處理 3 到 4 million 加侖廢水處理後已近於飲用水標準排出。另美國中央有 superfund 而紐約州也有基金，其經費來自廢棄物廢水之徵收。

Love Canal 事件的演繹表

年/月/日, 事　　件

1890, Mr. William Love 開始挖掘水利運河，但隨後又放棄了，此未完成之運河(共半英哩長)。

1942~1953, Hooker 化學公司，共掩埋 2 萬 5 仟噸的化學廢料在此廢棄之坑道中。

1953, Hooker 化學公司以 1 美元的價格賣給當地的教育委員會。

1953~1970, 學校、房舍、街道及水電管線，陸續完工並建築在 Love Canal 周遭的土地上。

1978.03, 地下室中滲漏出的化學廢料，已引起當地居民、媒體的高度關切且紐約的環保局亦開始研究此一化學廢料外洩事件。

1978.03~07, 衛生部與環保署展開一連串的調查；州政府官員也舉辦會議說明此一事件。

1978.08.02, 政府公告 Love Canal 為危險區域並建議暫時疏散居住在內圍的懷孕婦女及 2 歲以上的小孩。居民幾乎發生暴動。

1978.08, 州政府及聯邦政府相繼發表聲言，將收購內圍居民所有的房舍。

1978.10, 開始從 Love Canal 南部進行整治的工程。

1979.02, 衛生部建議暫時疏散居住在外圍的懷孕婦女及 2 歲以下的小孩。

1979.03, Love Canal 中、北部的整治工程開始進行

1979.04, 政府立法減免受災戶的房屋稅近 80%。

1980.05, 環保署研究證實 36 位接受研究的居民中，有 11 位居民其染色體已遭受破壞。

1980.05, 卡特總統下令收購約 700 戶居住在外圍的居民。

1980.12, 卡特總統下令使用超級基金 (Superfund) 幫助整治 LoveCanal。

1982.06, 內圍居民的房舍皆夷為平地。

1988.09, 衛生部宣稱多數曾遭受污染的地方已適合居住。

九、紐約州環保處第九分處

（一）非法棄置場址與超級基金列管場址

廢棄物非法棄置或有害廢棄物場址通常均由州政府執行現場緊急應變與初評(preliminary site assessments)，上開場址原則上由州政府自行列管(紐約州有自己的 superfund,但性質上仍屬公務預算惟具有專款專用性質)，必要時才通報 EPA 請其支援。紐約州並將場址初評後區分(class1,2,2a,3,4,5)等六

級，目前紐約州列管 857 處場址，而第九分處列管 159 處場址。EPA 所稱超級基金列管場址清理告一段落後，一般將場址交由地方州政府繼續執行監控計劃（post construction），並由地方自行負擔經費，此即為 class4 級之執行計劃。美國各州多數均有自己的基金而非全仰賴 EPA superfund，州基金來源主要有三：superfund 支援、bond 公債、化學物輸入運作之稅收。但州政府上開經費仍循預算程序，經州議會同意後，專款用於執行廢棄物污染場址整治相關工作。惟議會同意方式有時以十年為期授權執行，有時則以每年審查方式同意，然後者常影響場址清理整治之規劃與進度。

紐約州環保處第九分處處理廢棄物場址整治相關工作人員有三類：12 位工程技術人員、8 位緊急應變專業人員、2 位律師，另有合約環境檢驗室。

（二）公有褐地：由於多屬市 CITY 郡 COUNTY 所有地，故由州政府補助 75%，而市 CITY 郡 COUNTY 自行負擔 25%以進行清理開發。如為私有褐地：則原則上因非屬 EPA 列管場址故其清理工作得自行進行，但私有土地持有人因擔心自行開發後，如被發現為污染場址者，自身將陷入潛在污染責任人 PRPs 之訟爭中，且私人開發需銀行貸款支援時，銀行多要求開發者需取得州政府不訴追之文件（俗稱無污染證明）。故州政府同意準用列管場址之清理程序，審查私有土地持有人自行進行清理整治計劃，並賦予州政府同意將不訴追之文件，以免除州與市郡政府未來訴追之可能。然上開文件並非超級基金法案所授權之規範，致無法律保證效果，故仍非全無風險

（此亦為業界批評頗多之處），惟州政府表示，縱有上開風險，然事實上尚未有 EPA 仍訴追之情形。目前紐約州有 200 個自願性清理場址，而第九分處轄區有 15 至 20 個自願性清理場址。

十、Steve Justice[lawyer]

該法律事務所為因應褐地開發所產生環保技術、政府整治規範、財物規劃、銀行保險、地主與開發者間或開發者與爾後使用者間，相異且複雜之法律課題，故集合不同領域律師成立 Practice Groups。該法律事務所之客戶多為地主與開發者，由於 superfund 關係，地主與開發者如欲開發土地往往需面對政府環保法規、銀行及鄰地所有人之不同複雜議題，致懼於開發。故事務所因應上開需求，協助不同當事人間以合約方式解決其面臨之法律問題，以解決紛爭。Ohio 州政府針對褐地（與紐約州同）受理審核 VAP 計畫（Voluntary Action Program）【此在肯達基州稱為 Voluntary Environmental Remediation Program， VERP】，上開自願性褐地清理計畫經州政府核准實施後，得免除州政府訴追之可能，且其整治基準得依土地未來使用目的而有不同考量，通常地下水之整治要求即非依飲用水標準，故對清理計畫之經費需求有極大誘因，惟其土地地籍上將註明其土地地下水之污染狀況並不得作為指定特定用途（如住宅使用）。而基於使用者付費原則，VAP 計畫提出者須給付州政府按時計費之 oversite costs（平均多為場址清理費之 30－50%），然開發案如有地下水污染擴散至鄰地時，縱有上

開州政府免除訴追承諾，地主卻仍易受鄰地所有人訴訟。尤其當地下水污染流向鄰地且有地下水井時，其法律問題將更難解決。曾有修法（superfund 法）提議認為經核准之 VAP 計畫實施者，應受法律保障免受政府與第三人訴追，然上開提議對鄰地所有之第三人而言，將有違憲之虞。蓋憲法明定人民之財產權應受保護，如土地之地下水受他人土地擴散污染，卻不得訴追者，則上開法律顯有違憲法保護人民之財產權之基本原則。實務上由於依法律規定私人褐地之清理並非必由政府核准，始得為之。故有些案例為考量 VAP 計畫審查之複雜性與 oversite costs 按時計費之高價，地主亦得選擇自行清理。

十一、Andrew L. Kolesar (Partner　Thompson Hine LLP)

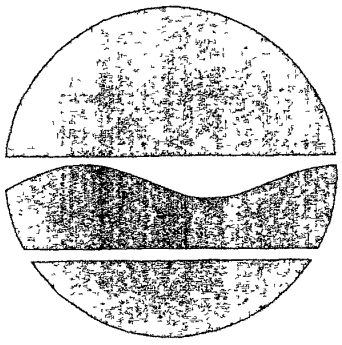
RCRA 與 CERCLA 之適用並無何者優先性，多由州政府 依個案選擇，然 CERCLA 大多處理 1980 年以前既存之污染案而無法依 RCRA 命改善時適用之。美國各州均可訂定較聯邦更嚴之法規，例如聯邦 clean water act 僅規範地表水但也有幾州將 clean water act 適用到地下水，故有關係之第三人（如其土地遭鄰地擴散污染），此時再該州即可依 clean water act 提起損害賠償訴訟。關於污染場址，有關係之第三人對污染源訴訟情形有三：一、依 common law 訴訟但在環境污染案常發生請求權時效完成致喪失強常可能；二、依 RCRA 法人民可依該法逕向法院請求命污染者執行立即改善措施，或第三人對於 90 日告知期間經過後，如地方政府所為命令污染源之措施仍未滿意時亦得向污染者訴訟；三、依 CERCLA 第三人可逕行清理後向污染者訴訟求償。不過，依

CERCLA 法案執行狀況，訴訟多處於政府與 PRPs 之間。而如政府可證明多數 PRPs 時，一般均以和解收場。CERCLA 施行多年一般認為有時該法過度重視程序規定以至於忽略實質整治結果，此種重程序輕實質情形，亦促使通認有三分之一至二分之一經費並非用於具體整治工作上。相同不合理現象發生在 PRPs 之定義過廣，政府只要抓到一人求償後，讓他繼續向他人求償，使多數 PRPs 間互相訴訟。而法院判決時偶有判原告勝訴之金額低於律師獲得之報酬，亦變相促使濫訴發生。

參、附 錄

附錄一

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION



March 2000

Special Report

on the status of

Inactive Hazardous Waste Sites

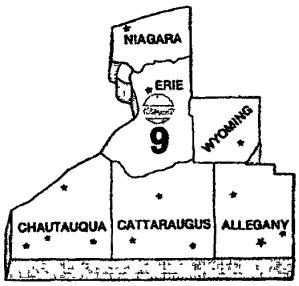
in

The City and Town of Tonawanda

INTRODUCTION

The Department has many different responsibilities

The New York State Department of Environmental Conservation (NYSDEC) has two major areas of responsibility: natural resources management, and environmental quality protection. As part of natural resource management, the department oversees the state's fish and wildlife resources and state lands. To protect the quality of our environment, the department issues permits to control pollution of air and water, transport and disposal of solid and hazardous wastes, pesticide use, mining and mined land reclamation. In addition, environmental remediation programs carry out or oversee the remediation of inactive hazardous waste disposal sites.

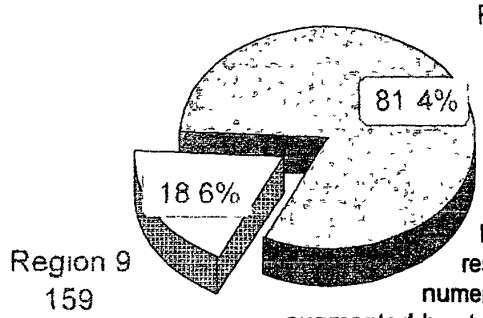


The department's programs are delivered through a network of nine regional offices and numerous sub-offices across the state. Each region is headed by a regional director and is organized and staffed to serve the needs of communities within its boundaries. The regional office is the first point of contact for obtaining or renewing NYSDEC permits and for reporting environmental or natural resource problems. Niagara, Erie, Wyoming, Chautauqua, Cattaraugus and Allegany counties comprise Region 9. It has a staff of more than 300, in 15 facilities, who provide a broad range of environmental services.

ENVIRONMENTAL REMEDIATION PROGRAM

These include the remediation of inactive hazardous waste sites throughout New York State

The Inactive Hazardous Waste Site Remediation Program was formally launched in 1979 with a mission to identify, evaluate and remediate all inactive hazardous waste sites in New York State that could have a significant impact on human health or the environment. This was in response to the situation at Love Canal, which clearly demonstrated the need for such a program. Responsibility for the program rests with the NYSDEC's Division of Environmental Remediation, in cooperation with the New York State Department of Health and the New York State Department of Law.



The hazardous waste remediation program in Region 9 has a staff of 17. Together, they are responsible for 159 hazardous waste sites and numerous smaller remedial projects. These efforts are augmented by staff located in Albany who oversee various projects. In addition, NYSDEC's Division of Solid/Hazardous Materials maintains a similar program for active manufacturing and disposal facilities.

THE REMEDIAL PROCESS

There are a number of steps that must be taken before actual remediation of a site begins

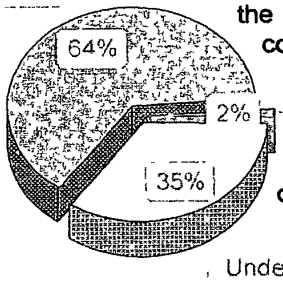
The investigation and remediation of a site generally follows a series of steps designed to evaluate, classify, thoroughly investigate, identify a remedial strategy, design and implement the remedy, and, if necessary, carry out long term monitoring and maintenance of the site. The major elements of the remedial process are outlined below in the order in which they occur.

Preliminary Site Assessment (PSA) - The first investigation of a site where hazardous waste has or may have been disposed of improperly is known as a PSA. The goal of the PSA is to determine whether a site meets the state's definition of a hazardous waste site by confirming the presence of hazardous waste and determining if the site poses a significant threat to public health or the environment. The PSA is a three-step process that includes:

- Records Search. a through background review and record check into past use and disposal activity at the site;
- Sampling/Surveys: sampling of exposed wastes, drums, surrounding soil and surface water, and performing geophysical and soil gas surveys; and,
- Groundwater monitoring: installing monitoring wells and analyzing water samples to check for subsurface contamination.

Design or Construction 42

More than half of the 66 sites in Region 9 that are a significant threat to human health or the environment are currently in the design or construction phase of the remedial process

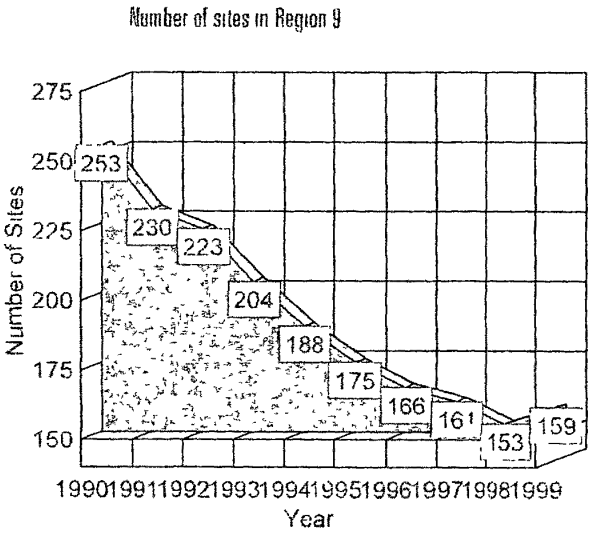


Remedial Investigation (RI) - A process to determine the nature and extent of contamination by collecting data and analyzing the site. It includes sampling and monitoring, as necessary, and includes the gathering of sufficient information to determine the necessity for, and proposed extent of, a remedial program for the site.

Feasibility Study (FS) - A process for developing, evaluating and selecting remedial actions, using data gathered during the remedial investigation to: define the objectives of the remedial program for the site and broadly develop remedial action alternatives; perform an initial screening of these alternatives; and perform a detailed analysis of a limited number of alternatives which remain after the initial screening stage.

Remediation follows similar paths for both Superfund and Responsible Party sites

Remedial Design - Once a remedial action has been selected, technical drawings and specifications for remedial construction are developed, as specified in the RI/FS report. Design documents are used to bid and construct the chosen remedy. The design is prepared by engineers with experience in inactive hazardous waste disposal site remedial actions.



Construction - For Superfund sties the DEC selects contractors and supervises construction work to carry out the designed remedial alternative. Where a Responsible Party exists, they are responsible for the selection of a contractor and must ensure that the remediation is completed in a satisfactory manner. Construction may be as straightforward as excavation of contaminated soil with disposal at a permitted hazardous waste facility. On the other hand, it may involve drum sampling and identification, complete encapsulation, leachate collection, storage and treatment, groundwater management, or other technologies. Construction costs may vary from several thousand dollars to many millions of dollars, depending on the size of the site, the soil, groundwater and other conditions, and the nature of the wastes.

Conditions at the site are remediated and, if needed, monitored.

Monitoring/Maintenance - Denotes post-closure activities to insure continued effectiveness of the remedial actions. Typical monitoring/maintenance activities include quarterly inspection by an engineering technician; measurement of level of water in monitoring wells; or collection of ground water and surface water samples and analysis for factors showing the condition of water, presence of toxic substances, or other indicators of possible pollution from the site. Monitoring/maintenance may be required indefinitely at many sites.

Interim Remedial Measures - Activities to address both emergency and non-emergency site conditions. They can be carried out without extensive investigation and evaluation, to prevent, mitigate, or remedy environmental damage caused by a site.

The state has programs which help municipalities and businesses recycle properties impacted by our industrial past

The State Superfund Program is remediating hundreds of contaminated sites across the State While proving highly successful, the Department recognizes that the Superfund Program alone cannot address all of the State's contaminated sites. Together with the State and Federal Superfund Programs, the Voluntary Cleanup and Brownfields Programs provide the Department with additional tools to cleanup contaminated sites.

Voluntary Cleanup Program

In Region 9, 5 Voluntary Cleanup agreements have been signed and several more are in process

The prime benefits of the Voluntary Cleanup Program are that contaminated sites are cleaned up sooner rather than later, they are cleaned up with private dollars, they are returned to productive economic use, and the need to develop uncontaminated land or greenfields is alleviated. Prior to implementation of the Voluntary Cleanup Program, developers and investors were reluctant to clean up contaminated properties because of the potential liabilities involved. Not only were contaminated properties left vacant, but development expanded into pristine areas.

Under the Voluntary Cleanup Program developers and others can agree to clean up not only inactive hazardous waste sites but also petroleum-contaminated sites, solid waste disposal sites and hazardous substances sites. Volunteers enter into an agreement to investigate the site and work with the Department to develop a site cleanup plan. The contemplated use of the site is established at the beginning of the process, and the volunteer is required to clean up the site to a level consistent with the safe use of the property for that purpose. All work is carried out under State oversight; the volunteer pays State oversight costs. Once the site-specific cleanup levels are reached, the volunteer would receive a release from State liability for the contaminants address in the work plan.

State Brownfields Program

In Region 9 seven State Assistance Contracts have been awarded for Brownfield projects Additionally, nine project applications are under review

Many municipalities across the State have been saddled with the financial and environmental burden of abandoned, idled or under-used properties where expansion or redevelopment is complicated by real or perceived environmental contamination. These abandoned sites, known as Brownfields, can pose public health, environmental, legal and financial burden on a community and its taxpayers.

Many of these properties have been vacant for several years. Municipalities have a difficulty finding parties willing to purchase these properties, because they cannot obtain financing for fear of future liability issues. At the same time, fiscal restraints impede municipalities from committing the funds necessary to remediate these properties.

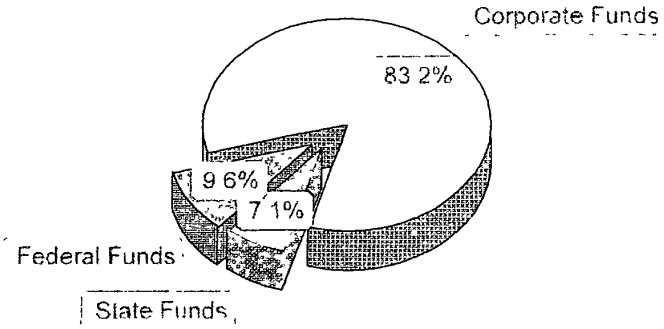
In an effort to assist municipalities and energize the brownfield remediation program, Governor Pataki proposed and New Yorkers approved a $200 million Environmental Restoration Fund as part of the Clean Water/Clean Air Bond Act of 1996. The Brownfields Program provides grants to municipalities for reimbursement of 75% of eligible costs for the investigation and/or cleanup of municipally-owned contaminated properties. The municipality cannot be responsible for the contamination on the property and the property cannot be a Class 1 or 2 site on the State Inactive Hazardous Waste Site Registry.

The sites will be cleaned to the same level of protection as required under the State Superfund Program. These properties may then be marketed for redevelopment by the municipality or used by the municipality for a variety of activities including industrial, commercial or public use. The Brownfields Program is expected to remediate a number of contaminated sites bringing viable businesses, employment opportunities and increased tax revenues into a community.

SITES WITHIN THE TONAWANDAS

Over $700 million has been spent on Hazardous Waste Sites in Region 9. As the pie chart demonstrates, most of these costs have been born by industry.

As of January, 2000 there were 159 listed hazardous waste sites in Region 9, with 12 of these sites within the City of Tonawanda and the Town of Tonawanda



Classification	1	2	2a	3	4	5	Total
New York State	0	508	45	83	205	16	857
Region 9	0	66	5	32	48	8	159
The Tonawandas	0	6	0	3	3	0	12

THE REMEDIAL STAFF

The investigation and remediation of these sites and others in Niagara and northern Erie Counties is being overseen by Region 9's staff. They are:

This remedial staff is responsible for about 100 sites

Mr Daniel King, P E Regional Hazardous Waste Remediation Engineer
Mr Abul Barkat P E , Project Manager
Mr Michael Hinton, P E , Project Manager
Mr John Hyden, Ph D P E , Project Manager
Mr Glenn May, Geologist, Project Manager
Mr Michael Podd, Citizen Participation Specialist
Mr Brian Sadowski, Senior Treatment Plant Operator
Mr James Tuk, Senior Construction Inspector
Mr Kevin Glaser, Construction Inspector

If you would like more information about Hazardous Waste Sites in the City of Tonawanda and the Town of Tonawanda, or additional information about the Department's various programs, please contact Mr. Michael Podd at (716) 851-7220.

INACTIVE HAZARDOUS WASTE SITES IN THE TOWN OF TONAWANDA, ERIE COUNTY

9-15-008B Ashland Tank # 75, 4625 River Road

Currently a Class 3 site in the Registry of Inactive Hazardous Waste Sites

Tank # 75 is a 200' by 300' open top storage tank constructed during World War II to store crude oil. Because of the war, a shortage of steel required the tank to be built as a concrete lined lagoon that is about 25' deep. It is suspected that hazardous waste from the shut down of Ashland Oil Refinery was placed into Tank # 75. Ashland Oil has agreed to properly clean and close this tank. The Department and Ashland are negotiating a Order on Consent to perform the work. Ashland is currently preparing a work plan for the remediation of the tank.

9-15-010 Bisonite Paint Company, 2250 Military Road

Currently a Class 3 site in the Registry of Inactive Hazardous Waste Sites

This site consists of a former settling pond utilized for both water and solvent based paint, and a land spreading area where solvents were used for weed control. The now closed facility had numerous environmental problems. The Division of Hazardous Substance Regulation has coordinated cleanup of drums and the drum storage area, transformers filled with oil containing PCB, and tanks In 1987 a Phase I investigation was completed. A Preliminary Site Assessment was completed in March 1994 and the site was reclassified to a Class 3.

In April 1996 Military Road Associates approached the Department as a volunteer to remediate the land spreading and tank farm areas of the site in preparation for the construction of mini-storage units. Test Pit Investigations were completed in April and May 1996 to delineate the extent of lead, chromium, and organic contaminated soils. Based upon these results, approximately 350 tons of contaminated soils were excavated in October 1996 and disposed off-site at approved landfills. Construction of the mini-storage units was completed during the winter of 1997 The Department has re-delineated the site boundaries to include only the settling pond.

9-15-018 Dunlop Tire, Sheridan Drive and River Road

Currently a Class 4 site in the Registry of Inactive Hazardous Waste Sites

The Dunlop Tire Corporation plant site consists of three separate landfills formerly utilized for the disposal of plant wastes A Record of Decision was executed on March 26, 1993 which called for construction of a cap over each landfill, with the implementation of long term maintenance and monitoring. Landfill construction is complete; the firm utilized naturally occurring clay which was present at the site to construct the caps. As a result Dunlop was able to cap over 20 acres of disposal area for a cost of about $1 million. Long term groundwater monitoring and maintenance are underway at the site; analytical data indicates that the caps have eliminated the migration of contaminants from the landfills.

9-15-031 & 9-15-063 River Road & NiMo-Cherry Farm, River Road

Currently in the process of reclassification to a Class 4 site in the Registry of Inactive Hazardous Waste Sites

A Remedial Investigation and Feasibility Study, under the State Superfund Program, was initiated in November 1991 and completed in late 1993 for the River Rd.. Site (915031). The Remedial Action Plan, finalized in March 1994, called for; the river bank to be stabilized; the site to be capped; extraction and proper disposal of contaminated groundwater and light non-aqueous phase liquids, and implementation of an operations, maintenance and monitoring program. The River Road site was merged with the Niagara Mohawk/Cherry Farm site

The NiMo Cherry Farm site (915063) is immediately north of the River Road site. In the fall of 1993 the Department amended the 1991 Record of Decision which outlined the remedial plans for the site. The amended remedy is similar to that for the River Road site and is compatible with plans calling for this area to be used as a regional park. Remedial Construction began 1996 and was completed in 1999.

In addition to the remedial activity, the PRPs completed the removal of about 50,000 cubic yards of contaminated sediment from the Niagara River. This work started in July and was completed by December 1998. Final seeding and planting was completed in 1999.

9-15-044 Polymer Applications, 3445 River Road

Currently a Class 2 site in the Registry of Inactive Hazardous Waste Sites

The Polymer Applications Site is 6.7 acres in size. Previous investigations at the site detected significant concentrations of phenols, benzene, toluene, xylene, and other contaminants in on-site soil and/or water. The Department has undertaken a Remedial Investigation and Feasibility Study, funded by the State Superfund. The investigation began in late January 1994 and was completed in August 1995. A Record of Decision was executed on March 8, 1996 that calls for the consolidation of off-site and on-site contaminated soils, biological treatment of the soils, capping the rear portion of the site to reduce infiltration, removal of several monitoring wells, and construction and operation of a water treatment system. The Department did an on-site pilot study in April 1997 to evaluate the effectiveness of biological treatment. The study was successful and confirmed that this process would be effective. Design the remedial system is completed. It's anticipated construction of the remedy will begin in 2000.

9-15-055 Tonawanda Coke, 3875 River Road

Currently a Class 2 site in the Registry of Inactive Hazardous Waste Sites

The site consists of the entire Tonawanda Coke Corporation plant area Various investigations completed by the company indicate the presence of widespread organic contamination in site soils and water. The company has completed the first phase of the Remedial Investigation. Negotiations for further investigation are underway.

9-15-056 Robin Steel, 4000 River Road

Currently a Class 2 site in the Registry of Inactive Hazardous Waste Sites

Through the 1970's, steel making wastes, such as spent pickling liquors and slag, were disposed on this site. In the 1980's Envirotek Limited, Inc. leased a portion of the site to operate a hazardous waste treatment, storage and disposal facility, and disposed of untreated wastes on the site. Under an EPA Consent Order, a group of Potentially Responsible Parties (PRPs), consisting of former Envirotek customers, performed interim remedial work on the portion of the site leased by Envirotek. This interim remediation addressed the immediate concerns related to improper storage and disposal of hazardous wastes; however, contaminated groundwater remained uncontrolled. The Remedial Investigation and Feasibility Study began in 1999 and is scheduled for completion in the spring of 2001.

9-15-074 Seaway/Niagara Landfill, Inc., River Road

Currently a Class 4 site in the Registry of Inactive Hazardous Waste Sites

The now closed landfill accepted municipal and industrial wastes from throughout western New York. The landfill closure program included construction of a cut off wall and leachate collection system. A Post Closure Monitoring Program continues under the Division of Solid and Hazardous Materials.

9-15-148 O-CEL-O, 305 Sawyer Avenue

Currently a Class 4 site in the Registry of Inactive Hazardous Waste Sites

The company completed a soil investigation at the site during September 1991 to determine the extent of carbon disulfide (CS_2) contamination. In late 1991 a total of 300 cubic yards of CS_2 contaminated soils were removed. Following this initial removal action, elevated concentrations of CS_2 were still present. As a result, all excavation work was halted. An investigation completed by the company in 1992 found significant additional CS_2 contamination. An Order on Consent for an Interim Remedial Measure (Storage Tank Upgrade), and a focused RI/FS has been executed. Field work began in March 1994 and was completed in the Spring 1996. The Department issued a Record of Decision in March 1999 indicating that no further remedial action was necessary. A long-term site monitoring is underway.

9-15-014 Chemical Leaman Tank Lines, 470 Fillmore Avenue

Currently a Class 2 site in the Registry of Inactive Hazardous Waste Sites

Chemical Leaman Tank Lines is a transporter of bulk chemicals from supplier to customer. Following shipment, the tank trucks were rinsed at the Chemical Leaman facility. Prior to 1978 these washings were discharged to three settling lagoons prior to discharge to the Tonawanda Sewage Treatment Plant. Dunng the summer and fall of 1988 the company reportedly excavated the lagoons and backfilled them with clean fill. Six monitoring wells have been installed to evaluate the effectiveness of this closure. A Preliminary Site Assessment was completed in March 1994. Based upon the extent of groundwater contamination by organic contaminants, the site has been reclassified to a Class 2. The Department has negotiated an Order on Consent with the company to perform a Remedial Investigation and Feasibility Study. The work plan for the investigation and study have been approved and will be implemented starting in 2000.

9-15-050 Spaulding Composites, 310 Wheeler Street

Currently a Class 2 site in the Registry of Inactive Hazardous Waste Sites

The Department, in May 1992, initiated a Multi-Media evaluation of the 46-acre manufacturing facility which revealed numerous hazardous waste storage problems, unpermitted discharges of PCBs to groundwater, surface water and storm sewers. Interim control measures were implemented and, in June 1993, the sewers were cleaned and other remedial measures were implemented. In July 1992 the firm announced it was closing the facility and would undertake a bankruptcy reorganization. The Department began working with Spaulding to develop and implement an environmentally sound shutdown plan for the facility. Decommissioning steps included the cleaning of production machinery, resin tanks and evaporators. Chemicals stored at the plant were removed. All hazardous waste present in the plant and/or generated as part of the shutdown have been taken off-site to a permitted hazardous waste disposal facility. The reorganization plan includes provisions for study and remediation, where necessary, of hazardous waste disposal areas. The Remedial Investigation and a supplemental investigation have been completed. The results of these investigations are under review by the Department. In addition, Spaulding is pursuing plans to redevelop the site to put it back into productive use.

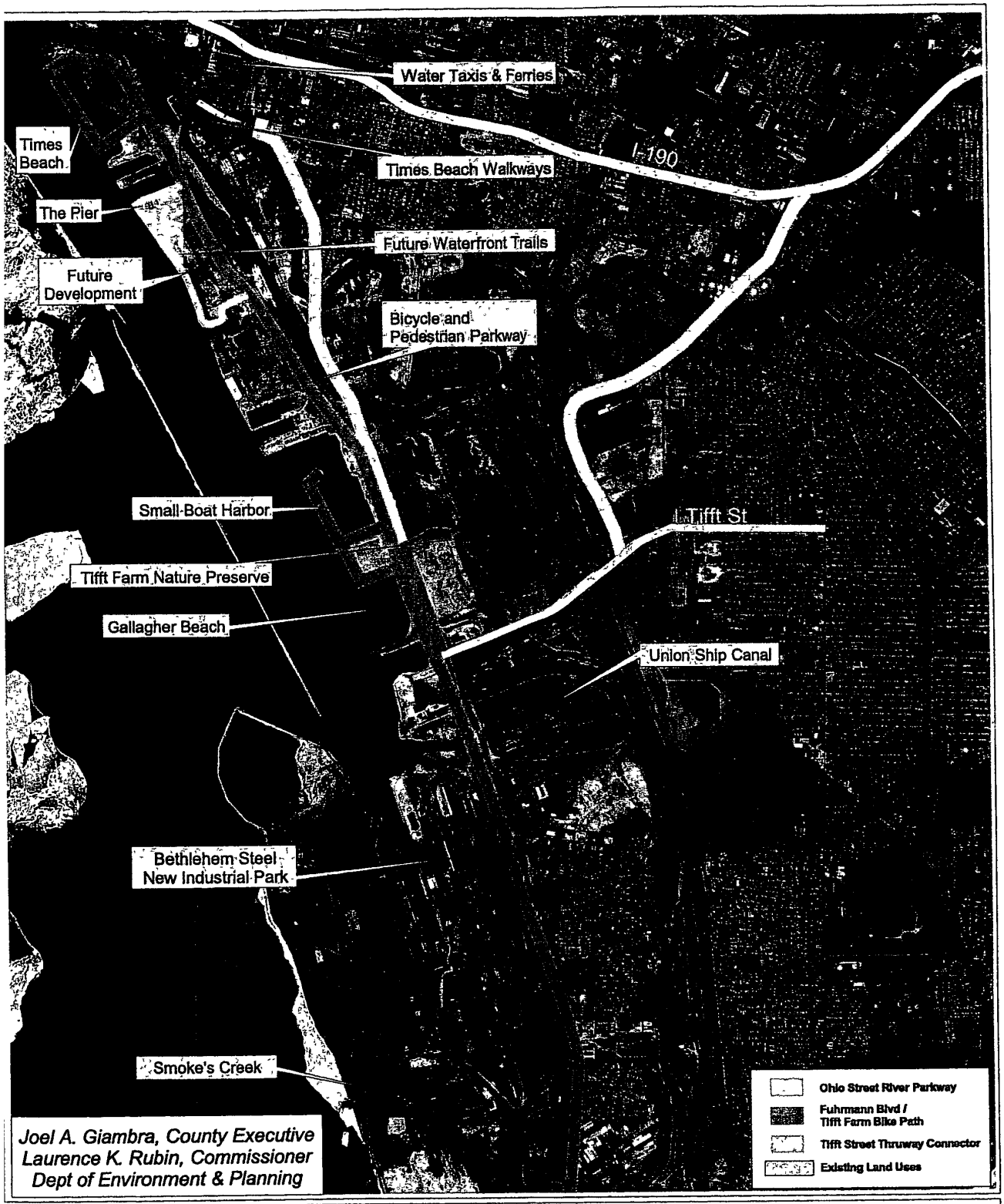
9-15-171 Gastown Sportsman Club, 126 East Niagara Street

Currently a Class 2 site in the Registry of Inactive Hazardous Waste Sites

In response to a spill complaint at the Gastown Sportsman Club the Department investigated the presence of a petroleum like substance entering the basement sumps of the club. Sampling, subsurface investigation and search/review of historical documents ultimately identified the material as coal tar. Past use of the site and adjacent properties was for the production of manufactured gas of which coal tar is a by-product. Indoor air testing by the NYSDOH identified volatile organics in the building basement (sump room and game room). Utilizing an emergency contractor, NYSDEC has installed a corrective measure designed to dewater the clubhouse sumps and redirect contaminated groundwater to an exterior collection and removal system. Installation of the system, consisting of a large diameter purge/dewatering well and phase separation and activated carbon treatment was completed September 1998 and long term operation is now underway. Coal tars and coal tar odors have been eliminated from the Gastown Sportsman Club. The site has been listed as a class 2 facility and additional site investigation and remediation are underway.

For more information about this, or any other of the Department's programs which are available to you in Region 9, please feel free to contact:

Air Resources	(716) 851-7130
Environmental Remediation	(716) 851-7220
Law Enforcement	(716) 851-7000
Natural Resources	(716) 851-7010
Environmental Permits	(716) 851-7165
Regional Director	(716) 851-7200
Solid and Hazardous Materials	(716) 851-7220
Water	(716) 851-7070



Map prepared by the Erie County Department of Environment & Planning Division of Planning: January 2001

Basemap copyrighted by the New York State Department of Transportation

800 0 800 1600 2400 3200 Feet

0.2 0 0.2 0.4 0.6 0.8 Miles

Waterfront Development Project and Transportation Concepts

附錄二

United States
Environmental
Protection Agency
Washington, D C 20460

Solid Waste
and Emergency
Response (5101)

EPA 500-F-97-090
May 1997

EPA

Brownfields National Partnership Action Agenda

Outreach and Special Projects Staff (5101) | Quick Reference Fact Sheet

EPA's Brownfields Economic Redevelopment Initiative is designed to empower States, communities, and other stakeholders in economic redevelopment to work together in a timely manner to prevent, assess, safely clean up, and sustainably reuse brownfields. A brownfield is a site, or portion thereof, that has actual or perceived contamination and an active potential for redevelopment or reuse. EPA's Brownfields Initiative strategies include funding pilot programs and other research efforts, clarifying liability issues, entering into partnerships, conducting outreach activities, developing job training programs, and addressing environmental justice concerns.

"We should restore contaminated urban land and buildings to productive use"

—President Bill Clinton
State of the Union Address
February 5, 1997

Background

The Clinton Administration has launched a landmark effort to improve communities by building partnerships between public and private organizations to link environmental protection with economic development and community revitalization. The Brownfields National Partnership seeks to protect public health and the environment, clean up contaminated properties, build economic viability, and create job opportunities.

The Interagency Working Group on Brownfields was established in July 1996 as a forum for Federal agencies to exchange information on brownfields-related activities and to develop a coordinated national agenda for addressing brownfields. The Interagency Working Group is developing a brownfields strategy, the Brownfields National Partnership Action Agenda, that will link more effectively environmental protection with economic development and community revitalization programs, and guide the Brownfields Initiative into the future.

Brownfields National Partnership Action Agenda

The Brownfields National Partnership Action Agenda includes more than 100 commitments from more than 25 organizations including more than 15 Federal agencies. These commitments represent a $300 million investment in brownfields communities by the Federal government and an additional $165 million in loan guarantees. The resulting action will help cleanup and redevelopment at up to 5,000 properties, leveraging an estimated $28 billion in private investment, creating up to 196,000 jobs, increasing local property taxes an estimated $800 million annually, protecting up to 34,000 acres of "greenfields" and improving the quality of life for as many as 18 million Americans living near brownfields.

Action Agenda highlights include:

- The Administration choosing 10 Brownfields Showcase Communities, each with a Federal coordinator and 5 or more Federal agencies, serving as models demonstrating successful collaboration on brownfields-related activities;
- The Environmental Protection Agency (EPA) funding $125 million for assessment, cleanup, state cleanup programs and job training;
- The Department of Housing and Urban Development (HUD) providing $155 million in community development and housing support and an additional $165 million in loan guarantees;
- The Economic Development Administration (EDA) granting $17 million for brownfields redevelopment in distressed areas;

- The Department of Transportation (DOT) funding $4.2 million for sustainable transportation addressing brownfields issues;

- The General Services Administration (GSA) conducting $1 million of environmental surveys on Federal properties to expedite brownfields development;

- The National Oceanic and Atmospheric Administration (NOAA) providing $900,000 for waterfront and coastal revitalization;

- The Department of Health and Human Services (HHS) committing $500,000 to support brownfields economic development and job creation and working with the Departments of Labor (DOL) and Education to link job training initiatives;

- The Department of Energy (DOE) providing $315,000 to link DOE cleanups with brownfields communities;

- HHS leading an Administration-wide effort to develop a public health policy for brownfields to protect community residents;

- Treasury working with Congress to pass the President's proposed $2 billion brownfields tax incentive; and

- EPA, the Department of Justice (DOJ) and the States collaborating to establish national guidelines for State voluntary cleanup programs.

Brownfields Showcase Communities

Purpose

The Brownfields National Partnership Action Agenda calls for the selection of 10 Showcase Communities across the country to demonstrate that through cooperation, Federal, State, local and private efforts can be concentrated around brownfields to produce environmental cleanup, stimulate economic development and revitalize communities. This proposal will result in cleaning up contaminated properties, creating jobs, expanding local economies, and improving communities' quality of life. The Brownfields Showcase Communities approach provides sustainable local solutions to local problems, solutions that can be replicated throughout the nation.

Background

Communities involved in the Brownfields Initiative have asked for more interaction among all levels of government, the private sector and non-governmental organizations. To that end, EPA and other Federal agencies have joined together to strengthen and improve their collaborative efforts to clean up and reuse contaminated property. The Brownfields Showcase Communities proposal is the centerpiece of that plan and a pattern for future efforts. The Communities selected will serve as models for broad-based cooperative efforts to support locally-based initiatives.

Implementation Steps

- Screening and selecting 10 communities as Brownfields Showcase Communities (EPA, the Departments of Commerce and the Interior, DOT, GSA, HHS, and HUD have been involved in the planning process). Selection criteria include community need, current brownfields activity and other related Federal activity, local commitment and State involvement, and community size and location.

- Providing resources and technical assistance to each Showcase Community to coordinate Federal brownfields activities and support State and local brownfields activities.

- Working with local Brownfields task forces and advisory boards to link Federal, State, local, and non-governmental activities with community members.

- Reporting annually and evaluating progress.

Contact

Linda Garczynski
U.S. EPA - OSPS
Phone: 202-260-4039
Facsimile: 202-260-6606

Or, visit the EPA Brownfields Website at:
http://www.epa.gov/brownfields

FACT SHEET

BROWNFIELDS SHOWCASE COMMUNITIES

GOALS:

- Promote environmental protection, economic redevelopment and community revitalization through the assessment, cleanup and sustainable reuse of brownfields.
- Link Federal, State, local and non-governmental action supporting community efforts to restore and reuse brownfields.
- Develop national models demonstrating the positive results of public and private collaboration addressing brownfields challenges.

BACKGROUND:

Brownfields are abandoned, idled or underused industrial and commercial properties where expansion or redevelopment is complicated by real or perceived contamination. EPA initially launched its Brownfields Initiative to empower States, communities, and other stakeholders in economic redevelopment to work together to assess, clean up and sustainably reuse brownfields. Communities have asked for more interaction among all levels of government, the private sector and non-governmental organizations -- the Showcase Communities Project responds to that request.

DESCRIPTION:

A partnership of Federal agencies with interests in brownfields redevelopment has been formed that will offer technical, financial and other assistance to selected communities. These communities will be called Brownfields Showcase Communities and will serve as models demonstrating the benefits of collaborative activity on brownfields. The Federal partners plan to designate ten Brownfields Showcase Communities, distributed across the country, varying by size, resources, and community character.

Interested communities can apply by submitting a short Statement of Interest. The selection criteria will include brownfields potential, community need, local commitment and partnership opportunities. A wide range of resource support will be leveraged -- technical, financial, and staff -- depending on the particular needs of each Showcase Community.

SELECTION PROCESS:

- Phase I- Initial Application and Screening
  - Public Notice: August 20
  - 2-page Statement of Interest: September 19
  - Selection of 30-40 candidate communities October 24

- Phase II- Final Selection
  - Request for 10-page proposal: October 27
  - Proposal Deadline: November 26
  - Selection of 10 Showcase Communities: December 19

CONTACT: Gayle Rice (202) 260-8431 or Sven-Erik Kaiser (202) 260-5138
EPA Office of Solid Waste and Emergency Response
Facsimile: 202-260-6606
Additional information available on the Internet at "www.epa.gov/brownfields"

August 15, 1997

附錄三

United States Environmental Protection Agency | Office of Solid Waste and Emergency Response | OSWER 9355 0-79FS
EPA/540/F/01/009
June 2001

EPA Superfund Post Construction Completion: An Overview

The purpose of this fact sheet is to provide an overview of Superfund Post Construction Completion (PCC), an integral part of the Superfund remedial program. The fact sheet lays out the goal and objectives for Superfund PCC work, describes why this work is important, identifies the activities included under the banner of PCC, and describes the roles and responsibilities of involved parties. The fact sheet addresses these topics at an overview level of detail. Key references and a bibliography are provided for more detailed information. The fact sheet addresses response actions completed under the Superfund program, including response actions completed by Federal facilities under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The activities described in this fact sheet do not address response actions taken under the EPA Brownfields program.

A. OVERVIEW

What is Superfund Post Construction Completion?

Superfund PCC is the name given for several activities generally undertaken at sites following the construction of response actions. These activities include operation and maintenance and long-term response actions (or LTRAs); institutional controls; five-year reviews; optimization of remedies; and deletion from the NPL. The goal of Superfund PCC is to ensure that response actions provide for the long-term protection of human health and the environment. The PCC activities described in this fact sheet contribute toward achieving this goal.

Why is this work important?

As of January 2001, more than 50% of the sites on the Superfund National Priorities List (NPL) were designated construction complete. An additional 400 sites have completed initial stages of remediation, and many of these should achieve construction completion over the next five years. Many of these sites have, or will have, remedies that only allow for restricted future uses due to contamination remaining on-site, with combinations of engineering and institutional controls to limit unacceptable exposures. Also, many of these sites with ground water contamination will require ongoing remediation over many years to

The policies and procedures set forth here are intended as guidance to Agency and other government employees They do not constitute rule-making by the Agency, and may not be relied on to create a substantive or procedural right enforceable by any other person The Government may take action that is at variance with the policies and procedures in this document.

achieve protective cleanup levels. Superfund PCC activities will help ensure that these response actions perform as intended and remain protective of human health and the environment. Finally, EPA, States, potentially responsible parties (PRPs), and other Federal agencies have invested millions of dollars in site characterization, and in the design and implementation of response actions. Superfund PCC activities will help preserve these financial investments.

Who is involved in conducting PCC activities?

Roles and responsibilities for the long-term care of sites following a cleanup are specifically addressed in CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). EPA, States, PRPs, and other Federal agencies all play an integral role in Superfund PCC and should fulfill their respective responsibilities to ensure that response actions remain protective. The primary responsibility for the long-term care of response actions is vested in States for Fund-financed sites, in viable and responsible PRPs where they assume the lead for cleanup, and in other Federal agencies for Federal facility sites. Specific responsibilities for States, PRPs and Federal agencies include operation and maintenance of waste containment structures; operation and maintenance of ground water restoration or containment systems; environmental monitoring; and implementation, oversight and enforcement of institutional controls required to ensure protectiveness. Federal agencies assume additional responsibilities when transferring property to external parties during or after remediation.

EPA's role in PCC also is extensive It may include operating Fund-financed surface and ground water restoration systems for up to ten years (LTRAs); ensuring that operation and maintenance and environmental monitoring is performed; ensuring that institutional controls are implemented and remain effective; evaluating remedy performance and conducting five-year reviews (or reviewing reports and evaluating the protectiveness of response actions when five-year reviews are performed by States or other Federal agencies); and deleting sites from the NPL once all response actions are completed. EPA also has responsibility for evaluating Federal agency demonstrations that a remedial action is "operating properly and successfully" as a precondition to the transfer of Federally-owned property.

Local government officials and citizens living and working near Superfund PCC sites also can play an important role Site managers should notify, and when appropriate involve, local citizens and officials when conducting five-year reviews, when considering changes to response actions, and when deleting sites from the NPL once the remediation process is complete. Local citizens and officials frequently can provide useful information related to the performance of O&M, compliance with physical and institutional controls, and redevelopment activities that might be planned or under consideration These perspectives are valuable when assessing if the remedy is performing as intended, and whether the remedy remains protective.

How do external stakeholders view PCC activities?

External stakeholder interest in PCC issues has been extensive. (Please see the bibliography for a partial listing of recent external stakeholder research reports.) Several external groups have coined the term "stewardship" when referring to the long-term care of sites following remediation. This term has evolved around large and complex Federal facility sites (e.g , DOE installations) but can apply to non-Federal Superfund sites as well. Definitions for stewardship suggested by these groups vary, but generally include the following concepts: site monitoring and maintenance; implementation, monitoring and enforcement of land use controls; environmental monitoring; oversight and enforcement; information collection and dissemination; and periodic evaluation of remediation systems (including the availability of new technology). These groups suggest clear roles and responsibilities and reliable funding as essential components of stewardship.

Other parties, including the EPA Office of Inspector General, the Environmental Law Institute, and Resources For The Future, have reviewed the Agency's performance of PCC activities. This level of interest and review will likely continue as the PCC workload grows.

B. POST CONSTRUCTION COMPLETION ACTIVITIES

As noted, Superfund PCC encompasses a number of related activities including: operation and maintenance of engineered containment remedies as well as ground water and surface water restoration systems (including LTRAs); implementation and management of institutional controls; five-year reviews; optimization of remedies based on actual operating experience; and deletion from the NPL. These PCC activities support four broad objectives:

- Maintain the integrity of Superfund response actions;
- Provide relevant information to stakeholders;
- Ensure the efficiency of post construction operations; and
- Delete sites from the NPL

The following is an overview of the PCC activities presented in this fact sheet, with references and a bibliography for more detailed information.

Operation and Maintenance and Long-term Response Action

Operation and Maintenance. Operation and Maintenance (O&M) are important components of a Superfund response to ensure that the remedy performs as intended. The NCP, Subpart A, section 300.5, defines O&M as the ". . . measures required to maintain the effectiveness of response actions." O&M typically begins after the remedy is determined to be "operational and functional" (see NCP Subpart E, section 435(f)), and may be required indefinitely for remedies that contain waste on-site or include institutional controls. O&M activities include maintaining engineered

containment structures; operating leachate and gas collection systems; operating ground water containment and restoration systems (following the LTRA period for Fund-financed sites with restoration remedies); monitoring to ensure that the remedy is performing as expected and the environment is protected; and maintaining and enforcing institutional controls and access restrictions. See **Highlight 1** for an example.

Under CERCLA and the NCP, performance of O&M generally is the responsibility of the States, PRPs or Federal facilities. EPA is responsible for ensuring that the O&M work is adequately performed. Specific EPA actions may include ensuring that O&M and monitoring reports are submitted through routine oversight, or enforcement when necessary, reviewing reports and evaluating monitoring results; performing on-site inspections and documenting the results. When appropriate, EPA may also troubleshoot problems, and develop or evaluate proposals for additional response actions or adjustments to existing remedies, to achieve objectives, improve performance, or reduce costs

Specific actions and roles and responsibilities are defined in O&M Manuals and O&M Plans. These documents provide technical and administrative details regarding the performance of O&M and should be prepared during remedial design/remedial action for sites requiring O&M. (See the EPA fact sheet *"Operation and Maintenance in the Superfund Program"* for a more detailed summary of the O&M Manual and O&M Plan.)

Highlight 1: Typical O&M Activities for Landfill Caps

- Maintenance of Landfill Cap
  - Mowing
  - Reseeding
  - Ensuring appropriate controls for run off
  - Repairing cracks, animal burrow damage, and areas of settlement and erosion
- Operation and Maintenance of Active Components
  - Leachate collection and treatment system
  - Gas collection and treatment system
- Monitor Land Use Controls
  - Monitor and enforce institutional controls
  - Maintenance of access controls (e.g., security fences)
- Environmental Monitoring
  - Monitoring to ensure that waste in the containment area is not migrating to ground water or affecting the environment

Cap maintenance and land use restrictions generally are required as long as waste remains in place. Active leachate and gas collection and treatment systems could be terminated if measurements indicate the collected gas and leachate can be released directly to the environment.

Long-term Response Action. A variation to EPA's normal oversight role during O&M is LTRA. The NCP, Subpart E, section 300.435, addresses financing of ground water and surface water restoration systems as Fund-financed remedial actions for up to ten years after the remedy becomes operational and functional. (LTRA generally does not apply for sites where the remedial action objective is limited to containment of ground water or surface water contamination.) EPA may assume a direct role in operating the restoration system during the LTRA period, or system operations can be assigned to the State (or to a unit of local government or a political subdivision) with funding provided from the Trust Fund.

When cleanup goals are not achieved upon completion of the ten year LTRA period, the system is transferred to the State for continued O&M, including follow-on monitoring that may be required after cleanup goals have been achieved. EPA should meet with the State one to two years prior to the transfer date to finalize a transfer plan and schedule. EPA and the State should conduct a joint inspection of the system and develop a list of actions that should be completed prior to the transfer. An optimization review (see discussion below) should be considered to ensure that the system is operating effectively and efficiently. Planning for the LTRA transfer can be tied to a five-year review where schedules coincide. A fact sheet summarizing best practice for LTRA transfers is under development.

Ground water remedies generally require active management, and site managers should remain involved in overseeing the performance of these projects during LTRA and O&M. Performance and monitoring data should be maintained to support analysis and decision-making. Specific areas of interest may include ensuring that the public is being protected (e g., the plume capture zone is being maintained), ensuring that restoration of the aquifer is progressing as planned; determining whether there are significant changes to the assumptions that were relied upon when selecting the remedy; and determining when the active portions of the remedy can be terminated The Superfund guidance *"Presumptive Response Strategy and Ex-situ Treatment Technologies for Contaminated Ground Water at CERCLA Sites"* describes a phased approach for ground water restoration which acknowledges the complexities and uncertainties involved with this work. The guidance also describes a number of refinements to enhance system performance that can be considered, depending on site conditions, during LTRA/O&M (see **Highlight 2**).

A useful tool that may help guide ground water restoration projects, and in limited cases other remedies involving O&M, is an "exit strategy." Simply stated, an exit strategy should define the decision criteria (response objectives from the decision document), measurement strategies (sampling locations and frequencies), contingency plans (actions to consider when remediation is not progressing as expected), and roles and responsibilities for determining when a response action is complete (information collection, analysis, and decision-making). Preparation of an exit strategy should be considered for ground water and surface water restoration projects, and for long-term monitoring. The

concept also may be useful for in-situ soil remediation involving soil vapor extraction or bioremediation, and containment remedies that include an active operational component (e.g , leachate and/or gas collection and treatment). Exit strategies should provide for sufficient flexibility to address changing site conditions, and should be reviewed and adjusted, as needed, on a periodic basis.

Highlight 2: Examples of Remedy Refinements for Ground Water Pump/Treat Remedies

- Change the extraction rate in some or all wells
- Cease extraction from some wells
- Initiate "pulsed pumping"
- Add or remove extraction or reinjection wells or drains
- Add or remove monitoring wells
- Refine source control components of the remedy
- Refine enhanced recovery or in-situ degradation components of remedy
- Refine ex-situ treatment components

O&M/LTRA Summary

- Purpose – Actions taken following the construction of a response action to achieve the objectives of the remedy (e.g., achieve cleanup levels in the aquifer; prevent waste migration and exposure; maintain the integrity of the remedy)
- When Implemented – O&M and LTRA begin once a remedy is determined to be "operational and functional" (generally up to one year following the completion of construction), O&M can extend indefinitely; LTRA is limited to Fund-financed surface water and ground water restoration remedies and extends up to 10 years
- Who – States, PRPs and other Federal agencies have responsibility for performing O&M; EPA has the responsibility to ensure that O&M is performed properly, EPA has operational responsibility for Fund-financed surface water and ground water restoration systems during LTRA

Key References for O&M/LTRA:

National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300, Subpart E, section 435(f).

"Operation and Maintenance in the Superfund Program," OSWER 9200.1-37FS, EPA 540-F01-004, May 2001. http://www.epa.gov/superfund/pubs.htm

"Presumptive Response Strategy and Ex-situ Treatment Technologies for Contaminated Ground Water at CERCLA Sites," OSWER 9283.1-12, EPA 540-R-96-023, October 1996.
http://www.epa.gov/superfund/pubs.htm

Institutional Controls

Institutional controls (also called land use controls, and activity and use restrictions) are non-engineered, administrative or legal instruments that minimize the potential for exposure to contamination by limiting land or resource use. Institutional controls can play an important role in remedy selection, and generally are used in conjunction with, rather than in lieu of, engineering measures for treatment or containment. Institutional controls can be used during all stages of a cleanup to accomplish various objectives. They are intended to minimize potential exposure when contamination remaining on-site restricts the unimpeded use of a site or a ground water aquifer. Institutional controls also can be used to ensure that engineered remedies are not adversely affected by activities at the site. Examples of institutional controls include "proprietary controls" (e.g., easements and restrictive covenants), "governmental controls" (e.g., zoning restrictions, special permit requirements), "informational devices" (e.g., State registries of contaminated property, deed notices, advisories), and "enforcement controls" (e.g., orders and consent decrees issued under CERCLA). Estimates suggest more than 600 Superfund NPL sites, as of January 2001, include one or more institutional controls as part of the remedy to help ensure protectiveness. Generally, institutional controls selected as part of a remedy should be implemented along with other components of the remedy before Superfund sites can be deleted from the NPL

The fact sheet *"Institutional Controls: A Site Managers Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups"* provides useful guidance when considering institutional controls as part of response actions. This guidance is intended to address concerns with institutional controls frequently raised by external parties. These include unclear legal authorities; unclear roles and responsibilities to implement, monitor, and enforce the controls; and uncertainty regarding the potential to modify or remove controls over time. When selecting institutional controls, the site manager should evaluate the situation at the site, define the needs that the institutional controls are intended to address, identify the kinds of legal and other tools available to meet those needs, and coordinate with the appropriate stakeholders (e.g., State and local government officials).

Implementation of institutional controls frequently lags behind the completion of physical construction. In the PCC time frame, site managers should ensure that appropriate measures are taken by States, PRPs and other Federal agencies to implement and maintain the institutional controls. Once institutional controls are in place, site managers should evaluate the administrative and legal documentation, as well as the physical site evidence, to ensure that they are fully effective. This review should be an integral part of the technical assessment performed during operation and maintenance inspections, as well as during

the five-year review process. EPA is developing additional guidance and piloting a tracking system to aid in the implementation and long-term management of institutional controls.

Institutional Controls Summary

- Purpose – To prevent exposure to contamination left on a site following cleanup; to prevent exposure to contamination until cleanup standards are met (e.g., ground water restoration); to protect components of the remedy
- When – Implemented during or immediately following remedy implementation consistent with the requirements of the decision document; maintained as long as needed to minimize/control/mitigate exposure or protect the remedy
- Who – Determined on a site-specific basis; site managers should work closely with States, PRPs, other Federal agencies, and local governments as appropriate and seek advance written agreements on who will implement, maintain, and enforce institutional controls

Key References for Institutional Controls:

National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300, Subpart E, sections 430 and 510.

"Institutional Controls: A Site Managers Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups," OSWER 9355.0-74FS-P, EPA 540-F-00-005, September 2000. http://www.epa.gov/superfund/pubs.htm

"Institutional Controls: A Site Managers Guide to Implementing, Monitoring and Enforcing Institutional Controls at Superfund and RCRA Corrective Action Cleanups" (Guidance under development, should be available during 2002 at http://www.epa.gov/superfund/pubs.htm)

Five-year Reviews

Five-year reviews generally are required following implementation of remedial actions selected under section 121 of CERCLA, when hazardous substances, pollutants, or contaminants remain on-site above levels that allow for unlimited use and unrestricted exposure. In addition, five-year reviews generally are appropriate for sites where completion of the remedial action ultimately will allow for unlimited use and unrestricted exposure, but the remedy will take longer than five years to reach cleanup levels. The purpose of a five-year review is to evaluate the implementation and performance of a remedy in order to determine if the remedy remains protective of human health and the environment. Five-year reviews provide an opportunity to identify potential problems or issues with the remedial action, and adjust O&M where necessary. Five-year reviews are required at more than 800 NPL sites as of January 2001.

EPA expects to release the *"Comprehensive Five-year Review Guidance"* during FY 2001. This document describes the

requirements, roles and responsibilities, and procedures for conducting five-year reviews. EPA typically has the responsibility for conducting five-year reviews for Fund-financed and enforcement-lead NPL sites, while other Federal agencies have responsibility for conducting reviews at Federal facility sites. Through cooperative agreements, EPA can provide funding to a State or Tribe to conduct five-year reviews. Also, EPA can authorize PRPs to conduct studies or investigations in support of a five-year review even though PRPs do not conduct actual reviews. In all cases, EPA retains the responsibility for making the protectiveness determination that is part of the review

Determining remedy protectiveness for a five-year review involves examining three questions:

- Is the remedy functioning as intended by the decision document?
- Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy still valid?
- Has any other information come to light that could call into question the protectiveness of the remedy?

Answers to these questions can be determined through visual observation during site visits; interviews with site stakeholders, and local citizens and officials; review/evaluation of response decision documents and existing O&M and monitoring information; and, when necessary, collection of new data. Findings of the review are documented in a report which should include an identification of issues; recommendations and follow-up actions; and a determination of whether the remedy is, or is expected to be, protective of human health and the environment. The report should identify the party responsible for implementing recommendations and follow-up actions, when needed, as well as a timetable for completion. Once completed, the five-year review report should be made available to the public. Completion of the five-year review should be straightforward when site managers are actively involved in managing LTRAs, overseeing O&M and environmental monitoring, and ensuring institutional controls are implemented and effective.

Priorities for EPA include completing five-year reviews on time, eliminating a backlog of overdue reviews by the end of FY 2002, and improving the quality of reviews and the resulting reports through implementation of the comprehensive guidance, and through training provided to site managers. The program completed more than 665 reviews through September 2000, and more than 180 reviews were completed during FY 2000. Between 140 and 180 reviews per year are scheduled over the next several years.

Five-year Review Summary

- Purpose – To evaluate the implementation and performance of a remedy to determine whether the remedy remains protective of human health and the environment

- When Implemented – Generally five years following the initiation of a CERCLA section 121 response action resulting in contamination remaining on-site after a cleanup that restricts future uses, and every succeeding five years so long as future uses remain restricted; generally five years after the date of construction completion for sites where completion of the CERCLA Section 121 response action ultimately will allow for unlimited use and unrestricted exposure but the remedy will take longer than five years to reach cleanup levels

- Who – EPA or States/Tribes when acting as lead agency under the NCP; Federal agencies for Federal facility NPL sites; EPA retains responsibility for protectiveness determination

Key References for Five-year Review:

National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300, Subpart E, section 430(f)

"Comprehensive Five-year Review Guidance", OSWER Directive 9355 7-03B-P, EPA 540R-98-050. Pending, should be available during FY 2001 at http://www.epa.gov/superfund/pubs.htm

Optimization of Remediation Systems

Once remediation systems have been functioning for a period of time, opportunities may exist to optimize the operations of the system The purpose of optimization is to identify potential changes that will improve the effectiveness of the system and/or reduce operating costs, without compromising the protectiveness of the remedy or other response objectives, through a comprehensive evaluation of system performance. Optimization recognizes that long-term remedial approaches should not remain static, that conditions change over time, and that better technologies, tools and strategies evolve which allow for continuous improvement of remedy performance.

Optimization can be applied to ground water restoration systems, as well as other remediation technologies (e.g., soil vapor extraction) and approaches (e.g., long-term monitoring). Optimization generally follows three steps: reviewing candidates and selecting sites; conducting the evaluation using an optimization protocol; evaluating results and implementing the best recommendations. Implementation may require an initial capital investment in order to realize long-term improvements and/or cost savings. Optimization techniques can be applied to ongoing response actions by EPA, States, PRPs, and other Federal agencies. The entity conducting the review should coordinate the recommended changes to the remediation system with appropriate parties (e.g., States) and obtain EPA approval, where appropriate, prior to implementation.

EPA will complete up to 20 pilot optimization studies of Fund-financed ground water restoration systems during FY 2001 The purpose of this initiative is to optimize the performance of the selected remedies, and increase awareness among EPA site managers so that optimization becomes integrated into the cleanup process.

These pilots will use the "Remedial Systems Evaluation" (RSE) approach developed by the U.S. Army Corps of Engineers. An RSE involves an independent team of experts working collaboratively with the site manager and the operating contractor to evaluate the performance of all major components of the operating system (e.g., above ground treatment system, extraction well network, monitoring network and sampling protocols, and data management). An RSE generally includes a review of site data, a site visit, and report preparation. It provides a comprehensive but low-cost evaluation of the remediation system and is an excellent first step in a continuous improvement process. Recommendations can highlight the need for additional information, propose revisions to the extraction system (e.g., well locations and/or depths, pumping rates), and/or modifications to the treatment process.

EPA site managers are encouraged to review other Fund-financed ground water restoration projects not addressed by the pilot, and consider proposals for optimization by external parties, where the potential exists to improve performance and/or reduce operating costs. Additional information on optimization and the RSE methodology is available at the web site noted below.

Optimization Summary

- Purpose – To improve the performance and/or reduce the operating costs of remediation systems without compromising protectiveness
- When Implemented – Once actual performance and cost data are available
- Who – Optimization studies can be initiated by EPA at Fund-financed sites, or by States, PRPs, or other Federal agencies for sites under their lead; recommendations should be reviewed and approved by EPA, in coordination with the State, prior to implementation

Key References for Optimization:

OERR Memorandum "Superfund Reform Strategy, Implementation Memorandum: Optimization of Fund-lead Ground Water Pump and Treat (P&T) Systems", OSWER Directive 9283.1-13, October 31, 2000. http://www.epa.gov/superfund/pubs.htm

Optimization Web site: http://www.frtr.gov/optimization

Deletion from the NPL

EPA can delete sites from the NPL once all response actions are complete and all cleanup levels achieved. Procedures for deleting sites are contained in the NCP, Subpart E, section 300.425, and *"Closeout*

Procedures for National Priorities List Sites." In making a determination to delete a site from the NPL, EPA must consider whether any of the following criteria have been met:

- Responsible or other parties have implemented all appropriate response actions required;
- All appropriate Fund-financed response under CERCLA has been implemented, and no further response action by responsible parties is appropriate, or
- The remedial investigation has shown that the release poses no threat to public health or the environment, and, therefore, taking of remedial measures is not appropriate.

EPA should consult with the State when making this determination.

Under Agency policy as described in *"Closeout Procedures for National Priorities List Sites,"* site deletion has been separated from the five-year review process. This means that EPA can delete a site from the NPL even when five-year reviews are required. Deletion from the NPL does not preclude eligibility for subsequent response actions. If future site conditions warrant, response actions can be taken by the PRPs, or using the Trust Fund. If there is a significant release from a site deleted from the NPL, the site may be restored to the NPL without calculating a new hazard-ranking score.

EPA also has the ability to delete portions of NPL sites. The Agency may use partial deletions to designate uncontaminated areas of a site, or when portions of a site are cleaned up and potentially available for productive use. Requirements for partial deletion are essentially the same as those noted above for a full deletion. Procedurally, partial deletions require clear documentation that supports the decision and mapping of the portion to be deleted. These are defined in *"Closeout Procedures for National Priorities List Sites."*

EPA has released guidance to streamline and accelerate the deletion process. The *"Direct Final Process for Deletions"* guidance is appropriate for sites where deletion or partial deletion from the NPL is not expected to be controversial, and the Agency does not expect adverse comments from the public. The direct-final process has been used successfully at several sites, and the guidance includes approved templates to aid in developing the required notices.

As of January 1, 2001, EPA had deleted 230 sites from the NPL, and completed 21 partial deletions. Expeditious deletion of sites is a program emphasis During FY 2001 and beyond, EPA's goal is to delete 30 sites per year

Deletion Summary

- Purpose – To provide notice and take comments on EPA's decision to remove sites from the NPL
- When – No further CERCLA response is appropriate
- Who – EPA has the responsibility for deletions with State concurrence

Key References for Deletion:

National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300, Section 425(e)

"Closeout Procedures for National Priorities List Sites", OSWER Directive 9320.2-09A-P, EPA 540-R-98-016, January 2000. http://www.epa.gov/superfund/pubs.htm

"Direct Final Process for Deletions", OSWER Directive 9320.2-12-FS-P, October 31, 2000. http://www.epa.gov/superfund/pubs.htm

C. ADDITIONAL INFORMATION

Copies of this document are available at the Superfund web site, http://www.epa.gov/superfund/pubs/htm. Copies of this document may also be obtained from the OERR Document Center (703) 603-9232. General Questions regarding this topic should be referred to the Call Center at 1-800-424-9346. The subject matter specialist for this document is Paul Nadeau of OERR.

D. BIBLIOGRAPHY

"Remedial Design/Remedial Action Handbook", OSWER Directive 9355.0-04B, EPA 540/R-95/059, PB95-963307, June 1995, (OERR Document Center).

"Guidance for Evaluating the Technical Impracticability of Ground Water Restoration", OSWER 9234.2-25, EPA/540-R-93-080, PB93-963507, September 1993. http://www.epa.gov/superfund/resources/gwdocs/monit.htm

"Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites", OSWER Directive 9200.4-17P, April 21, 1999. http://www.epa.gov/superfund/resources/gwdocs/tec_imp.htm

"A Guide to Developing and Documenting Cost Estimates During the Feasibility Study", EPA 540-R-00-002, OSWER 9355.0-75, July 2000. http://www.epa.gov/superfund/pubs.htm

"Institutional Controls and Transfer of Real Property Under CERCLA Section 120 (h)(3)(A), (B) or (C)", February 2000. http://www.epa.gov/swer/ffrr/guide.htm

"Guidance for Evaluation of Federal Agency Determinations that Remedial Actions are Operating Properly and Successfully Under CERCLA Section 120(h)(3)", (Interim), August 1996. (http://www.epa.gov/swer/ffrr/guide.htm).

Memorandum, "Joint DOE/EPA Interim Policy Statement on Leasing Under the Hall Amendment", June 23 and June 30, 1998. http://www.epa.gov/swer/ffrr/guide.htm

"Institutional Controls: A Reference Manual", Work Group Draft, US EPA, March 1998

"Backlog of Five-year Review Reports Increased Nearly Threefold", US EPA Office of Inspector General Audit Report, 1999-P-218, September 30, 1999. http://www.epa.gov/oigearth/eroom.htm

DOD Memorandum "Responsibility for Additional Environmental Cleanup after Transfer of Real Property", July 25, 1997. http://www.dtic.mil/environdod/publish.htm

DUSD(ES/CL) Memorandum "Policy on Land Use Controls Associated with Environmental Restoration Activities", Jan 17, 2001. http://www.dtic.mil/environdod/publish.htm

DUSD(ES/CL) Memorandum "Guidance on Land Use Control Agreements with Regulatory Agencies, Mar 2, 2001 http://www.dtic.mil/environdod/publish.htm

"The Environmental Site Closeout Process Guide", September 1999 (available from www.afbca.hq.af.mil/closeout/

DOE Memorandum "Long-term Stewardship Responsibility" January 19, 2001. http://lts.apps.em.doe.gov/center

"A Report To Congress on Long-Term Stewardship" Volume 1 and 2, DOE/EM-0563, January 2001. http://lts.apps.em.doe.gov/center

DOE Guidance "Long-ter Stewardship Implementation Plan Guidance", Draft January , 2001 http://lts.apps.em.doe.gov/center

"Standard Guide for the Use of Activity and Use Limitations, Including Institutional and Engineering Controls", ASTM Standard Guide, Designation: E 2091-00. www.astm.org

"Rolling Stewardship: Beyond Institutional Controls, Preparing Future Generations for Long-Term Environmental Cleanups", National Environmental Policy Institute, December 1999. www.nepi org

"Protecting Public Health at Superfund Sites, Can Institutional Controls Meet the Challenge", Environmental Law Institute, ELI Doc #d10.01, 2000. www.eli org

"Long-Term Institutional Management of US Department of Energy Legacy Waste Sites", National Research Council, August 2000. www.national-academies.org

"Long-Term Stewardship and the Nuclear Weapons Complex: The Challenge Ahead", Resources for the Future, June 1998. www.rff.org

"Linking Land Use and Superfund Cleanups: Unchartered Territory", Resources for the Future, June 1997. www.rff.org

"Long-Term Stewardship of Contaminated Sites, Trust Funds as Mechanisms for Financing and Oversight", Resources for the Future, December 2000. www.rff org

"Beyond Fences, Brownfields and the Challenges of Land Use Controls", No. 42495, International City/County Management Association. www.icma.org

附錄四

Frequently Asked Questions about Waste

General Questions

- What is RCRA and what does it regulate?
- How can I report environmental problems with waste management?

Hazardous Waste Questions

- What is a RCRA hazardous waste?
- How much hazardous waste is generated each year in the United States?
- How are hazardous waste laws enforced?
- What types of businesses generate hazardous waste?
- Who is regulated by the RCRA hazardous waste program?
- How should household hazardous waste (e g ,paint, paint thinner, batteries, used oil) be disposed?
- What are the safe alternatives to hazardous materials for home use (e g , lawn products)?

Solid Waste Questions

- What is a RCRA solid waste?
- How much municipal solid waste is generated each year in the United States?
- Who regulates landfills that accept municipal garbage? Can these municipal landfills accept hazardous waste?
- What are the benefits of recycling? Are there environmental and/or financial benefits that encourage recycling?
- What new products come from recycled products? What is the process?
- Does the recycling process make more pollution?
- How do we get more people to recycle?

General Answers

What is RCRA and what does it regulate?
RCRA is the Resource Conservation and Recovery Act, which was enacted by Congress in 1976 RCRA's primary goals are to protect human health and the environment from the potential hazards of waste disposal, to conserve energy and natural resources, to reduce the amount of waste generated, and to ensure that wastes are managed in an environmentally sound manner RCRA regulates the management of solid waste (e g , garbage), hazardous waste, and underground storage tanks holding petroleum products or certain chemicals

How can I report environmental problems with waste management?
The public may discuss environmental problems and concerns over waste management with their local or state government waste management division Another resource for solid and hazardous waste issues is your EPA Regional office Contacts can be found on our regional page

---

Hazardous Waste Answers

What is a RCRA hazardous waste?
Wastes that exhibit certain characteristics may be regulated by RCRA A waste may be considered hazardous if it is ignitable (i e , burns readily), corrosive, or reactive (e g , explosive) A wastes may also be considered hazardous if it contains certain amounts of toxic chemicals In addition to these characteristic wastes, EPA has also developed a list of over 500 specific hazardous wastes Hazardous waste takes many physical forms and may be solid, semi-solid, or even liquid

How much hazardous waste is generated each year in the United States?
In 1999, over 20,000 hazardous waste generators produced over 40 million tons of hazardous waste regulated by RCRA

How are hazardous waste laws enforced?
In any given state, EPA or a state hazardous waste agency enforces the hazardous waste laws EPA encourages states to assume primary responsibility for implementing the hazardous waste program through state adoption, authorization, and implementation of the regulations

What types of businesses generate hazardous waste?
Many types of businesses generate hazardous waste Some are small companies that may be located in your community For example, the following types of businesses typically generate hazardous waste dry cleaners, auto repair shops, hospitals, exterminators, and photo processing centers Some hazardous waste generators are larger companies like chemical manufacturers, electroplating companies, and petroleum refineries

Who is regulated by the RCRA hazardous waste program?
The RCRA hazardous waste program regulates commercial businesses as well as federal, state and local government facilities that generate, transport, treat, store, or dispose of hazardous waste Each of these entities is regulated to ensure proper management of hazardous waste from the moment it is generated until its ultimate disposal or destruction

How should household hazardous waste (e.g., paint, paint thinner, batteries, used oil) be disposed?
Hazardous wastes that are generated in the home, like mineral spirits and old paint, are not regulated by the federal RCRA program Many communities provide collection centers or pick-up services for the management of household hazardous waste Local recycling centers or fire departments may be able to provide more information about locations and details

What are the safe alternatives to hazardous materials for home use (e.g., lawn products?
Homeowners can use products that are nonhazardous or less hazardous and should use only the amount needed for a project Leftover materials can be shared with neighbors, donated to a business charity or government agency, or given to a household hazardous waste program Information on proper use of home and garden chemicals as well as safer alternatives can be found at EPA's Office of Prevention, Pesticides, and Toxic Substances Web site for concerned citizens

---

Solid Waste Answers

What is a RCRA solid waste?
According to the EPA regulations, solid waste means any garbage, or refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution

control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities

How much municipal solid waste is generated each year in the United States?
In 1998, approximately 220 million tons of municipal solid waste or garbage was generated in the United States This means each person generated an average of 4 46 pounds of solid waste per day

Who regulates landfills that accept municipal garbage? Can these municipal landfills accept hazardous waste? Landfills that collect household garbage are predominately regulated by State and local governments EPA has, however, established minimum criteria that these landfills must meet in order to stay open The only hazardous waste that municipal landfills can accept is household hazardous waste and waste that is exempt from hazardous waste regulation

What are the benefits of recycling? Are there environmental and/or financial benefits that encourage recycling?
Recycling prevents the emissions of many greenhouse gases and water pollutants, saves energy, supplies valuable raw materials to industry, creates jobs, stimulates the development of greener technologies, conserves resources for future generations, and reduces the need for new landfills and combustors

What new products come from recycled products? What is the process?
Recycling creates new products such as aluminum cans, newspapers, cereal boxes, paper towels, egg cartons, carpeting, motor oil, car bumpers, nails, trash bags, glass containers, comic books, and laundry detergent bottles Steps in the recycling process include collecting the recyclable components of municipal solid waste, separating materials by type, processing them into reusable forms, and purchasing and using the goods made with reprocessed materials

Does the recycling process make more pollution?
Using recovered material generates less solid waste Recycling helps to reduce the pollution caused by the extraction and processing of virgin materials Also, when products are made using recovered rather than virgin materials, less energy is used during manufacturing and fewer pollutants are emitted

How do we get more people to recycle?
Educating the public about the benefits of recycling and/or providing economic incentives will get more people involved in recycling

Home
Background
Environ. Indicators
Cleanup Reforms
Success Stories
Facility Information
References
Public Involvement
Training
Meetings
Contacts

Background

What is RCRA?

RCRA is the Resource Conservation and Recovery Act, which was enacted by Congres RCRA's primary goals are to protect human health and the environment from the potent waste disposal, to conserve energy and natural resources, to reduce the amount of was and to ensure that wastes are managed in an environmentally sound manner

For a more in-depth overview of RCRA and its programs, see the RCRA Orientation Ma

Back to Top

What are the Office of Solid Waste's Cleanup Responsibilities?

OSW is responsible for both ensuring that currently generated solid waste (hazardous a nonhazardous waste) is managed properly, and that currently operating management fa address any contaminant releases from their operations To ensure that currently gener are properly managed, Congress passed the Resource Conservation and Recovery Act 1976 Congress amended RCRA in 1984 with the Hazardous and Solid Waste Amendm to require the cleanup of contamination in the environment from improper waste manag practices prior to the passage of RCRA and from potential future releases HSWA requi responsible parties that are seeking a permit to treat, store, or dispose of hazardous wa clean up environmental contaminants at their sites regardless of the time of the release at TSD facilities is termed **RCRA Corrective Action**

Back to Top

What is the Corrective Action Program?

Accidents or other activities at RCRA facilities (or TSDFs) have sometimes released ha pollutants into soil, ground water, surface water, and air The Corrective Action Program RCRA facilities to address the investigation and cleanup of these hazardous releases th There are approximately 3700 facilities that are in the corrective action workload. The d investigation and subsequent Corrective Action necessary to protect human health and t

environment varies significantly among facilities When EPA determines that state progr equivalent to the federal RCRA program, the corrective action program is delegated to t this time 33 states are authorized to run their own Corrective Action Program The curre state authorization for Corrective Action is mapped here - *(Adobe Acrobat PDF* file)*

Back to Top

How is Corrective Action different from the Superfund Program?

OSW's hazardous waste cleanup program, referred to as the Corrective Action Program than Superfund because it deals with sites that have viable operators and on-going oper Superfund was primarily designed to remedy the mistakes in hazardous waste manage the past at sites that have been abandoned or where a sole responsible party cannot be Cleanup at Superfund sites is primarily paid for by the Superfund Trust Fund with mone mainly from taxes on the chemical and petroleum industries The Corrective Action Prog encompasses active, or soon to be active facilities, that are permitted or seek a permit t or dispose of hazardous waste As a condition for obtaining a RCRA operating permit, t facilities are required to clean up contaminants that are released or have been released RCRA facilities must pay for the cleanup at their site For more information see the **Sup Program web site**

Back to Top

How does a facility enter into Corrective Action?

One of the keys to understanding the RCRA Corrective Action Program is knowing how becomes subject to Corrective Action There are three primary ways a Treatment, Stora Disposal Facility becomes subject to the Corrective Action process

1 A TSD facility that is seeking a permit to operate must ensure, through the Corre process, that there are no unacceptable releases from past waste management
2 EPA may issue an *enforcement order*, because of high priority contaminant relea a facility seeking a permit to implement Corrective Action
3 A facility owner/operator may volunteer to perform Corrective Action by entering with EPA in order to expedite the process

In addition, accidental releases from facility operations are addressed by Corrective Acti

Back to Top

What are the RCRA Cleanup Reforms?

Since 1984, EPA and authorized states have made considerable progress in implementi Corrective Action requirements Despite the progress made, states, environmental grou regulated community have raised concerns, including slow progress in achieving clean environmental results, an emphasis on process and reports over actual work in the field impractical or overly conservative cleanup goals, and lack of meaningful public participa

Because of various reasons raised by many stakeholders, the Agency believes that it is fundamental re-evaluation of its Corrective Action Program This re-evaluation comes in the RCRA Cleanup Reforms For more information on RCRA Cleanup Reforms see the Cleanup Reforms - (Adobe Acrobat PDF*[28KB] file) || ASCII text file

Back to Top

What are Environmental Indicators?

While the ultimate goal of RCRA Corrective Action is to achieve final cleanups, we mea near-term success of the program and reforms against the Government Performance a (GPRA) goals and annual cleanup targets for getting current human exposures controlle migration of contaminated groundwater under control to minimize risk Measuring and r progress toward these goals will be a top priority for EPA and the States over the next s

The two corrective action Environmental Indicators, Current Human Exposures Under C Migration of Contaminated Groundwater Under Control, are measures of program progr being used to meet the goals set under the (GPRA). New EI guidance was issued in Fe and describes how EPA and the States should determine if these measures have been here to view new guidance (PDF format [52KB])] These Environmental Indicators are d facility decision makers by clearly showing where risk reduction is necessary, thereby he regulators and facility owner/operators reach agreement earlier on stabilization measure remedies that must be implemented Focusing on the Environmental Indicators should a reduce delays in the review of cleanup work plans and allow owner/operators and regul concentrate on those problems that potentially pose significant risks

Back to Top

What is the RCRA Cleanup Baseline?

EPA developed the RCRA Cleanup Baseline in conjunction with the states as a result of the Government Performance & Results Act (GPRA) requiring EPA to measure and trac progress There are 1714 facilities on the RCRA Cleanup Baseline

The two near-term measures of progress in the RCRA Corrective Action Program are k Environmental Indicators The Environmental Indicators for the RCRA Corrective Action "migration of contaminated groundwater under control" and "current human exposures u

Most of the 1714 facilities were identified in the early 1990's when EPA and the states w their corrective action workload, and were identified as facilities where early cleanup pro be appropriate Today, many of these facilities have already made progress in their clea Some of these facilities have met the environmental indicator measures, and at some of facilities cleanup is complete Many of the facilities that have not yet met the environme measures have still made substantial progress by stabilizing problems or in some cases final remedies Approximately 35% of the 1,714 facilities have not yet been assessed by states for EI determinations When assessed, it may be determined that some facilities meet EI measures At other facilities, corrective action has either not begun or is procee varying rates [click here to view the RCRA Cleanup Baseline] - (Adobe Acrobat PDF file

Note that there is a lag time (about 2-3 months) between the time Environmental Indicat certified as achieved at a facility and when that information becomes publicly available v website For more information on the cleanup status of an individual facility, please refer and State contact list (Hot link to contact list)

The company names found on the list are the current facility owners There may be com this baseline that are the current property owner but did not cause the contamination T be cases where the former owners have entered an agreement to be responsible for the Unfortunately, this database is unable to track and identify these instances

Back to Top

Which facilities have Environmental Indicator determinations?

Meeting the corrective action GPRA goals is the highest priority of the national RCRA pr are using two Environmental Indicators to measure near-term program performance an these goals The environmental indicators are the "migration of contaminated groundwa control" and "current human exposures under control "

Verifying that "exposures are controlled" and "groundwater releases are controlled" are i

measures that can be achieved in a variety of ways, such as by stabilizing the source of contamination (for instance, capping soil contamination with a thick layer of clay) or by i final cleanup remedy for the problem Achieving these measures is an important cleanu for each facility However, there still may be additional work necessary to complete final Facilities are expected to continue stabilization and cleanup activities until they meet the objectives for the facility To meet an EI determination means that there are no unaccep pathways of exposure or contamination at the facility This list of facilities shows those o Cleanup Baseline that have met both EIs [click here to view list of Baseline Facilities wit Determinations]

Back to Top

Who can I contact to get facility specific information?

The Contacts for Facility Specific Information provides a list by region of individuals and numbers to contact if you have facility-specific questions For general questions about t Cleanup Reforms, please contact the RCRA Hotline at 1(800)424-9346

Back to Top

How is Corrective Action enforced?

The National Hazardous Waste Enforcement Program is managed by EPA's Office of E and Compliance Assurance

Back to Top

How can the public be involved in Corrective Action?

Public participation plays an integral role in all RCRA programs, including Corrective Act RCRA Public Participation Manual provides a clear description of the many public partici activities that are required by federal regulations as well as pointing out steps you or you can take to provide more public input into the process

Back to Top

What other Waste Cleanup efforts exist in EPA?

In addition to OSW's waste clean up efforts, you may wish to investigate the following w programs throughout EPA

Underground Storage Tanks: Cleaning Up UST Releases EPA has been tasked with programs that would prevent, detect, and clean up releases from underground storage t EPA regulations require UST owners and operators to respond to a release by reporting its source, mitigating fire and safety hazards, investigating the extent of the contaminati cleaning up soil and ground water as needed to protect human health and the environm

Oil Spills: Despite the nation's best efforts to prevent spills, almost 14,000 oil spills are year, mobilizing thousands of specially trained emergency response personnel and chall best-laid contingency plans Although many spills are contained and cleaned up by the p responsible for the spill, some spills require assistance from local and state agencies, a occasionally, the federal government EPA is the lead federal response agency for oil sp in inland waters, and the U S Coast Guard is the lead response agency for spills in coa and deep water ports

The Cleanup of Federal Facilities: Federal Facilities Restoration and Reuse Across t thousands of federal facilities are contaminated with hazardous waste, unexploded ordn

radioactive waste, fuels, and a variety of other toxic contaminants These facilities includ different types of sites, such as abandoned mines, nuclear weapons production plants, f distribution areas, and landfills To overcome the difficulties posed by contamination at f facilities, EPA's Federal Facilities Restoration and Reuse Office (FFRRO) works with Do other federal entities to help them develop creative, cost-effective solutions to their envir problems FFRRO's overall mission is to facilitate faster, more effective, and less costly reuse of federal facilities

Hazardous Waste Cleanup Information Web Site: Technology Innovation Office The Waste Cleanup Information Web Site is intended as a forum for anyone interested in wa (remediation) and contains information on policies, programs, organizations, publication databases useful to regulators, consulting engineers, technology developers, researche remediation contractors The site contains technology descriptions and reports as well a news on business aspects of waste site remediation (clean up) and links to other sites i managers interested in site characterization and soil and ground water remediation tech

Back to Top

URL http //www epa gov/epaoswer/hazwaste/ca/backgnd htm
This page was last updated August 10, 2000

EPA Home | OSWER Home | OSW Home | RCRA Hotline | Search EPA

Search OSW

Go

Managing Waste
Frequently Asked Questions
Reduce Reuse and Recycle
Generate and Transport
Treat Store and Dispose
Cleanup

Visitor Center

EPA Regions States and Tribes

Laws Regulations and Policies

Visitor Survey

BOBBY 3.2 APPROVED

EPA United States Environmental Protection Agency

Office of Solid Waste

What's New | Topics | RCRA Online | Publications | Other Resources | Contact Us

Electronics A New Opportunity for Waste Prevention, Reuse and Recycling
Adobe Acrobat PDF File [987 KB]

Industrial and Special Waste

- Batteries
- Cement Kiln Dust
- Crude Oil & Natural Gas
- Fossil Fuels
- Industrial Waste
- Medical Waste
- Mining Waste
- Universal Waste
- Used Oil

Municipal Solid Waste

- Basic Facts
- Climate Change
- Composting
- Comprehensive Procurement Guidelines
- Disposal
- Full Cost Accounting
- Household Hazardous Waste
- Jobs Through Recycling
- Landfills
- Pay-As-You-Throw
- Product Stewardship formerly EPR
- Program Information
- Recycling
- Source Reduction
- WasteWise

Hazardous Waste

- Combustion
- Corrective Action
- Data
- Definition of Solid Waste
- Generators
- Land Disposal Restrictions
- Manifest
- Permitting
- Radioactive Mixed Waste
- Recycling Hazardous Waste
- State Authorization
- Test Methods
- Waste Identification
- Waste Minimization

EPA Home | OSWER Home | About OSW | RCRA Call Center | Search EPA

URL http //www epa gov/epaoswer/osw/index htm
Last Modified Friday, July 20, 2001 09 45 56

Visitor Center

The OSW Visitor Center is designed to allow the general public to quickly access information that is important to them.

In addition to the links suggested on this page, you may also find it useful to visit the OSW topics page. The topics portion of the OSW web site allows users to find information by scrolling through an alphabetized keyword list. Additional resources that may be of interest to non-technical users are located at the bottom of this page.

- Concerned Citizens
  --Environmental Justice
- Small Business
- Students and Teachers
- Kids

Additional Resources:

Commonly used environmental terms, acronyms, and abbreviations.

- Abbreviations and acronyms commonly used by OSW
- EPA's terms of the environment

Statistical information and data.

- OSW Software and Databases
  This Web page provides links to various software and databases developed by the Office of Solid Waste.
- Envirofacts Warehouse
  Provides users with direct access to environmental information contained in various EPA databases including hazardous waste, Superfund information, toxic releases, facility information, risk management plans, grants/funding, water permits, and drinking water contaminant occurrence.
- Enviromapper
  Allows users to map various types of environmental information, including hazardous waste, water discharge permits, toxic and air releases, watersheds, and Superfund sites. Enviromapper can also be used to spatially view environmental statistics, profiles, and trends.
- The 1997 National Biennial RCRA Hazardous Waste Report
  Presents a detailed overview of waste handling practices throughout the United States, including information on the quantity of waste generated, managed,

shipped, and received by treatment, storage, and disposal facilities The report also provides information on waste imported and exported between States and identifies every hazardous waste generator in the country (reported to be a large quantity generator) and every treatment, storage, or disposal facility. Users may also directly query the 1997 RCRA hazardous waste data files.

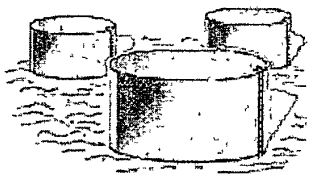
- Facts about municipal solid waste and recycling
  Presents information, data, and trends concerning solid waste generation in the United States and recycling rates.

- Window to My Environment
  Allows users to easily access comprehensive information about air, land, and water by entering a zip code. The "window" integrates environmental data with local geographical features by pulling together information from several EPA databases.

EPA Home | OSWER Home | About OSW | RCRA Hotline | Search EPA

URL http //www epa gov/epaoswer/osw/visitor htm
Last Modified Tuesday, July 03, 2001 12 13 39

Treat, Store, and Dispose of Waste



Background

Hazardous waste treatment, storage, and disposal activities are controlled by state and federal requirements Most municipal waste (garbage) is managed in accordance with state requirements that meet federal municipal waste standards Waste primarily falls into two catagories hazardous waste, and nonhazardous waste (or municipal solid waste) Waste that does not fall into these two catagories is called special or other waste Because hazardous waste poses a greater potential environmental threat, it is managed more strictly than municipal waste Like municipal waste, most hazardous waste is managed in accordance with state requirements that meet federal hazardous waste standards Operating permits are required for the treatment, storage, or disposal of hazardous waste Other information on municipal or hazardous waste can be found in Laws and Regulations The definitions used on this page are not strict regulatory definitions, but more basic explanations of the terms For more information on regulatory definitions please see section 260 10 in 40 CFR 260 of the Federal Hazardous Waste Standards

1995-96 Treatment, Storage, and Disposal Facts

- 208 million tons of municipal solid waste were generated in the United States in 1996 Of the municipal solid waste generated, 56 million tons (27 percent) were recovered by recycling or composting, 33 5 million tons (16 percent) were combusted at high temperatures, and 118 5 million tons (57 percent) were landfilled
- 214 million tons of hazardous waste was generated in the United States in 1995 Wastewater accounted for 202 million tons (97 percent) of the generated hazardous waste
- 1,983 RCRA treatment, storage, and disposal facilities managed 208 million tons of hazardous waste The remaining 6 million tons of hazardous waste was managed in facilities exempt from RCRA, but subjected to other controls such as the National Pollution Discharge Elimination System
- the majority (143 million tons, 68 percent) of the hazardous waste was managed in waste water treatment units Deepwell/underground injection (a type of disposal) accounted for 24 million tons (11 percent) of the generated hazardous waste, landfills accounted for 1 million tons (less than 0 5 percent), and combustion at high temperatures accounted for 4 million tons (2 percent) The majority of the remaining 36 million tons (17 percent) of hazardous waste underwent some type of treatment

Treatment

Treatment is any process that changes the physical, chemical, or biological character of a waste to make it less of an environmental threat Treatment can neutralize the waste, recover energy or material resources from a waste, render the waste less hazardous, or make the waste safer to transport, store, or dispose of

Municipal waste may be treated instead of landfilled One type of municipal waste treatment involves high temperature burning of the waste in an incinerator This combustion of municipal waste significantly reduces its volume The ash from municipal waste combustion must be properly managed to prevent the environmental damage from any potential hazardous constituents Also, emissions from the incinerator's smoke stack must be within acceptable regulatory levels
Hazardous waste generally must be treated before it can be disposed of The treatment standards for hazardous waste are found in a table following 40 CFR 268 40 Detailed descriptions of the appropriate treatment technologies are found in section 268 42, Table 1, "technology codes and description of technology-based standards" Policies related to treatment of hazardous waste are found in the RCRA Permit Policy Compendium and in RCRA Online
A brief description of several treatment technologies is found at Waste Treatment Technologies Also, useful information on treatment technologies is available from OSWER's Technology Innovation Office

---

Storage

Storage is the holding of waste for a temporary period of time At the end of the storage period, the waste is treated, disposed of, or stored elsewhere

Municipal waste in many cases is temporarily stored at waste transfer stations At the transfer station, waste is off-loaded from local collection routes and in some cases sorted according to type The waste is then loaded onto larger trucks or rail cars for transport to either a municipal waste treatment or disposal facility
Hazardous waste, in many cases, is stored prior to treatment or disposal The most common hazardous waste storage practices are container storage, storage in tanks, and storage in containment buildings The regulatory requirements for these types of storage practices are found in 40 CFR 264 and 40 CFR 265 Policies related to the storage of hazardous waste are found in the RCRA Permit Policy Compendium and in RCRA Online

---

Disposal

Disposal is the placement of waste into or on the land Disposal facilities are usually designed to permanently contain the waste and prevent the release of harmful pollutants to the environment

The most common disposal technology used for both municipal and hazardous waste is landfilling Landfills are waste management structures where waste is placed into the land Both municipal and hazardous waste landfills usually have liner systems and leachate collection systems to prevent contamination of the ground water under the landfill Ground-water monitoring is also generally required along with corrective action if releases of hazardous pollutants occur Once the landfills stop receiving waste they are required to close by putting an impermeable cover on the landfill to prevent rainwater from entering Specific management standards for municipal waste landfills are found in 40 CFR 258 Hazardous waste landfill standards are found in 40 CFR 264 and 40 CFR 265
Another disposal technology that is commonly used to manage liquid hazardous waste is injection wells Hazardous waste injection wells are used to dispose of liquid wastes deep underground The waste is usually injected under high pressure thousands of feet underground The wells must be properly designed and operated

to prevent waste from escaping the underground confinement area More information on underground injection well requirements can be found in 40 CFR 144, 145, 146, 147 and 148 Policies related to the disposal of hazardous waste can be found in the RCRA Permit Policy Compendium and in RCRA Online

---

Publications/Guidance/Data related to Treatment, Storage and Disposal

- RCRA Regulations
- Nonhazardous and Municipal Solid Waste
- Other Wastes Medical Waste, Mining Waste, Oil and Gas

Hazardous Waste

- Hazardous Wastes Documents
- RCRA Online
- RCRA Permit Policy Compendium
- Land Disposal Restrictions

* Some of the documents provided by EPA are Adobe Acrobat PDF (Portable Document Format) files They can be viewed, and printed, with the use of an Adobe Acrobat Reader The Adobe Acrobat's Reader is available, free, for Unix, Macintosh, IBM DOS, and IBM Windows operating systems Download the latest version of Adobe Acrobat The readers are available directly from Adobe

Generate and Transport Waste

What Are Hazardous Waste Generators and Transporters?

Generators are individuals that produce hazardous waste, usually as a result of an industrial process Transporters are individuals or entities that move hazardous waste from the generator off-site to a facility that can recycle, treat, store, or dispose of the waste For the regulations about identifying hazardous waste, see 40 CFR 261 [Adobe Acrobat PDF File]

Hazardous waste may be transported to another location to be treated, stored or disposed, or may be managed at the place of generation When waste is to be transported off-site, the generator prepares a shipping document called a manifest. This tracking form must accompany the waste to its final destination, and is used to track the waste from "cradle-to-grave " For additional information see The Hazardous Waste Manifest

Regulatory definitions for generators and transporters can be found at 40 CFR 260 10 [Adobe Acrobat PDF File]

Are All Hazardous Waste Generators Regulated in the Same Way?

No, hazardous waste generators are divided into three categories, based on the amount of waste produced, and are subject to different levels of regulation The three types of hazardous generators are (Please note that the following provides only brief generator definitions For more detailed information, refer to the links under each generator type)

1 **Conditionally exempt small quantity generators (CESQGs)** generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month For more information about CESQGs, see the CESQG Rule page

2 **Small quantity generators (SQGs)** generate between 100 kg and 1,000 kg of hazardous waste per month For more information on SQGs, see Understanding the Hazardous Waste Regulations, a Handbook for Small Businesses

3 **Large quantity generators (LQGs)** generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month For more information on LQG requirements, see Hazardous Waste Requirements for Large Quantity Generators

What Are the Requirements for Hazardous Waste Generators?

- Requirements for CESQGs (Conditionally Exempt Small Quantity Generators) includes (see also 40 CFR 261 5 [Adobe Acrobat PDF File])
  - CESQGs must identify all the hazardous waste they generate
  - CESQGs must not accumulate more than 1000 kg of hazardous waste at any time
  - CESQGs must ensure that their hazardous waste is delivered to someone who is authorized to manage their waste

- Requirements for SQGs (Small Quantity Generators) and LQGs (Large Quantity Generators) include (see also 40 CFR 262 [Adobe Acrobat PDF File])
  - Obtaining an EPA Identification number (contact state environmental office for number)
  - Handling wastes properly before shipment (packaging, labeling, marking, placarding, accumulation time, etc)
  - Complying with the manifest system
  - Recordkeeping and reporting requirements

- Some states may have additional requirements for generators You should contact your state environmental office if you are not familiar with the requirements that may apply to you

What Are the Requirements for Hazardous Waste Transporters?

Requirements for transporters include (see also 40 CFR 263 [Adobe Acrobat PDF File])

- Obtaining an EPA Identification number
- Complying with the manifest system
- Responding appropriately to hazardous waste discharges
- Complying with both the RCRA requirements (40 CFR Part 263) & DOT regulations (49 CFR Part 171-179)

Some states may have additional requirements for generators You should contact your state environmental office if you are not familiar with the requirements that may apply to you

The Hazardous Waste Manifest

The Uniform Hazardous Waste Manifest (the manifest) is a form used to track the movement of hazardous waste from the point of generation to the point of ultimate disposition ("cradle to grave") (For information regarding the manifest requirements, see 40 CFR part 262, subpart B [Adobe Acrobat PDF File])
RCRA manifests include information such as

- name and address of the generator, transporter, and the destination facility
- U S DOT description of the waste being transported and any associated hazards
- waste quantity
- name and phone number of a contact in case of an emergency
- other information required either by EPA or the state

Visit the "Manifest Automation Pilot" subpage to further explain the manifest system

Facts & Figures for Nonhazardous and Hazardous Waste Generators and Transporters>
(from the Municipal Solid Waste Charactenzation Report, 1996 Edition, and the 1995 RCRA Biennial Report)

- In 1996 a total of 209 7 million tons of MSW was generated This reflects a decrease of nearly 2 million tons from 1995, when MSW generation was 211.5 million tons Of the MSW generated, 57 3 million tons (27 3 percent) were recovered by recycling or composting, 36 1 million tons (17 2 percent) were combusted at high tempratures, and 116 3 million tons (55 5 percent) were landfilled
- The per capita generation rate in 1996 was 4 3 pounds per person per day, compared to 4 4 pounds per person per day in 1995
- The per capita discard rate (after recovery for recycling, including composting) was 3 2 pounds per person per day in 1996, down from 3 3 pounds per person per day in 1995
- Recycling (including composting) recovered 27 percent (57 million tons) of MSW in 1996, up from 26 percent (55 million tons) in 1995
- There were nearly 9,000 curbside recycling programs in the United States in 1996, as well as more than 10,000 drop-off centers for recyclables About 360 materials recovery facilities helped process the recyclables collected More than 3,000 yard trimmings composting programs were reported
- Recovery of paper and paperboard reached 41 percent (33 million tons) in 1996, accounting for more than half of the total MSW recovered In addition, nearly 11 million tons of yard trimmings were recovered for composting in 1996, accounting for the second largest fraction of total recovery The percentage of yard trimmings composted (38 percent) has more than doubled since 1992
- Landfills managed 55 percent of MSW generated (116 million tons), down from 57 percent in 1995 Combustion facilities managed 17 percent (36 million tons) of total MSW generated, about the same as in 1995
- In 1995, 20,873 LQGs produced 214 million tons of hazardous waste regulated by RCRA This is a decrease of 3,489 LQGs and a decrease of 44 million tons of waste compared to 1993 The five (5) States whose LQGs generated the largest amount of hazardous waste were Texas (69 million tons), Tennessee (39 million tons), Louisiana (17 million tons), Michigan (13 million tons), and Illinois (13 million tons). Together, the LQGs in these States accounted for 70% of the national total waste generated
- In 1995, wastewater generation accounted for 95% of the national generation total, while in 1993, wastewater generation accounted for 92% percent of the national generation total
- Overall, total hazardous waste generation decreased from 258 million tons in 1993 to 214 million tons in 1995 Wastewater generation decreased from 237 million tons in 1993 to 202 million tons in 1995, and non-wastewater generation decreased from 22 million tons in 1993 to over 11 million tons in 1995

Other Documents Related to Hazardous Waste Generators and Transporters

- Understanding the Hazardous Waste Rules A Handbook for Small Business
- RCRIS RCRA Regulated Handlers
- BRS Biennial RCRA Hazardous Waste Report (1993)
- 1995 RCRA Biennial Report
- Control of Transfrontier Movements of Wastes destined for Recovery Operations, OECD Council Decision Implementation Final Rule (October 12, 1996)

Municipal Solid (Nonhazardous) Waste Generation and Transport Information

- Municipal Solid Waste Factbook - Reference manual about household waste

management practices

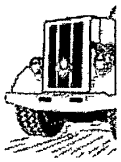
- Municipal Solid Waste Characterization Report, 1996 Edition
- Municipal Solid Waste Characterization Report, 1995 Edition
- Decision Makers Guide to Solid Waste Management
- Flow Control and Municipal Solid Waste - a review of the legal provisions that allow state and local governments to designate the places where municipal solid waste is taken for processing
- Pay As You Throw Unit Pricing - residents pay for household waste directly based on the amount of waste they generate
- Full Cost Accounting for Municipal Solid Waste - a primer for managing the economics of solid waste

---

Get Acrobat Reader * Some of the documents provided by EPA are in an Adobe Acrobat PDF (Portable Document Format) file They can be viewed, and printed, with the use of an Adobe Acrobat Reader The Adobe Acrobat's Reader is available, free, for Unix, Macintosh, IBM DOS and IBM Windows operating systems Click this button to download the latest version of Adobe Acrobat The readers are available directly from Adobe

EPA Home | OSWER Home | OSW Home | RCRA Hotline | Search EPA

URL http //www epa gov/epaoswer/osw/generate htm
Last Modified Tuesday, July 03, 2001 12 13 53



Laws, Regulations and Policies

RCRA Laws and General Information
Historical and current information about RCRA Laws, Regulations and Policies

Rules, Regulations and Policies
Federal Register and related activities Listed by Topic Area

RCRA Laws and General Information

- The Resource Conservation and Recovery Act (RCRA) US code EXIT EPA
- The RCRA Regulations (40 CFR Parts 240-299)
- Mercury-Containing and Rechargeable Battery Management Act
  Adobe Acrobat PDF File || ASCII Text File
- RCRA Hotline Training Modules - *"Introduction to Other Laws that Interface with RCRA"*
  Adobe Acrobat PDF File ASCII Text TileRCRA Hotline Training Modules - *"Introduction to RCRA Statutory Overview"*
  Adobe Acrobat PDF File || ASCII Text File
- RCRA Online
- RCRA Orientation Manual - July 1998
- RCRA Reducing Risk from Waste
  en Español

Rules, Regulations and Policies

Cement Kiln Dust
Cleanup Hazardous Waste
Chlorinated Aliphatics
Disposal of Nonhazardous Waste
Financial Assurance
Fossil Fuels
Generate and Transport Waste
Identification of Hazardous Waste
Land Disposal Restrictions
Military Munitions
Mining Waste
Municipal Solid Waste Landfills
Oil and Gas Drilling and Production Waste
Permits and Permitting
Procurement Guidelines
Radioactive and Mixed Hazardous Waste
Recycling
State Authorization
Treatment of Hazardous Waste
Universal Waste
Waste Minimization

Cement Kiln Dust

Cleanup Hazardous Waste

Disposal of Nonhazardous Waste

- Guidance for Industrial Waste Management - June 11, 1999
- Agency Information Collection Activities Proposed Collection, Comment Request, Criteria for

Classification of Solid Waste Disposal Facilities and Practices, Recordkeeping and Reporting Requirements (Renewal), Notice of Request for Renewal
- Alternatives for Ground-Water Monitoring at Small, Dry, Remote Municipal Solid Waste Landfills - Summer 1995
- Conditionally Exempt Small Quantity Generator (CESQG) Rule - June 1996
- Financial Assurance for Municipal Solid Waste Landfills - November 1996
- Site-Specific Flexibility Requests for Municipal Solid Waste Landfills in Indian Country, Draft Guidance - August 1997

Financial Assurance

- Financial Assurance Mechanisms for Corporate Owners and Operators of Municipal Solid Waste Landfill Facilities - April 10, 1998

Fossil Fuels

Generate and Transport Waste

- Agency Information Collection Activities Proposed Collection Comment Request, U S Exports and Imports of Hazardous Wastes RCRA ICR No 1647 02 - November 01, 2000
- Agency Information Collection Activities Notification of Regulated Waste Activity and RCRA Hazardous Waste Part A Permit Application and Modification - May 14, 1999
- The 1999 Hazardous Waste Report (draft) *"Supporting Statement for EPA Information Collection Request 976 09" - October 1998*
  Adobe Acrobat PDF File [70 K] || *About*
- Conditionally Exempt Small Quantity Generator Rule - June 1996
- Control of Transfrontier Movements of Wastes Destined for Recovery Operations OECD Council Decision Implementation Final Rule - April 1996
- Hazardous Waste Generator Standards - ICR - *"Supporting Statement for EPA Information Collection Request Number 0820 06 - Hazardous Waste Generator Standards"* - July 15, 1997
- Hazardous Waste Requirements for Large Quantity Generators - June 1996
  ASCII text file || Adobe Acrobat PDF File || *About*
- Office of Solid Waste Burden Reduction Project, Notice of Data Availability and Request for Comment - June 18, 1999
- Request for Information Concerning Transfrontier Movements of Wastes Destined for Recovery Operations Within the OECD Area - August 17, 1999
- Requirements for Generators Transporters, and Waste Management Facilities Under the RCRA Hazardous Waste Manifest System Information Collection Request
- Universal Waste - Final Rule - May 1995

Identification of Hazardous Waste

Land Disposal Restrictions

Military Munitions

- Military Munitions Final Rule - February 1997

Mining Waste

- Mining Waste- Bevill Amendment and Supporting Documentation - August 1994
- Land Disposal Restrictions Phase IV - Final Rule
  Treatment Standards Proposed for Toxicity Characteristic (TC) Metal and Mineral Processing Wastes

Municipal Solid Waste Landfills

Oil and Gas Drilling and Production Waste

- **Oil, Gas, Geothermal Drilling and Production Waste Regulation** - July 6, 1988
  ASCII text file || WordPerfect file || *Description of files* (text file)
- **Oil, Gas, and Geothermal Energy Wastes Regulatory Clarification** - March 22, 1993
  ASCII text file || WordPerfect file || *Description of files* (text file)

Permits and Permitting

- Agency Information Collection Activities Continuing Collection, Comment Request, Part B Permit Application, Permit Modifications and Special Permits - July 23, 1999
- Agency Information Collection Activities Notification of Regulated Waste Activity and RCRA Hazardous Waste Part A Permit Application and Modification - May 14, 1999
- Permit Improvement Team - July 1996
- RCRA Online - September 1998
- RCRA Permit Policy Compendium - July 1997
- Standards Applicable to Owners and Operators of Closed and Closing Hazardous Waste Management Facilities Post-Closure Permit Requirement and Closure Process, Final Rule - October, 1998

Procurement Guidelines

- Comprehensive Procurement Guidelines III, Final (January 2000)
- Comprehensive Procurement Guidelines III, Proposed (August 1998)
- Comprehensive Procurement Guidelines II - November 1997
- Comprehensive Procurement Guidelines I - April 1995
- Paper Products Recovered Materials Advisory Notice (RMAN), Final Guidelines - May 1996
- Paper Products Recovered Materials Advisory Notice II - June 1998

Recycling

- **Hazardous Waste**
  Implementation of the Mercury-Containing and Rechargeable Battery Management Act
  Adobe Acrobat PDF file || ASCII Text File || *About*

  Universal Waste - Final Rule - May 1995

  Waste-Derived Fertilizer

State Authorization

- State Rule Authorization and Adoption Status

Treatment of Hazardous Waste

- Agency Information Collection Activities Continuing Collection, Comment Request Hazardous Waste Specific Unit Requirements and Special Waste Processes and Types - May 5, 2000
- Agency Information Collection Activities, Continuing Collection, Comment Request, General Hazardous Waste Facility Standards - June 17, 1999
- Final Standards for Hazardous Air Pollutants for Hazardous Waste Combustors
- The 1999 Hazardous Waste Report (draft) *"Supporting Statement for EPA Information Collection Request 976 09" - October 1998* Adobe Acrobat PDF File[70 K] || *About*
- Hazardous Waste Combustors Revised Standards,Final Rule - Part 1 RCRA Comparable Fuel Exclusion, Permit Modifications for Hazardous Waste Combustion Units, Notification of Intent To Comply, Waste Minimization and Pollution Prevention Criteria for Compliance Extensions - July 1998
- Hazardous Waste Combustion Rulemaking Continuous Emissions Monitoring System Notice of Data Availability - December 1997
- Land Disposal Restrictions Notice of Intent To Grant a Site-Specific Treatment Variance to Chemical Waste Management, Inc Proposed Rule
- Part 279 Requirements Used Oil Management Standards (Poster)
  Adobe Acrobat PDF File [85 K] || *About*
- Proposed Revised Technical Standards for Combustion Units - March 1996
- Office of Solid Waste Burden Reduction Project, Notice of Data Availability and Request for Comment - June 18, 1999

Universal Waste
Final Rule—May 1995

Waste Minimization
Notice of Availability of Draft RCRA Waste Minimization PBT Chemical List - November 1998

* Some of the documents provided by EPA are Adobe Acrobat PDF (Portable Document Format) files They can be viewed, and printed, with the use of an Adobe Acrobat Reader The Adobe Acrobat's Reader is available, free, for Unix, Macintosh, IBM DOS, and IBM Windows operating systems Click this button to download the latest version of Adobe Acrobat The readers are available directly from Adobe

URL http //www epa gov/epaoswer/osw/laws-reg htm
Last Modified Tuesday, July 03, 2001 12 13 51

附錄五

United States Environmental Protection Agency | Solid Waste and Emergency Response (5305W) | EPA530-F-99-018 July 1999

RCRA CLEANUP REFORMS

Faster, Focused, More Flexible Cleanups

The U S Environmental Protection Agency (EPA) is implementing a set of administrative reforms, known as the RCRA Cleanup Reforms, to the Resource Conservation and Recovery Act (RCRA) Corrective Action program The reforms are designed to achieve faster, more efficient cleanups at RCRA sites that treat, store, or dispose of hazardous waste and have potential environmental contamination Although these reforms will emphasize flexibility and trying new approaches to clean up these facilities, EPA and the states will continue to ensure protection of human health and the environment

Why Is EPA Doing the RCRA Cleanup Reforms?

When the RCRA law and regulations governing proper hazardous waste management went into effect around 1980, thousands of facilities became newly subject to these federal regulations This RCRA regulatory structure has helped ensure that hazardous waste generated from ongoing industrial operations is properly managed and does not contribute to a future generation of toxic waste sites However, many of these facilities had existing soil and groundwater contamination resulting from historical waste management practices The RCRA Corrective Action program addresses cleanup of existing contamination at these operating industrial facilities.

Congress, the general public, EPA, and state agencies all believe the pace and progress of RCRA cleanups must be increased In reviewing the program, EPA and other stakeholders identified several factors that were impeding timely and cost-effective RCRA cleanups In some instances, RCRA cleanups have suffered from an emphasis on process steps and a lack of clarity in cleanup objectives An additional complication is that the application of certain RCRA requirements, such as the land disposal restrictions (LDR), minimum technological requirements, and permitting, can create impediments to cleanup

What Are the RCRA Cleanup Reforms?

The RCRA Cleanup Reforms are EPA's comprehensive effort to address the key impediments to cleanups, maximize program flexibility, and spur progress toward a set of ambitious national cleanup goals The national cleanup goals focus on 1,712 RCRA facilities identified by EPA and the states warranting attention over the next several years because of the potential for unacceptable exposure to pollutants and/or for groundwater contamination The goals, set by EPA under the Government Performance and Results Act (GPRA), are that by 2005, the states and EPA will verify and document that 95 percent of these 1,712 RCRA facilities will have "current human exposures under control," and 70 percent of these facilities will have "migration of contaminated groundwater under control " To ensure that these ambitious goals are achieved, the RCRA Cleanup Reforms outline aggressive national cleanup goals for each of the next several years Implementation of the proposed reforms will help us achieve the national RCRA cleanup goals Specifically, the RCRA Cleanup Reforms will

National Cleanup Goals
(Number of Facilities with Cleanup Measures Verified per Year)

Year	Current Human Exposures Controlled	Groundwater Contamination Controlled
1999	172	84
2000	172	172
2001	172	172
2002	172	172
2003	257	172
2004	257	172
2005	255	172
Total by 2005	1629* (95%)	1200* (70%)

*Includes facilities verified prior to 1999

- Provide new results-oriented cleanup guidance with clear objectives
- Foster maximum use of program flexibility and practical approaches through training, outreach, and new uses of enforcement tools
- Enhance community involvement including greater public access to information on cleanup progress

These reforms are described in more detail at the end of this fact sheet The reform efforts are intended to build on actions taken by EPA and the states in recent years to accelerate cleanups, such as

- The May 1, 1996, Advance Notice of Proposed Rulemaking (ANPR, 61 *FR* 19432) which contains the Agency's latest guidance for the corrective action program and identifies a number of flexible cleanup approaches
- Recent promulgation of the the Hazardous Remediation Waste Management Requirements ("HWIR-Media," 63 *FR* 65874, November 30, 1998) which, among other things, create streamlined RCRA permits for cleanup wastes, release "cleanup only" facilities from requirement to conduct facility-wide corrective action, and allow for temporary "staging piles" that have flexible design and operating requirements
- Recent promulgation of the Post-Closure Regulation (63 *FR* 56710, October 22, 1998) which provides flexibility to EPA and authorized states by removing the requirement that interim status facilities obtain a permit for the post-closure care of a waste management unit when other enforcement documents are used, and harmonizing the sometimes duplicative closure and corrective action requirements
- The Land Disposal Restrictions Standards for Contaminated Soils (63 *FR* 28617, May 26, 1998) which better tailor RCRA's LDRs to contaminated soils managed during cleanups

How Will the Success of the Reforms Be Measured?

While the ultimate goal of RCRA Corrective Action is to achieve completed cleanups, we will measure the near-term success of the program and reforms against the GPRA goals and annual cleanup targets for verifying that current human exposures are under control and migration of contaminated groundwater is under control (see table on preceding page) Measuring and recording our progress toward these goals will be a top priority for EPA and the states over the next several years

How Will EPA Involve Stakeholders In the Reforms?

We will provide periodic updates on the RCRA Cleanup Reforms and solicit input from stakeholders through several means including focus meetings, *Federal Register* notices, the new RCRA Corrective Action newsletter, Internet postings, and press releases EPA seeks continuous feedback from all stakeholders on the need for additional reforms beyond those already underway While the Agency values and appreciates the feedback and interest of all stakeholders, limited resources will not allow us to respond individually to those who provide input on the RCRA Cleanup Reforms All input will be seriously considered by EPA, however Based on stakeholder input and our ongoing assessment of the program, we will continue to refine the RCRA Cleanup Reforms, add reforms as needed, and communicate program changes including those resulting from stakeholder input

For More Information

If you have questions regarding these reforms, please call the RCRA Hotline at 800-424-9346 You may also e-mail your questions via our Web site at <www epa gov/epaoswer/hotline/index htm>

The RCRA Corrective Action program is run jointly by EPA and the states, with 33 states and territories authorized to implement the program. Corrective action is conducted under RCRA permits, orders and other approaches

If you would like to provide written feedback on the Reforms, please mail them to the RCRA Information Center (5305W), USEPA, 401 M St , SW, Washington, DC 20460 or, e-mail to <rcra-docket@epa gov> Please include the following number on all correspondence, written or e-mailed, to the RCRA Information Center F-1999-CURA-FFFFF

RCRA Cleanup Reforms

EPA is Implementing the following reforms to help streamline RCRA cleanups and meet the national cleanup goals

I. Provide new results-oriented cleanup guidance with clear objectives

EPA will issue a *Federal Register* notice concerning the operating guidance for the corrective action program EPA also will issue several guidance documents to emphasize use of flexibility in the corrective action process, consistent measures for determining when a site has met corrective action goals, and to provide a more consistent basis for groundwater use decisions

a Notice Concerning 1990 Subpart S Proposal

In an upcoming *Federal Register* notice, EPA plans to announce its intention not to take final action on most of the provisions of the July 27, 1990, proposed Subpart S rule Provisions of Subpart S which have been finalized (e g , Corrective Action Management Units) will remain in effect This notice is intended to eliminate uncertainty for states and owner/operators created by the potential promulgation of detailed federal regulations, thereby clearing the way for implementation of more flexible corrective action approaches In the notice, EPA plans to clarify that the Agency does not intend to finalize a process-oriented corrective action approach, and to confirm that the 1996 Advanced Notice of Proposed Rulemaking remains the primary corrective action program guidance

b Corrective Action Guidance

1 Environmental Indicators Guidance and Implementation

The two corrective action Environmental Indicators—*Current Human Exposures under Control* and *Migration of Contaminated Groundwater under Control*—are measures of program progress and are being used to meet the goals set under the Government Performance and Results Act This guidance, issued in February 1999, describes how to determine if these measures have been met

These Environmental Indicators are designed to aid site decision makers by clearly showing where risk reduction is necessary, thereby helping regulators and facility owner/operators reach agreement earlier on stabilization measures or cleanup remedies that must be implemented Focusing on the Environmental Indicators should also help reduce delays in the review of cleanup work plans and allow owner/operators and regulators to concentrate on those problems that potentially pose significant risks

2 Results-Based Approaches for RCRA Corrective Action

This guidance will stress that results-based approaches which emphasize outcomes and eliminate unnecessary process steps, should be a significant part of state/regional corrective action programs in order to meet the GPRA goals and to move facilities toward the longer-term goal of final facility cleanup Results-based approaches include setting cleanup goals, providing procedural flexibility in how goals are met, inviting innovative technical approaches, focusing data collection, and letting owner/operators undertake cleanup action with reduced Agency oversight, where appropriate Under such approaches, owner/operators focus on environmental results and the most technologically efficient means of achieving them while still being held fully accountable

3 Corrective Action Completion Guidance

This guidance will discuss how to document completion of corrective action at facilities It will address termination of permits and interim status where corrective action is complete, how to determine that corrective action is complete at part of a facility, and the importance of public involvement in corrective action. This guidance will provide for a more predictable completion process and provide facility owner/operators with reasonable assurance that regulatory activities can be completed at their facility

4 The Role of Groundwater Use in RCRA Corrective Action

This guidance is intended to provide more certainty about cleanup objectives and expectations with respect to groundwater remediation It will include recommendations on how to account for current and reasonably expected uses of groundwater when implementing interim and final RCRA corrective action remedies.

II. Foster Maximum Use of Program Flexibility and Practical Approaches through Training, Outreach, And New Uses of Enforcement Tools

Through outreach and training, EPA will encourage maximum appropriate use of the existing flexibility in the corrective action program and prompt implementation of recent rules offering regulatory flexibility.

a Prompt Implementation of the HWIR-Media and Post-Closure Rules

EPA will strongly encourage states to expeditiously incorporate the Hazardous Remediation Waste Management Requirements (HWIR-Media) and Post-

Closure regulations into their programs As more states adopt and implement the flexibility in the HWIR Media rule, Post Closure rule, and the alternative soil treatment standards promulgated under LDR Phase IV, impediments to cleanup will be reduced This is because these rules limit the applicability in certain cleanup situations of some RCRA requirements such as land disposal restrictions, minimum technological requirements, and permitting, or provide alternative requirements more tailored to cleanup situations

b Maximize Practical Approaches and Use All Appropriate Authorities to Expedite Cleanup

The national EPA program office will reach out to the EPA regions, states, and external stakeholders to emphasize the importance of environmental results in the corrective action program EPA will place a priority on authorizing additional states to implement corrective action or enhancing work sharing arrangements with states that are not authorized for the program With the RCRA Cleanup Reforms we hope to develop a new atmosphere of partnership and cooperation among regulatory authorities, industry, and stakeholders

We will encourage regulators to use a broad spectrum of approaches to expedite corrective action and achieve GPRA goals These approaches include new uses of enforcement tools to create incentives for cleanup at facilities with cooperative owners as well as to compel cleanups at facilities where collaborative approaches have not yielded results

c Provide Comprehensive Training on Successful Cleanup Approaches

EPA has launched a comprehensive training effort on Results-Based Corrective Action, which features a three-day workshop offered to EPA Regions and states in 1999 and 2000 An Internet version of this training is also being developed for release The training will emphasize to corrective action regulators the flexibility in existing policies and regulations EPA and State regulators will learn from their peers about innovative, successful approaches that are speeding cleanups now at corrective action sites The training emphasizes using a Conceptual Site Model and Environmental Indicators to help focus corrective action activity at sites This comprehensive training effort will help EPA and State regulators make maximum use of the flexibility inherent in the corrective action program and to adopt more streamlined approaches for accelerating cleanups

III. Enhance Community Involvement Including, Greater Public Access to Information on Cleanup Progress

a Emphasize Public Involvement in RCRA Cleanups

Some of the clear benefits of meaningful public involvement include letting the public know from the onset that their opinions are valued and can influence decision making, learning from the public about past environmental problems associated with the facility, gaining an understanding of current as well as future land use plans, and avoiding delays which can arise late in the remedy selection process when the public has not been adequately engaged

EPA will continue to emphasize the importance of meaningful public involvement throughout RCRA cleanups EPA's commitment to meaningful public involvement was described in the 1996 Advance Notice of Proposed Rulemaking and is part of the central theme of effective communication that is interwoven throughout the corrective action training effort In addition, public involvement is the focus of the RCRA Public Participation Training which is now under development and will be offered to regions and states EPA will also convene workshops with stakeholders later this year Through these workshops we hope to better understand the public's concerns as well as gather suggestions for further improvements to the corrective action program

b Provide Detailed Information on Cleanup Progress

EPA will post information on cleanup progress for individual facilities on the Internet With this information, we hope to generate greater public interest and awareness in corrective action at individual facilities, thereby enhancing the ability of the community to become more involved in decisions about the cleanup This information will allow stakeholders to monitor progress at facilities in their area as well as overall progress in the corrective action program Information is available at <www epa gov/epaoswer/osw/cleanup htm>

United States Environmental Protection Agency | Solid Waste and Emergency Response (5305W) | EPA530-F-99-018 July 1999

RCRA CLEANUP REFORMS

Faster, Focused, More Flexible Cleanups

The U S Environmental Protection Agency (EPA) is implementing a set of administrative reforms, known as the RCRA Cleanup Reforms, to the Resource Conservation and Recovery Act (RCRA) Corrective Action program The reforms are designed to achieve faster, more efficient cleanups at RCRA sites that treat, store, or dispose of hazardous waste and have potential environmental contamination Although these reforms will emphasize flexibility and trying new approaches to clean up these facilities, EPA and the states will continue to ensure protection of human health and the environment

Why Is EPA Doing the RCRA Cleanup Reforms?

When the RCRA law and regulations governing proper hazardous waste management went into effect around 1980, thousands of facilities became newly subject to these federal regulations This RCRA regulatory structure has helped ensure that hazardous waste generated from ongoing industrial operations is properly managed and does not contribute to a future generation of toxic waste sites However, many of these facilities had existing soil and groundwater contamination resulting from historical waste management practices. The RCRA Corrective Action program addresses cleanup of existing contamination at these operating industrial facilities

Congress, the general public, EPA, and state agencies all believe the pace and progress of RCRA cleanups must be increased In reviewing the program, EPA and other stakeholders identified several factors that were impeding timely and cost-effective RCRA cleanups In some instances, RCRA cleanups have suffered from an emphasis on process steps and a lack of clarity in cleanup objectives An additional complication is that the application of certain RCRA requirements, such as the land disposal restrictions (LDR), minimum technological requirements, and permitting, can create impediments to cleanup

What Are the RCRA Cleanup Reforms?

The RCRA Cleanup Reforms are EPA's comprehensive effort to address the key impediments to cleanups, maximize program flexibility, and spur progress toward a set of ambitious national cleanup goals The national cleanup goals focus on 1,712 RCRA facilities identified by EPA and the states warranting attention over the next several years because of the potential for unacceptable exposure to pollutants and/or for groundwater contamination The goals, set by EPA under the Government Performance and Results Act (GPRA), are that by 2005, the states and EPA will verify and document that 95 percent of these 1,712 RCRA facilities will have "current human exposures under control," and 70 percent of these facilities will have "migration of contaminated groundwater under control " To ensure that these ambitious goals are achieved, the RCRA Cleanup Reforms outline aggressive national cleanup goals for each of the next several years Implementation of the proposed reforms will help us achieve the national RCRA cleanup goals Specifically, the RCRA Cleanup Reforms will

National Cleanup Goals
(Number of Facilities with Cleanup Measures Verified per Year)

Year	Current Human Exposures Controlled	Groundwater Contamination Controlled
1999	172	84
2000	172	172
2001	172	172
2002	172	172
2003	257	172
2004	257	172
2005	255	172
Total by 2005	1629* (95%)	1200* (70%)

*Includes facilities verified prior to 1999

- Provide new results-oriented cleanup guidance with clear objectives

- Foster maximum use of program flexibility and practical approaches through training, outreach, and new uses of enforcement tools

- Enhance community involvement including greater public access to information on cleanup progress

These reforms are described in more detail at the end of this fact sheet The reform efforts are intended to build on actions taken by EPA and the states in recent years to accelerate cleanups, such as

- The May 1, 1996, Advance Notice of Proposed Rulemaking (ANPR, 61 *FR* 19432) which contains the Agency's latest guidance for the corrective action program and identifies a number of flexible cleanup approaches

- Recent promulgation of the the Hazardous Remediation Waste Management Requirements ("HWIR-Media," 63 *FR* 65874, November 30, 1998) which, among other things, create streamlined RCRA permits for cleanup wastes, release "cleanup only" facilities from requirement to conduct facility-wide corrective action, and allow for temporary "staging piles" that have flexible design and operating requirements

- Recent promulgation of the Post-Closure Regulation (63 *FR* 56710, October 22, 1998) which provides flexibility to EPA and authorized states by removing the requirement that interim status facilities obtain a permit for the post-closure care of a waste management unit when other enforcement documents are used, and harmonizing the sometimes duplicative closure and corrective action requirements

- The Land Disposal Restrictions Standards for Contaminated Soils (63 *FR* 28617, May 26, 1998) which better tailor RCRA's LDRs to contaminated soils managed during cleanups

How Will the Success of the Reforms Be Measured?

While the ultimate goal of RCRA Corrective Action is to achieve completed cleanups, we will measure the near-term success of the program and reforms against the GPRA goals and annual cleanup targets for verifying that current human exposures are under control and migration of contaminated groundwater is under control (see table on preceding page) Measuring and recording our progress toward these goals will be a top priority for EPA and the states over the next several years

How Will EPA Involve Stakeholders In the Reforms?

We will provide periodic updates on the RCRA Cleanup Reforms and solicit input from stakeholders through several means including focus meetings, *Federal Register* notices, the new RCRA Corrective Action newsletter, Internet postings, and press releases EPA seeks continuous feedback from all stakeholders on the need for additional reforms beyond those already underway While the Agency values and appreciates the feedback and interest of all stakeholders, limited resources will not allow us to respond individually to those who provide input on the RCRA Cleanup Reforms All input will be seriously considered by EPA, however Based on stakeholder input and our ongoing assessment of the program, we will continue to refine the RCRA Cleanup Reforms, add reforms as needed, and communicate program changes including those resulting from stakeholder input

For More Information

If you have questions regarding these reforms, please call the RCRA Hotline at 800-424-9346 You may also e-mail your questions via our Web site at <www epa gov/epaoswer/hotline/index htm>

The RCRA Corrective Action program is run jointly by EPA and the states, with 33 states and territories authorized to implement the program Corrective action is conducted under RCRA permits, orders and other approaches.

If you would like to provide written feedback on the Reforms, please mail them to the RCRA Information Center (5305W), USEPA, 401 M St , SW, Washington, DC 20460 or, e-mail to <rcra-docket@epa gov> Please include the following number on all correspondence, written or e-mailed, to the RCRA Information Center F-1999-CURA-FFFFF

RCRA Cleanup Reforms

EPA is Implementing the following reforms to help streamline RCRA cleanups and meet the national cleanup goals

I Provide new results-oriented cleanup guidance with clear objectives

EPA will issue a *Federal Register* notice concerning the operating guidance for the corrective action program EPA also will issue several guidance documents to emphasize use of flexibility in the corrective action process, consistent measures for determining when a site has met corrective action goals, and to provide a more consistent basis for groundwater use decisions

a Notice Concerning 1990 Subpart S Proposal

In an upcoming *Federal Register* notice, EPA plans to announce its intention not to take final action on most of the provisions of the July 27, 1990, proposed Subpart S rule Provisions of Subpart S which have been finalized (e g , Corrective Action Management Units) will remain in effect This notice is intended to eliminate uncertainty for states and owner/operators created by the potential promulgation of detailed federal regulations, thereby clearing the way for implementation of more flexible corrective action approaches In the notice, EPA plans to clarify that the Agency does not intend to finalize a process-oriented corrective action approach, and to confirm that the 1996 Advanced Notice of Proposed Rulemaking remains the primary corrective action program guidance

b Corrective Action Guidance

1 Environmental Indicators Guidance and Implementation

The two corrective action Environmental Indicators—*Current Human Exposures under Control* and *Migration of Contaminated Groundwater under Control*—are measures of program progress and are being used to meet the goals set under the Government Performance and Results Act This guidance, issued in February 1999, describes how to determine if these measures have been met

These Environmental Indicators are designed to aid site decision makers by clearly showing where risk reduction is necessary, thereby helping regulators and facility owner/operators reach agreement earlier on stabilization measures or cleanup remedies that must be implemented Focusing on the Environmental Indicators should also help reduce delays in the review of cleanup work plans and allow owner/operators and regulators to concentrate on those problems that potentially pose significant risks

2 Results-Based Approaches for RCRA Corrective Action

This guidance will stress that results-based approaches which emphasize outcomes and eliminate unnecessary process steps, should be a significant part of state/regional corrective action programs in order to meet the GPRA goals and to move facilities toward the longer-term goal of final facility cleanup Results-based approaches include setting cleanup goals, providing procedural flexibility in how goals are met, inviting innovative technical approaches, focusing data collection, and letting owner/operators undertake cleanup action with reduced Agency oversight, where appropriate Under such approaches, owner/operators focus on environmental results and the most technologically efficient means of achieving them while still being held fully accountable

3 Corrective Action Completion Guidance

This guidance will discuss how to document completion of corrective action at facilities It will address termination of permits and interim status where corrective action is complete, how to determine that corrective action is complete at part of a facility, and the importance of public involvement in corrective action. This guidance will provide for a more predictable completion process and provide facility owner/operators with reasonable assurance that regulatory activities can be completed at their facility

4 The Role of Groundwater Use in RCRA Corrective Action

This guidance is intended to provide more certainty about cleanup objectives and expectations with respect to groundwater remediation It will include recommendations on how to account for current and reasonably expected uses of groundwater when implementing interim and final RCRA corrective action remedies

II. Foster Maximum Use of Program Flexibility and Practical Approaches through Training, Outreach, And New Uses of Enforcement Tools

Through outreach and training, EPA will encourage maximum appropriate use of the existing flexibility in the corrective action program and prompt implementation of recent rules offering regulatory flexibility

a Prompt Implementation of the HWIR-Media and Post-Closure Rules

EPA will strongly encourage states to expeditiously incorporate the Hazardous Remediation Waste Management Requirements (HWIR-Media) and Post-

Closure regulations into their programs As more states adopt and implement the flexibility in the HWIR Media rule, Post Closure rule, and the alternative soil treatment standards promulgated under LDR Phase IV, impediments to cleanup will be reduced This is because these rules limit the applicability in certain cleanup situations of some RCRA requirements such as land disposal restrictions, minimum technological requirements, and permitting, or provide alternative requirements more tailored to cleanup situations

b Maximize Practical Approaches and Use All Appropriate Authorities to Expedite Cleanup

The national EPA program office will reach out to the EPA regions, states, and external stakeholders to emphasize the importance of environmental results in the corrective action program EPA will place a priority on authorizing additional states to implement corrective action or enhancing work sharing arrangements with states that are not authorized for the program With the RCRA Cleanup Reforms we hope to develop a new atmosphere of partnership and cooperation among regulatory authorities, industry, and stakeholders

We will encourage regulators to use a broad spectrum of approaches to expedite corrective action and achieve GPRA goals These approaches include new uses of enforcement tools to create incentives for cleanup at facilities with cooperative owners as well as to compel cleanups at facilities where collaborative approaches have not yielded results

c Provide Comprehensive Training on Successful Cleanup Approaches

EPA has launched a comprehensive training effort on Results-Based Corrective Action, which features a three-day workshop offered to EPA Regions and states in 1999 and 2000 An Internet version of this training is also being developed for release The training will emphasize to corrective action regulators the flexibility in existing policies and regulations EPA and State regulators will learn from their peers about innovative, successful approaches that are speeding cleanups now at corrective action sites The training emphasizes using a Conceptual Site Model and Environmental Indicators to help focus corrective action activity at sites This comprehensive training effort will help EPA and State regulators make maximum use of the flexibility inherent in the corrective action program and to adopt more streamlined approaches for accelerating cleanups

III Enhance Community Involvement Including, Greater Public Access to Information on Cleanup Progress

a Emphasize Public Involvement in RCRA Cleanups

Some of the clear benefits of meaningful public involvement include letting the public know from the onset that their opinions are valued and can influence decision making, learning from the public about past environmental problems associated with the facility, gaining an understanding of current as well as future land use plans, and avoiding delays which can arise late in the remedy selection process when the public has not been adequately engaged

EPA will continue to emphasize the importance of meaningful public involvement throughout RCRA cleanups EPA's commitment to meaningful public involvement was described in the 1996 Advance Notice of Proposed Rulemaking and is part of the central theme of effective communication that is interwoven throughout the corrective action training effort In addition, public involvement is the focus of the RCRA Public Participation Training which is now under development and will be offered to regions and states EPA will also convene workshops with stakeholders later this year Through these workshops we hope to better understand the public's concerns as well as gather suggestions for further improvements to the corrective action program

b Provide Detailed Information on Cleanup Progress

EPA will post information on cleanup progress for individual facilities on the Internet With this information, we hope to generate greater public interest and awareness in corrective action at individual facilities, thereby enhancing the ability of the community to become more involved in decisions about the cleanup This information will allow stakeholders to monitor progress at facilities in their area as well as overall progress in the corrective action program Information is available at <www epa gov/epaoswer/osw/cleanup htm>

United States Environmental Protection Agency | Solid Waste and Emergency Response (5305W) | EPA 530-F-01-001 January 2001 http //www epa gov/osw

Office of Solid Waste

RCRA CLEANUP REFORMS

Reforms II: Fostering Creative Solutions

The U S Environmental Protection Agency (EPA) is implementing a second set of administrative reforms to accelerate the cleanup of hazardous waste facilities regulated under the Resource Conservation and Recovery Act (RCRA) EPA's 1999 Reforms promoted faster, focused, more flexible cleanups The 2001 Reforms reinforce and build upon the 1999 Reforms and will pilot innovative approaches, accelerate changes in culture, connect communities to cleanup, and capitalize on redevelopment potential, while maintaining protection of human health and the environment

Why Is EPA Reforming the RCRA Corrective Action Program?

The goals for the RCRA Corrective Action program remain very challenging. To more effectively meet these goals and speed up the pace of cleanups, EPA introduced RCRA Cleanup Reforms in 1999 and is implementing additional Reforms in 2001. The 1999 and 2001 Reforms build upon actions taken by EPA and the states in recent years to accelerate cleanups. EPA believes that the 1999 Reforms remain central to successful implementation of the program The 1999 Reforms were designed to:

- Focus the program more effectively on achievement of environmental results, rather than fulfillment of unnecessary steps in a bureaucratic process;
- Foster maximum use of program flexibility and practical approaches to achieve program goals;
- Enhance public access to cleanup information and improve opportunity for public involvement in the cleanup process.

The 1999 Reforms set the near-term focus of the program on attainment of the two Environmental Indicators and established an environment for program implementors to be innovative and results-oriented. The 1999 Reforms have successfully led the program toward *faster, focused, more flexible cleanups*. An example of progress since 1997 is the increase, from 47 to 504, in the number of RCRA cleanup facilities meeting both Environmental Indicators.

What are the Goals of the RCRA Corrective Action Program?

EPA has established two near-term goals, termed "Environmental Indicators," for the RCRA Corrective Action program. These goals, developed under the Government Performance and Results Act (GPRA), are that by 2005, the states and EPA will verify and document that 95 percent of the 1,714 RCRA cleanup facilities under GPRA focus will have "current human exposures under control," and 70 percent of these facilities will have "migration of contaminated groundwater under control." The long-term goal of the program is to achieve final cleanup at all RCRA corrective action facilities.

In 2000, EPA held a series of meetings with program implementors and stakeholders, including representatives from tribes, federal and state agencies, regulated industry, and environmental and community groups; to discuss program impediments, successful approaches and ideas for 2001 Cleanup Reforms. Central ideas that emerged include the importance of: (1) reinforcing and building upon the 1999 Reforms; (2) empowering program implementors to try new approaches at the site level; and (3) using frequent, informal communication throughout the cleanup process.

What Are the RCRA Cleanup Reforms of 2001?

The RCRA Cleanup Reforms of 2001 highlight those activities that EPA believes would best accelerate program progress and foster creative solutions. The 2001 Reforms reflect the ideas EPA heard from program

implementors and stakeholders and introduce new initiatives to reinforce and build upon the 1999 Reforms. Specifically, the 2001 Reforms will:

- Pilot innovative approaches,
- Accelerate changes in culture,
- Connect communities to cleanups;
- Capitalize on redevelopment potential.

The 2001 Reforms include just some of the innovative approaches that have been identified by program implementors and stakeholders. EPA intends to continue work in other areas critical to meeting program goals. In particular, we seek to continue a dialogue with interested parties on groundwater cleanup and other issues relating to final cleanup; provide guidance tailored to cleanup at facilities with limited resources to pay for cleanup; and, continue to work with federally-owned facilities to help them meet their Environmental Indicator goals. Similarly, we encourage program implementors and stakeholders to use approaches that improve the program yet are not specifically included in the RCRA Cleanup Reforms.

I. Pilot innovative approaches.

The RCRA Cleanup Reforms Pilot Program will support state and EPA Regional Offices in their efforts to use innovative, results-orientated and protective approaches to speed achievement of Environmental Indicator goals and final cleanup. Stakeholders are encouraged to contact state and EPA Regional Offices with their pilot ideas

EPA has set a target of 25 pilot projects to be launched in 2001. EPA expects at least one pilot project in each EPA Region, administered by the state or EPA. EPA will showcase pilot projects to share successes and lessons learned and to promote use of similar approaches at other facilities. EPA recommends that stakeholders consider pilot projects in one or more areas. Examples include pilots that

- Achieve program goals most effectively at companies with multiple facilities;
- Improve stakeholder involvement and communication to resolve issues where cleanup progress is slow;
- Use site characterization technologies or strategies that efficiently assess Environmental Indicators,
- Enhance the use of protective and accountable state non-RCRA Cleanup programs to achieve program goals;
- Establish EPA Regional or state "corrective action expediters" to focus on cleanups that are stalled or delayed;
- Expedite achievement of program goals at federally-owned facilities;
- Use Superfund or emergency authorities at RCRA sites for bankrupt or unwilling facilities.

What is the RCRA Corrective Action Program?

In 1980, when the RCRA law and regulations went into effect, thousands of facilities became subject to hazardous waste management regulations. These regulations helped ensure that hazardous waste generated from ongoing industrial operations is properly managed and does not contribute to a future generation of toxic waste sites. However, many of these facilities had soil and groundwater contamination resulting from their waste management practices prior to 1980. The RCRA Corrective Action program addresses cleanup of past and present contamination at these operating industrial facilities.

Who Runs the RCRA Corrective Action Program?

The RCRA Corrective Action program is run by both EPA and the states, with 38 states and territories authorized to implement the program. Corrective action is conducted under RCRA permits, orders and other approaches

II. Accelerate changes in culture.

EPA will help program implementors and stakeholders accelerate changes in the culture in which they implement the program by: focusing on results over process; encouraging frequent, informal communication among stakeholders, encouraging partnerships in training; promoting methods of information exchange; and, using new approaches to meet Environmental Indicator and long-term cleanup goals. EPA will:

- *Promote nationwide dialogue among program implementors and stakeholders on RCRA cleanups.* EPA Regional Offices will work with states in an effort to hold at least one meeting in 2001 in each EPA Region, open to all stakeholders who wish to interact, provide input, or learn more about the RCRA Corrective Action program. Discussion topics could cover local, regional or national topics relevant to corrective action.

- *Conduct targeted training in partnership with program implementors and stakeholders* EPA will work with interested parties to deliver targeted training, depending upon the needs of those requesting the training and available resources. Training topics could cover, for example: innovative technical and administrative approaches to cleanup; success stories and lessons learned from implementation of the 1999 Cleanup Reforms; Corrective Action program basics; and use of performance-based approaches to corrective action.

- *Use web-based communication to share successes and lessons learned and promote innovative approaches.* EPA will support the establishment of a web-based interactive tool to promote sharing of successes and lessons learned and to provide for frequent exchange of ideas among all stakeholders on any corrective action topic, including those that are technical, policy-oriented or site-specific.

- *Overcome barriers to achieving Environmental Indicators.* EPA will clarify the relationship between Environmental Indicators and final cleanups and how Environmental Indicators can be met within the context of existing orders and permits. EPA will answer "Frequently Asked Questions" about Environmental Indicators, and issue technical guidance on ways to assess the impacts of contaminated groundwater on surface water and indoor air quality In addition, EPA will demonstrate new uses of enforcement tools to achieve Environmental Indicators

Focus on Results

The RCRA Cleanup Reforms foster creative, practical, results-based approaches to corrective action. In the field, this means:

- *Providing tailored oversight.* Eliminate administrative or technical steps where not needed to assure effective performance.
- *Using holistic approaches.* Evaluate facilities for overall risk and apply appropriate facility-wide corrective action measures.
- *Exercising procedural flexibility.* Emphasize results over mechanistic process steps and eliminate unproductive activities.
- *Setting performance standards.* Establish clear protective standards the owner/operator must fulfill to complete corrective action.
- *Targeting data collection.* Examine actual conditions at each facility to design data requirements as needed to support corrective action decisions

III. Connect communities to cleanups.

EPA will provide the public with more effective access to cleanup information. EPA seeks to increase public interest in and awareness of cleanup activities, and to further enhance the public's ability to become more involved in decisions about cleanups in communities. EPA will:

- *Clarify principles and expectations for public involvement in corrective action cleanups* EPA will set out general principles and expectations for providing the public with the opportunity to become involved at corrective action sites. EPA also will share examples of successful public involvement approaches that have been used at RCRA cleanup sites and lessons learned.

- *Increase support of Technical Outreach Services for Communities (TOSC).* The TOSC program provides communities with technical and educational assistance from universities on issues associated with cleanup of hazardous sites. EPA will provide resources to the TOSC program for community involvement at RCRA cleanup sites and advertise the availability of this program.

- *Place Environmental Indicator evaluation forms and cleanup summaries on EPA web sites.* EPA will place Environmental Indicator evaluation forms and summaries of cleanup activities of 1,714 RCRA facilities on the web sites of EPA Regional Offices. The evaluation forms and summaries will provide readily available information on the status of cleanup at these sites

- *Publicize and promote the use of readily accessible cleanup information sources.* EPA will produce and distribute a pamphlet for the general public that explains how to access RCRA Corrective Action program information and site-specific cleanup information.

IV. Capitalize on redevelopment potential.

EPA encourages program implementors and stakeholders to capitalize on the redevelopment potential of RCRA cleanup sites. Many of these sites are located in areas that are attractive for redevelopment and are poised for community revitalization. These factors can

motivate interested parties to pursue an expedited cleanup, sometimes with additional resources. EPA will.

- *Initiate Additional RCRA Brownfields Pilots.* EPA will launch 4-6 additional RCRA Brownfields pilot projects in 2001. These pilots will be designed to showcase the flexibility of RCRA and the use of redevelopment potential to expedite or enhance cleanups. Pilot applicants could be program implementors or stakeholders. Pilot participants also benefit from RCRA brownfields expertise. Limited funding may become available for EPA to conduct public meetings and related activities.

- *Initiate the Targeted Site Effort (TSE) Program to spur cleanup at RCRA sites with significant redevelopment/reuse potential.* EPA will ask each Regional Office to identify two sites for the TSE in 2001. The TSE program will apply to sites that have significant redevelopment/reuse potential, and require a limited amount of extra EPA support to help spur cleanup. The TSE program will provide participants with focused attention and access to RCRA brownfields expertise. Limited funding may be available for EPA to conduct public meetings and related activities

- *Provide training and outreach to program implementors on using redevelopment potential to meet program goals.* EPA will provide training and outreach to program implementors and stakeholders to promote the environmental and community benefits that can be gained by integrating brownfields redevelopment opportunities and RCRA facility cleanups.

- *Promote cleanup and redevelopment with RCRA "Comfort/Status" Letters.* "Comfort/status" letters provide information regarding EPA's intent to exercise its RCRA corrective action response and enforcement authorities at a cleanup site. EPA will issue examples of letters that have been used to spur cleanup and redevelopment at RCRA facilities.

How Will EPA Measure the Results of the Reforms?

Measuring and recording the results of the RCRA Cleanup Reforms is a priority for EPA and the states to ensure continued improvement of the Corrective Action program. EPA will measure progress in putting the reforms into practice. EPA recognizes program implementors are using new approaches that may or may not be highlighted in the Cleanup Reforms, and will measure progress under these approaches as well. While the ultimate goal of the Corrective Action program is to achieve final cleanups, EPA will continue to measure the near-term success of the program against its Environmental Indicator goals for controlling human exposure and migration of contaminated groundwater.

How Will EPA Involve Stakeholders in Implementing the Reforms?

EPA will provide periodic updates on the RCRA Cleanup Reforms and solicit input from stakeholders through several means, including focus meetings, Federal Register notices, the RCRA Corrective Action Newsletter, Internet postings, and press releases

EPA seeks continuous feedback from all stakeholders on the need for additional reforms beyond those already underway. EPA values and appreciates the feedback and interest of all stakeholders. However, limited resources may not allow us to respond individually. Based on stakeholder input and our ongoing assessment of the program, we will continue to refine and add to the RCRA Cleanup Reforms, as needed, and will communicate program changes.

If you would like to provide written comments on the RCRA Cleanup Reforms, please mail your comments to: RCRA Information Center (5305W), U.S. Environmental Protection Agency, Ariel Rios Building, 1200 Pennsylvania Avenue, NW, Washington, DC, 20460-0002, or send an email to the RCRA docket at rcra-docket@epa gov. Please include the following number on all correspondence, written or e-mailed, to the RCRA Information Center: F-2001-CRII-FFFFF.

For More Information

For information on corrective action cleanups, please visit state and EPA Regional web sites, which can be linked via the EPA corrective action web site at http://www epa gov/correctiveaction. The EPA corrective action web site has the latest and more detailed information on the RCRA Cleanup Reforms.

If you have questions regarding the RCRA Cleanup Reforms, please call the RCRA Hotline at 800-424-9346 or TDD 800-553-7672, or visit their web site at http://www epa.gov/epaoswer/hotline/index htm.

United States Environmental Protection Agency | Office of Solid Waste | EPA530-D-00-001 July 2001 draft http://www epa gov/correctiveaction

HANDBOOK OF GROUNDWATER PROTECTION AND CLEANUP POLICIES FOR RCRA CORRECTIVE ACTION (7/20/01)

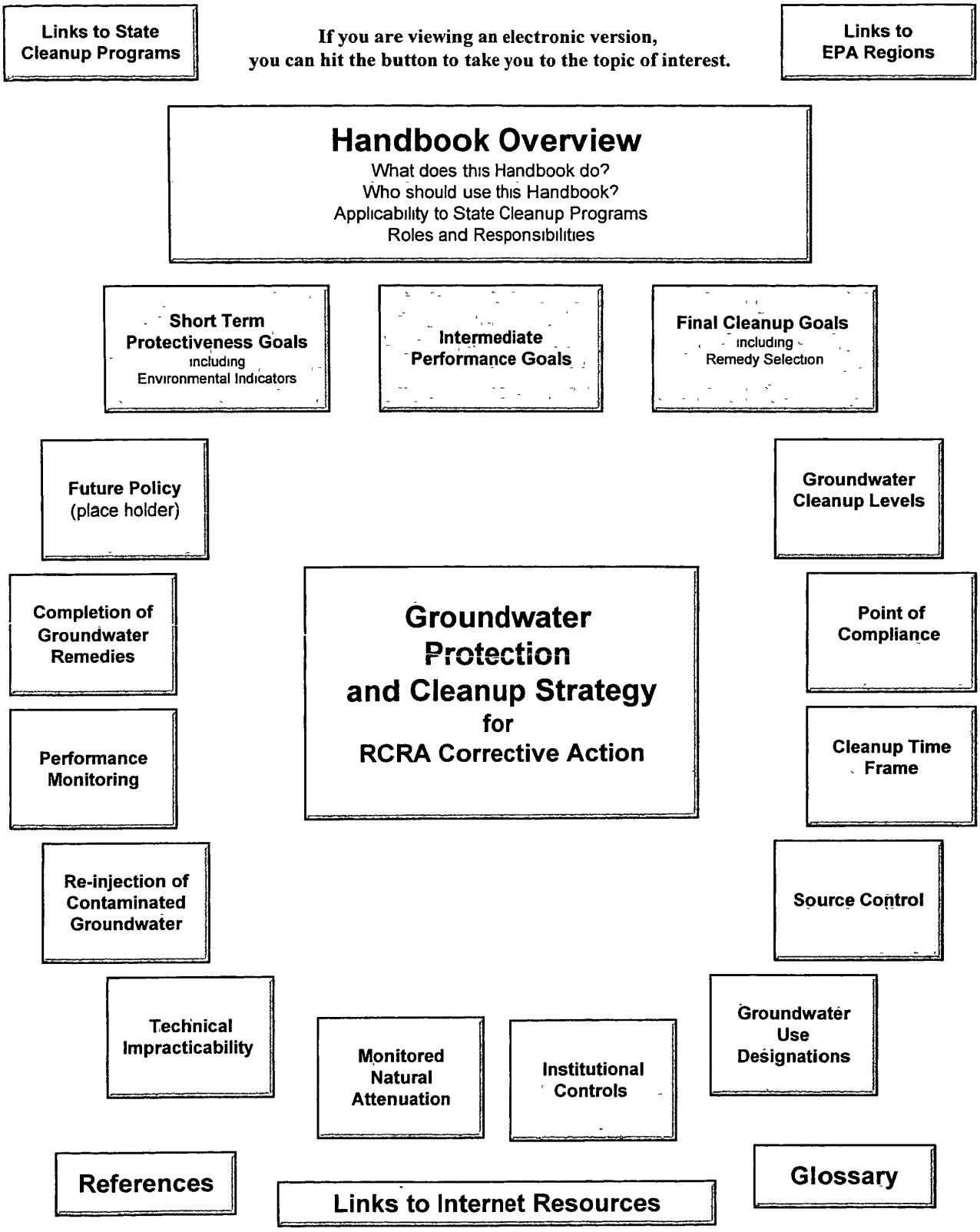
This Handbook applies to facilities that are subject to corrective action under Subtitle C of the Resource Conservation and Recovery Act.

Issued by the
Office of Solid Waste
Corrective Action Programs Branch

Note: The RCRA statutory provisions and EPA regulations referenced in this document contain legally binding requirements. This document does not substitute for those provisions or regulations, nor is it a regulation itself. Thus, it does not impose legally-binding requirements on EPA, States, or the regulated community, and may not apply to a particular situation based upon the circumstances EPA and State decision makers retain the discretion to adopt approaches on a case-by-case basis that differ from this guidance where appropriate Any decisions regarding a particular facility will be made based on the applicable statutes and regulations Therefore, interested parties are free to raise questions and objections about the appropriateness of the application of this guidance to a particular situation, and EPA will consider whether or not the recommendations or interpretations in the guidance are appropriate in that situation EPA may change this guidance in the future

Acknowledgments

This Handbook was produced by EPA's Office of Solid Waste. Contributing authors include Guy Tomassoni from the Corrective Action Programs Branch, and Deborah Goldblum and Joel Hennessy from EPA Region III's Waste and Chemicals Management Division. We express a special thanks to Joel and Deborah for their expertise, time and dedication to this effort, as well as the Region III management who supported their involvement. We also acknowledge and thank the individuals and organizations that provided comments and suggested improvements on the April 20, 2000 draft version. You can obtain copies of the actual comments by contacting the RCRA Information Center at 703/603-9230 (mentioning docket # F-2000-CURA-FFFFF).


Links to State Cleanup Programs
If you are viewing an electronic version, you can hit the button to take you to the topic of interest.
Links to EPA Regions
Handbook Overview
What does this Handbook do?
Who should use this Handbook?
Applicability to State Cleanup Programs
Roles and Responsibilities
Short Term Protectiveness Goals including Environmental Indicators
Intermediate Performance Goals
Final Cleanup Goals including Remedy Selection
Future Policy (place holder)
Groundwater Cleanup Levels
Completion of Groundwater Remedies
Point of Compliance
Groundwater Protection and Cleanup Strategy for RCRA Corrective Action
Performance Monitoring
Cleanup Time Frame
Re-injection of Contaminated Groundwater
Source Control
Technical Impracticability
Monitored Natural Attenuation
Institutional Controls
Groundwater Use Designations
References
Links to Internet Resources
Glossary

This page intentionally left blank.

Table of Contents

Overview

(Updated 7/20/01)

What does this Handbook do?

This Handbook is designed to help you as a regulator, member of the regulated community, or representative of the public find and understand EPA policies on protecting and cleaning up groundwater at Resource Conservation and Recovery Act (RCRA) corrective action facilities[1]. EPA developed this Handbook as part of the RCRA Cleanup Reforms (refer to http://www.epa.gov/epaoswer/hazwaste/ca/reforms.htm) that EPA announced in July 1999 and January 2001 (EPA, 2001a and EPA, 1999c). EPA's goal for this Handbook is that it will help meet the objectives of these reforms by reducing time-consuming uncertainties and confusion about EPA's policies concerning groundwater protection and cleanup at RCRA facilities. We believe reducing uncertainties and confusion will in turn help promote faster, focused and more flexible cleanups, and foster creative solutions.

This Handbook conveys EPA's recommendation that groundwater cleanups[2] generally be implemented in terms of short-term protectiveness goals, intermediate performance goals, and final cleanup goals. EPA recommends that facilities, regulators, and members of the public use these goals to focus discussions as well as resources, and to ultimately improve the quality of groundwater at and near corrective action facilities. EPA is issuing this Handbook to

Why is groundwater important?

Beneath the surface of the earth, a huge supply of fresh water is available to support the health and economic well-being of our country More specifically,

- ✓ Groundwater supplies drinking water to half of the nation and virtually all people living in rural areas
- ✓ Groundwater supplies the majority of water in streams and rivers in large areas of the country and provides much of the water in lakes and wetlands; these surface water bodies provide the balance of drinking water to those areas that do not rely on groundwater as their primary source for drinking water
- ✓ Groundwater supports many billions of dollars worth of food production and industrial activity

(EPA, 1999b)

[1] This Handbook primarily addresses corrective action as required by the 1984 Hazardous and Solid Waste Amendments (HSWA) to RCRA For additional background regarding RCRA in general, refer to the RCRA Orientation Manual available at http //www epa gov/epaoswer/general/orientat/. For more information about RCRA corrective action, refer to the corrective action web site at http //www epa gov/correctiveaction

[2] The terms cleanup or cleaning up, when used in this Handbook, refer to the range of activities that could occur in the context of addressing environmental contamination at RCRA facilities For example, cleanup activities could include removing waste or contaminated media (e g., excavation, pumping groundwater, etc.), in-place treatment of the waste or contaminated media (e g , bioremediation), containment of the waste or contaminated media (e g , barrier walls, low-permeable covers, liners, etc), or various combinations of these approaches. The term "cleanup" is often used interchangeably with the term "remediate" or "remediation "

communicate what EPA believes should generally occur at RCRA corrective action facilities to protect human health and the environment.

How do the policies described in this Handbook differ from requirements?

Among other differences, policies are not enforceable requirements as are regulations and statutes. However, policies can become enforceable when they are included in regulatory tools such as permits and administrative orders.

Who should use this Handbook?

This Handbook is designed to help anyone who wants to develop a better understanding of EPA's groundwater cleanup policies for RCRA corrective action facilities. We wrote this Handbook for state and EPA regulators, owners and operators of facilities subject to RCRA corrective action, and members of the public. Throughout the rest of this Handbook we will refer to these three groups as regulators, facilities, and the public, respectively. Sometimes, we will refer to all three groups collectively as "stakeholders."

How will this Handbook help me?

If you are a regulator, the Handbook can help clarify key groundwater-related policies that you should consider, where appropriate, to guide investigations and cleanups at your assigned facilities (via permits, orders or voluntary actions). EPA encourages you to use this Handbook to do your part in promoting a technically sound, reasonable[3], and consistent approach to protecting and cleaning up our nation's groundwater.

If you represent a facility, the Handbook can help you reduce your uncertainties about the actions a regulator may require of you. Reducing uncertainties can help you in your financial planning and project management in general. Clarity in EPA's general expectations will allow you to phase your investigation and cleanup strategy in a manner consistent with the RCRA Corrective Action program priorities. These policies can help if you are currently undergoing RCRA corrective action under some form of regulatory oversight, or if you intend to begin cleanup in advance of oversight by an EPA or state regulator.

If you are a member of the public, this Handbook can help you understand what EPA generally expects regulators and facilities to do during an investigation and cleanup of contaminated groundwater at a RCRA corrective action facility. EPA encourages you to use this Handbook as a tool in your interaction with regulators or facilities. In essence, EPA wrote this Handbook to help you influence decisions related to groundwater protection and cleanup at RCRA corrective action facilities.

---

[3] EPA acknowledges that the term "reasonable" may mean different things to different people In the context of this Handbook, the lead regulator responsible for ensuring the facility meets corrective action goals should define what is reasonable on a facility-specific basis with input from interested stakeholders

What does the RCRA Corrective Action program do?

Accidents or other activities at RCRA facilities have sometimes released hazardous waste or hazardous constituents into soil, groundwater, surface water, or air. The Corrective Action program requires such facilities to conduct investigations and cleanup actions as necessary to protect human health and the environment. Currently, EPA believes that there are over 6,000 facilities subject to RCRA corrective action. Of these, approximately 3,700 facilities have corrective action already underway or will need to implement as necessary corrective action as part of the process to obtain a permit to treat, store or dispose of hazardous waste. To help prioritize resources, EPA established specific goals for 1,714 facilities[4] that generally warrant attention in the next several years.

EPA's authority to require facility-wide corrective action comes from the Resource Conservation and Recovery Act (RCRA). Specific sections of that statute regulators can use to require corrective action (or aspects of corrective action) include· 3004(u)&(v), 3005(c)(3), 3008(h), 3013, and 7003. EPA's regulatory provisions for corrective action at permitted facilities is found primarily in 40 CFR Part 264 Subpart F. EPA provides additional direction on corrective action through guidance, policy directives and related regulations. The most recent and comprehensive guidance issued for RCRA corrective action is in Section III (pages 19440-19455) of the May 1, 1996 Advance Notice of Proposed Rulemaking (ANPR; EPA, 1996a; 61 FR 19431, available at http://www epa.gov/docs/fedrgstr/EPA-WASTE/1996/May/Day-01/pr-547 pdf).

If you are relatively new to RCRA corrective action, you can learn more about the program by referring to the background information at http://www.epa.gov/correctiveaction/backgnd htm.

What are the general roles and responsibilities of various stakeholders involved with RCRA corrective action?

EPA Headquarters

EPA Headquarters oversees the national Corrective Action program through its Office of Solid Waste and its Office of Site Remediation Enforcement. In general, major responsibilities of these offices for corrective action include: developing goals for the regional Corrective Action programs and monitoring progress toward those goals; developing regulations, policies and guidance on implementing corrective action; providing technical and policy assistance; acting as a liaison to other EPA programs (e.g., Superfund) and federal agencies (e.g., Departments of Defense and Energy) involved in cleanup issues; providing information and testimony to Congress; and, seeking input from outside stakeholders (e g , regulated community, public interest groups, environmental groups, etc.) to consider various and diverse interests.

---

[4] You can refer to http //www epa gov/correctiveaction/facility htm for additional information about these 1,714 facilities

Lead Regulators

Typically, there will be a "lead regulator" who is the first-line staff person for the government authority that is responsible for ensuring that a facility implements corrective action as necessary to meet facility-specific corrective action goals. The lead regulator could either be a federal employee working in an EPA regional office or an employee of a particular state or territory. The lead regulator is typically responsible for a variety of activities, including, for example:

- drafting permits, orders, or voluntary agreements
- reviewing documents developed by the facility
- recommending facility-specific approaches and, where appropriate, making decisions pertaining to a variety of corrective action issues
- ensuring the public has opportunities to provide input on corrective action issues.

EPA Regional Offices

EPA's ten regional offices (http://www epa gov/correctiveaction/regions.htm) typically have a lead role for corrective action at facilities located in states that have not yet been authorized to implement corrective action. Sometimes, EPA may continue carrying out lead regulator responsibilities during early stages of a newly authorized state cleanup program. Furthermore, EPA also may have the lead role on specific corrective action enforcement related issues (e.g., issuing administrative orders) in both authorized and unauthorized states.

EPA's regional offices are also responsible for overseeing state programs in situations where the state has the lead role for implementing corrective action. Responsibilities for that oversight role include, for example establishing goals, tracking progress and reporting progress to EPA headquarters, developing and distributing guidance; contributing to EPA Headquarters initiatives (e.g., supplying comments on guidance, regulations, etc); conducting training; and, providing facility-specific assistance on technical, policy and public participation issues.

States and Territories

States or territories (http://www epa gov/correctiveaction/state htm) could have the lead role in implementing corrective action at a particular facility where: (1) EPA has authorized the state corrective action program, or (2) an EPA regional office has entered into a "worksharing agreement" with either an unauthorized or authorized state program. EPA Headquarters supports the variety of creative approaches EPA regions and states/territories use to work together toward achieving corrective action goals.

As of July 2001, EPA has authorized 38 states and territories for facility-wide corrective action. EPA's authorization of a state Corrective Action program is based on an evaluation that the state is capable of implementing corrective action equivalently to EPA, and in manner consistent with applicable federal statutes, regulations and guidance. These authorized states have the primary responsibility for corrective action at hazardous waste treatment, storage and disposal facilities

(TSDFs). This responsibility includes making decisions dealing with the policies addressed in this Handbook. You can refer to http://www.epa.gov/epaoswer/hazwaste/state/charts/chart2.pdf or http://www.epa.gov/ epaoswer/hazwaste/state/maps/coract.pdf for a current list or map, respectively, of the states authorized to implement RCRA corrective action.

Facilities

Facilities subject to RCRA corrective action are responsible for conducting investigations and cleanups as necessary to protect human health and the environment. Facilities subject to a permit, order or sometimes even a voluntary agreement typically present their recommendations for investigation and cleanup activities to the lead regulator for review and approval. However, many facilities are also pro-actively conducting investigations and cleanup actions in advance of oversight[5] by a state or EPA regulator. Additionally, many facilities are also assuming greater responsibility to involve the public throughout corrective action.

Public

EPA strongly encourages the public to get involved with corrective action to help ensure protection of human health and the environment in which they live. The RCRA statute, EPA's regulations and detailed guidance describe a variety of public involvement opportunities and activities. The following activities are just some actions you (see highlight box) can take to help influence corrective action decisions:

Who is the public?

The "public" in the context of RCRA refers not only to private citizens, but also representatives of consumer, environmental, and minority associations, trade, industrial, agricultural, and labor organizations, public health, scientific, and professional societies, civic associations; public officials, and government and educational associations

- find out if a particular facility of interest is on a list of facilities EPA believes warrant attention in the next several years (http://www.epa.gov/correctiveaction/lists/base_sta.pdf)

- contact the state (http://www.epa.gov/correctiveaction/state htm) or EPA region (http://www.epa gov/correctiveaction/regions htm) to identify the lead regulator ask for your name to be placed on mailing lists for notices, fact sheets and other documents distributed by EPA, the state, or the facility actively participate in public hearings and other meetings.

---

[5] To avoid duplicating efforts and to ensure compliance with applicable laws and regulations, EPA strongly recommends that facilities conducting cleanup actions without oversight by an EPA or state regulator do so with a clear understanding of applicable state and EPA requirements and implementation guidance In particular, facilities should be fully aware of requirements associated with managing remediation waste For more information about federal requirements and implementation guidance associated with remediation waste, you should refer to http //www epa gov/correctiveaction/resource/guidance htm#Remediation Waste

For a more complete list of activities as well as other detailed guidance pertaining to public participation, you should refer to EPA's 1996 RCRA Public Participation Manual (EPA, 1996d) available at http //www.epa.gov/epaoswer/hazwaste/permit/pubpart/manual htm. You can also contact EPA regional and state offices to determine whether they have additional guidance concerning public involvement at corrective action facilities.

How do the policies in this Handbook apply to state cleanup programs?

EPA expects states to consider this guidance carefully when they have a lead role in implementing cleanups at RCRA corrective action facilities However, as mentioned previously, this document reflects Agency guidance and is not a binding statute or regulation. Therefore, states have considerable latitude in making decisions that would lead to equivalent levels of protection EPA would achieve if the federal government were implementing the program. Also, it is extremely important that Handbook users consult with the state cleanup program prior to conducting corrective action to ensure that state requirements and guidance are addressed. Some specific examples you should be aware of with regard to state cleanup programs include:

- Some states have their own specific requirements regarding administrative procedures and cleanup criteria (e g., primary and secondary drinking water standards, risk levels, exposure scenarios for closing waste management units, etc.) - such states may not be able to take advantage of some of the approaches described in this Handbook
- Regulators (both state and federal) typically make investigation and cleanup decisions on a case-by-case basis; therefore, a particular approach used at one facility may be inappropriate at another facility

TOPICS PRESENTED*

- Groundwater Protection and Cleanup Strategy
- Short-Term Protectiveness Goals
- Intermediate Performance Goals
- Final Cleanup Goals
- Groundwater Cleanup Levels
- Point of Compliance
- Cleanup Time Frame
- Source Control
- Groundwater Use Designation
- Institutional Controls
- Monitored Natural Attenuation
- Technical Impracticability
- Re-injection of Contaminated Groundwater
- Performance Monitoring
- Completion of Groundwater Remedies

* See below discussion (or click here) to see how EPA intends keep this Handbook current

How is this Handbook organized?

EPA organized this Handbook to address its overall implementation strategy for contaminated groundwater and to summarize and clarify policies that are very often the subject of questions and some confusion While some topics deal with broader issues, the primary focus of this Handbook is on groundwater Furthermore, the topics addressed in this Handbook predominantly were designed to address facilities undergoing facility-wide corrective action under RCRA §3004(u) and (v), and §3008(h) that were enacted as part of the Hazardous and Solid Waste Amendments (HSWA) to RCRA. However,

the policies on groundwater cleanup levels and points of compliance address some questions unique to corrective action at RCRA regulated units[6]. You should be aware that 40 CFR 264, Subpart F includes specific groundwater monitoring and corrective action requirements for RCRA regulated units[7].

Note that key topics mentioned within the text are often underlined and "hyperlinked." This feature allows you to recognize and quickly go to topics that are expanded elsewhere in the Handbook.

Where do the policies in this Handbook come from?

Most of the topics in this Handbook are already addressed in an existing EPA guidance document, directive or memorandum. We do not intend for this Handbook to replace or otherwise supercede previous guidance, but it does reflect EPA's latest thinking on groundwater policies for RCRA corrective action.

You will notice that many of the policies come from Section III of the May 1, 1996 Advance Notice of Proposed Rulemaking (ANPR; EPA, 1996a) that is available at http://www.epa.gov/docs/fedrgstr/EPA-WASTE/1996/May/Day-01/pr-547.pdf. EPA issued the ANPR in part to seek public comment on how to address the proposed regulations for corrective action (55 FR 30798; Subpart S, July 27 1990). After considering comments on the ANPR, EPA opted against finalizing these regulations because, among other things, the Agency decided it was not necessary for successful implementation of the program. In fact, since a majority of the states and territories were already authorized to implement facility-wide corrective action in lieu of EPA, and several others were seeking authorization, EPA decided that issuing corrective action regulations would be unnecessarily disruptive. In an October 7, 1999 Federal Register Notice (64 FR 54604; EPA, 1999a), EPA announced its withdrawal of most of the provisions of 1990 proposed corrective action regulations. In this notice, EPA stated that rather than issuing a rule to achieve consistency at all facilities, it would be more appropriate to develop guidance and

---

[6] Regulated Units are defined in 40 CFR 264.90 (available through http //www.access gpo gov/nara/cfr/cfr-retrieve html#page1) as surface impoundments, waste piles, land treatment units, and landfills that received hazardous wastes after July 26, 1982.

[7] A recent rulemaking (Post-Closure Regulations (EPA, 1998e), 63 FR 56710, October 22, 1999, available at http //www epa.gov/fedrgstr/EPA-WASTE/1998/October/Day-22/f28221 pdf) provides flexibility for regulators to allow alternative requirements for groundwater monitoring and corrective action for releases to groundwater if (1) the regulated unit is situated among solid waste management units (SWMUs) or areas of concern (AOCs) that appear to have contributed to the same release and (2) the alternative requirements will protect human health and the environment (see 264 90(f)). EPA encourages states to adopt and seek authorization for this provision, either separately or as part of the full post-closure rule, but, some states might choose not to adopt all or parts of this rule Pending authorization or adoption for this portion of the post-closure rule, states authorized for corrective action would be able to implement the provision if they could do so as a matter of state law, and they implemented it in a way that was no less stringent than federal requirements For more detail on authorization for the post-closure rule see the preamble to the rule.

training to promote consistency, where appropriate. This Handbook is an example of such guidance.

The October 7, 1999 notice also stated that Section III of the ANPR should serve as the primary corrective action implementation guidance. For that reason, the ANPR is a key reference for many of the topics in this Handbook. Section V of the ANPR requested comments on a number of topics addressed in this Handbook, such as the point of compliance. This Handbook does not foreclose further discussion of issues raised for comment in the ANPR, and EPA intends to update this Handbook as the Corrective Action program continues to evolve.

EPA recognizes that some elements in this Handbook may appear new because of the names used to describe them For example, "Intermediate Performance Goals" is a term introduced in this Handbook, however, it is consistent with the phased approach to corrective action EPA emphasized in the ANPR and other guidance going back to the early 1990s (EPA, 1991a and EPA, 1990).

You may also notice that the choice of words to describe a policy in this Handbook may differ from the words in the ANPR or original source of the policy; however, the substance of the policy remains the same. There are two primary reasons for this difference. First, we wrote this document in "plain language" and second, the terminology in RCRA is evolving.

"Plain language" uses everyday words, active voice and shorter sentences. This style is designed to make documents easier to read and more understandable to the public. While it may appear at times that EPA has changed its position on a topic because EPA selected different words, the policy is actually still be the same. For example, the Handbook recommends several factors for assessing use, value and vulnerability of groundwater. These factors are the same factors as those listed in the Comprehensive State Groundwater Protection Program ("CSGWPP") Guidance (EPA, 1992a), except we modified the words to meet the goals of plain language.

Another source of perceived change stems from the maturing of RCRA corrective action terminology[8]. As the program has evolved, so have RCRA definitions For example RCRA's early guidance, Subpart S and the ANPR referred to point of compliance only in the context of final cleanup. We now formally recognize that the concept of "point of compliance" can be used in the context of short-term, intermediate and final cleanup goals. We made this change because we recognized that the general definition of point of compliance applies to a variety of situations where regulators require facilities to achieve certain concentrations of chemicals in groundwater.

Are the policies contained in this Handbook consistent with EPA's other cleanup programs?

The basic approaches described in this Handbook are consistent with EPA's Superfund, Underground Storage Tank and Brownfields cleanup programs. Much of the Handbook is derived from guidance developed jointly by EPA's cleanup programs (e.g , Use of Monitored Natural Attenuation at Superfund, RCRA and Underground Storage Tank Sites (EPA, 1999d))

---

[8] Note, some states may have their own terms to describe similar concepts addressed in this Handbook.

This Handbook, therefore, is consistent with EPA's long-standing goal for EPA's cleanup programs to yield similar remedies in similar circumstances. To learn more specifically about RCRA-CERCLA coordination issues, you should refer to, "Coordination between RCRA Corrective Action and Closure and CERCLA Site Activities" (EPA, 1996b) available at http://www.epa.gov/correctiveaction/resource/guidance/gen_ca/coordmem.pdf and the RCRA-CERCLA deferral policy found in 54 FR 41004-41006 (October 4, 1989b). For more detailed information about EPA's Superfund, Underground Storage Tank, and Brownfields cleanup programs, you can link to their respective Internet Web sites found in Appendix 2.

How will I know that the policies in this Handbook are current?

EPA intends to update this Handbook as necessary to add new topics, new policies, or to change or clarify existing policies. Therefore, if you are reading a printed copy of this Handbook, we urge you to access the electronic version available via the Internet at http://www.epa.gov/correctiveaction/resource/ guidance/gw_use/gwhandbk/gwhandbook.htm that EPA will keep up-to-date. The front page of the Internet version will indicate the most recent date EPA revised the Handbook (e.g., Updated _____). Additionally, the top of each policy section includes the date of the most recent revision. You should compare this date to the Internet version to ensure that you are reading the Agency's most current guidance.

How can I get further information about the policies in this Handbook?

You can get further information on policies in this Handbook in several ways. You can refer to the references at the end of each policy or to the complete list of references at the end of the Handbook in Appendix 1. Note that most references provide an Internet Web address and a "hotlink" that allows you to directly access the document of interest. You can also get more information by contacting individuals in EPA Regional or state cleanup programs. If you are viewing this document electronically and have access to the Internet, you can press the link to state or EPA program buttons on the interactive button page at the beginning of the Handbook to guide you to contacts in EPA or state offices. Internet Web links are also provided in Appendix 2 to help you find more information. Lastly, if you are uncertain a meaning of a term, you can refer to the glossary provided in Appendix 3.

References:

EPA, 2001a. RCRA Cleanup Reforms Round II - Fostering Creative Solutions (EPA-530-F-01-001, January). Available at http://www.epa.gov/epaoswer/hazwaste/ca/reforms.htm.

EPA, 1999a. Corrective for Solid Waste Management Units at Hazardous Waste Management Facilities (64 FR 54604, October 7). Available at http://www.epa.gov/correctiveaction/resource/guidance/ gen_ca/withdrwl.htm.

EPA, 1999b. Safe Drinking Water Act, Section 1429 Groundwater Report to Congress. EPA-816-R-99-016; October, 1999. Available at http://www.epa.gov/ogwdw000/gwr/finalgw.pdf.

EPA, 1999c. RCRA Cleanup Reforms (EPA530-F-99-018). For more information, refer to http://www.epa.gov/epaoswer/osw/factsheet1.pdf.

EPA, 1999d. Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action and Underground Storage Tank Sites (April 21) OSWER Policy Directive 9200.4-17P. Available at http://www.epa.gov/swerust1/directiv/d9200417.htm. Other helpful links regarding MNA available at http://www.epa.gov/swerust1/mna/index.htm and http://www.epa.gov/swerust1/oswermna/mnalinks.htm

EPA, 1998a RCRA Orientation Manual (EPA530-R-98-004). Available at http://www.epa.gov/epaoswer/general/orientat/index.htm.

EPA, 1998e. Standards Applicable to Owners and Operators of Closed and Closing Hazardous Waste Management Facilities· Post-Closure Permit Requirement and Closure Process; Final Rule (63 FR 56710). Available at http://www.epa.gov/fedrgstr/EPA-WASTE/1998/October/Day-22/f28221.pdf

EPA, 1997a. Memorandum from Elliott P. Laws and Steven A. Herman to RCRA/CERCLA Senior Policy Managers titled, "Use of the Corrective Action Advance Notice of Proposed Rulemaking as Guidance" (January 17). Available at http://www.epa.gov/correctiveaction.

EPA, 1996a. Advance Notice of Proposed Rulemaking (61 FR 19432, May 1). Available at http://www.epa.gov/docs/fedrgstr/EPA-WASTE/1996/May/Day-01/pr-547.pdf. Particularly relevant pages: 19448-52.

EPA, 1997b Rules of Thumb for Superfund Remedy Selection (EPA 540-R-97-013). Available at http://www.epa.gov/superfund/resources/rules/rulesthm.pdf.

EPA, 1996b Memorandum from Steven A. Herman and Elliott P. Laws to RCRA/CERCLA Senior Policy Managers titled, "Coordination between RCRA Corrective Action and Closure and CERCLA Site Activities" (September 24). Available at http://www.epa.gov/correctiveaction/resource/guidance/gen_ca/coordmem.pdf.

EPA, 1996d. RCRA Public Participation Manual (EPA530-R-96-007) Available at http://www.epa.gov/epaoswer/hazwaste/permit/pubpart/manual.htm Particularly relevant pages: 2.5-2.7.

EPA, 1991a Managing the Corrective Action Program for Environmental Results: The RCRA Stabilization Effort (October 25). Available at http://yosemite.epa.gov/osw/rcra.nsf/d8382df2d09b6466852565280051974 5/27d1baa5c1dbb8f38525670f006be76d?OpenDocument.

EPA, 1990. The Nation's Hazardous Waste Management Program at a Crossroads: The RCRA Implementation Study (EPA/530-SW-90-069).

EPA, 1989b. National Priorities List for Uncontrolled Hazardous Waste Sites - Final Rule Covering Sites Subject to the Subtitle C Corrective Action Authorities of the Resource Conservation and Recovery Act (commonly referred to as the RCRA Deferral Policy). Available in Section V which appears on 54 FR 41004-41006. Available at http://www.epa.gov/superfund/sites/npl/f891004.htm#41000.

1. Groundwater Protection and Cleanup Strategy
(Updated 7/20/01)

What is EPA's groundwater protection and cleanup strategy for RCRA corrective action?

EPA's groundwater strategy is generally to focus resources at facilities that warrant attention in the near term, control short-term threats, prioritize actions within facilities to address the greatest risks first, and make progress toward the ultimate goal of returning contaminated groundwater to its maximum beneficial use[1]. This strategy guides regulators and facilities toward achieving environmental results rather than following any particular administrative process, and emphasizes clear communication among all stakeholders. Tthis strategy is consistent with the phased approaches recommended in past Agency guidance (EPA, 1990, EPA, 1991a; EPA, 1996a; EPA, 1996c, and others), and is also consistent with EPA's overall groundwater protection and cleanup goals described below.

How does this strategy benefit the public, regulators and facilities?

This strategy benefits the public because it promotes early actions and continued progress toward our overall groundwater protection and cleanup goals Regulators benefit because it helps them focus their oversight resources on defining, tracking, and, if necessary, enforcing measurable milestones. Facilities benefit because the strategy helps them plan for investigation and cleanup actions.

Rationale for
Groundwater Protection and Cleanup Strategy

Based on EPA's experience with environmental cleanups over the past 20 years, it is clear that addressing contaminated groundwater is challenging from both a resource as well as technology perspective Therefore, EPA believes its strategy involving short-term, intermediate and final goals provides a realistic approach that focuses resources on the greatest threats first and emphasizes results rather than a particular process This strategy emphasizes protection and cleanup of groundwater by using meaningful and measurable milestones as well as clear and effective communication

What is EPA's overall goal for groundwater protection and cleanup?

EPA's overall goal with respect to groundwater is to prevent adverse effects to human health and the environment and to protect the environmental integrity of the nation's groundwater resources (EPA, 1991b). EPA believes that short-term prevention and long-term cleanup goals are both essential elements of its strategy to achieve EPA's overall goal that

[1] EPA recognizes that groundwater serves a variety of uses and purposes, including for example, drinking water, agricultural irrigation, discharge to adjacent groundwater and surface water bodies, etc. As such, EPA also recognizes that there could be a variety of ways humans as well as ecological receptors (including aquatic fauna that resides in groundwater) can be exposed to contaminated groundwater Within the range of reasonably expected uses and exposures, the maximum beneficial groundwater use is the one that warrants the most stringent groundwater cleanup levels and approaches

includes protecting human health and the environment for the present as well as future generations.

With respect to prevention, we should: (1) protect groundwater to ensure that the nation's public and private drinking water supplies, including those currently used as well as those reasonably expected to be used, do not cause adverse health effects both in the short term as well as for future generations; and, (2) protect groundwater to avoid negative impacts to ecosystems such as those caused by contaminated groundwater flowing into surface water (EPA, 1991b).

With respect to cleanup of contaminated groundwater, facilities as well as regulators should: (1) prioritize cleanup activities to limit the risk to human health first; and then, (2) restore[2] currently used and reasonably expected sources of drinking water and groundwater closely hydraulically connected to surface waters, whenever such restorations are practicable and attainable (EPA, 1991b).

EPA believes that stakeholders evaluating appropriate prevention and cleanup strategies should consider use, value and vulnerability of the groundwater resources, as well as social and economic values. For more information regarding this overall goal, you should refer to "Protecting the Nation's Groundwater: EPA's Strategy for the 1990's" (EPA, 1991b). The groundwater protection and cleanup strategy presented in this Handbook supports EPA's overall groundwater goals

How should facilities and regulators implement this groundwater protection and cleanup strategy for RCRA corrective action?

EPA recommends that regulators and facilities implement this strategy in terms of short-term protectiveness goals, intermediate performance goals, and final cleanup goals. You can find more detailed descriptions of these goals later in this Handbook.

How do short-term, intermediate and final cleanup goals work together to achieve EPA's overall groundwater goals?

EPA believes its strategy (see Figure 1 - next page) to implement corrective action in terms of short-term, intermediate and final cleanup goals is an efficient and effective way to satisfy RCRA's statutory mandate to protect human health and the environment both now and in the future. EPA does not view these three goals as discrete elements; rather, EPA designed them to support each other toward achieving EPA's overall groundwater protection and cleanup goals.

---

[2] The term "restore" or "restoration" used in this context refers to achieving a certain cleanup level(s) developed to ensure protection based on maximum beneficial use of the groundwater at a particular facility. Restoring contaminated groundwater does not necessarily imply cleanup to pristine conditions

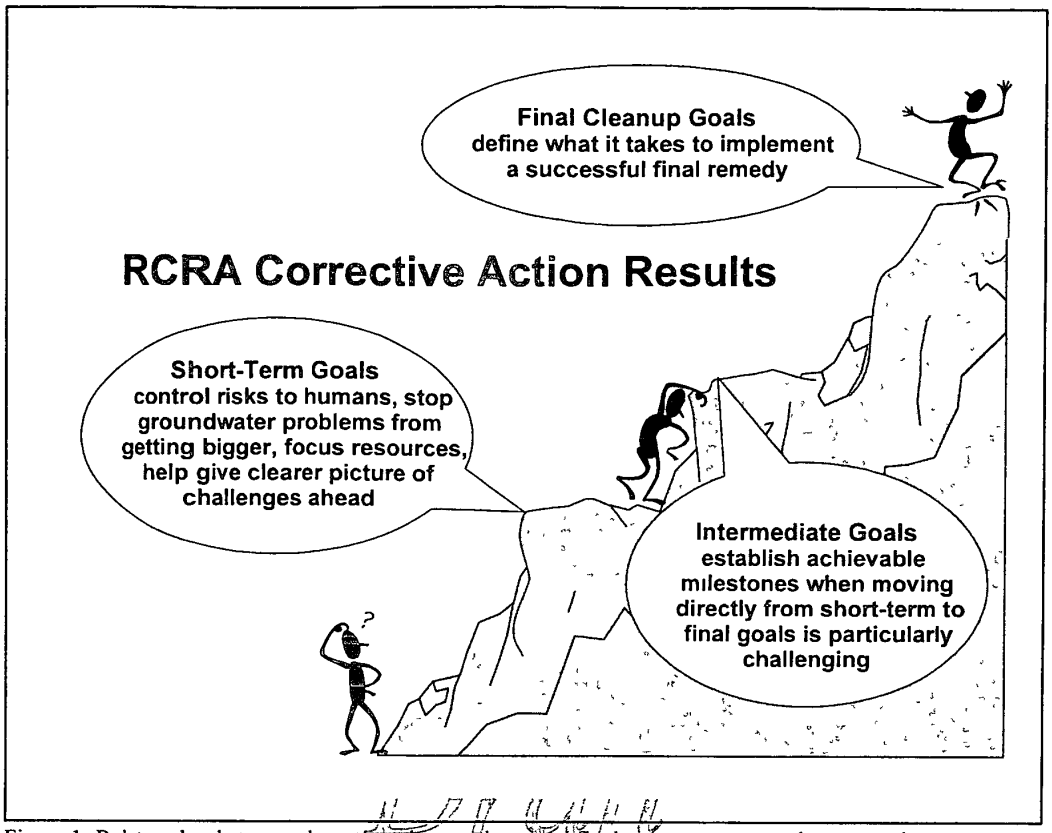


Figure 1· Relationship between short-term, intermediate, and final corrective action cleanup goals

In the short-term[3], EPA believes it is important that facilities take actions as soon as possible to ensure that (1) humans are not being exposed to unacceptable levels of contamination, and (2) that contaminated groundwater is not continuing to migrate beyond its current extent[4]. EPA measures these short-term protectiveness goals with two environmental indicators[5] called Current Human Exposures Under Control and Migration of Contaminated Groundwater Under Control (EPA, 1999e). EPA has found that these environmental indicators are proving to have benefits beyond just demonstrating facilities are meeting these two important goals. For example, clear, achievable and meaningful milestones associated with environmental indicators help promote

[3] Short-term in this context refers to the Corrective Action Program's year 2005 goals EPA established in response to the Government Performance and Results Act. You should refer to the Short-Term Protectiveness Goals section of this Handbook for more specific information pertaining to these short-term goals

[4] Cleaning up contaminated groundwater can be very challenging, therefore, this element of the overall strategy is designed to prevent our existing problems associated with contaminated groundwater from getting worse

[5] You can learn more about these two indicators at http //www epa gov/correctiveaction/eis htm

effective working relationships between stakeholders; these relationships often foster creative results-based approaches that are increasing the overall pace, efficiency and effectiveness of subsequent actions leading to final cleanup goals. Furthermore, the actions facilities take to achieve these goals should help facilities ultimately achieve the final goals. For example, stopping a plume of contaminated groundwater from getting bigger in the short term limits the extent of the problem the facility will have to address to achieve final cleanup goals.

With respect to final cleanup goals for contaminated groundwater, EPA generally expects[6] to return usable groundwater to its maximum beneficial use wherever practicable within a time frame that is reasonable given the particular circumstances of the facility. EPA recognizes, however, that some states determine that certain groundwater is either not usable and/or they have no intention to use it in the foreseeable future[7]. For such situations, EPA acknowledges that final cleanup goals such as source control and long-term plume containment may provide an appropriate level of protection to human health and the environment (EPA, 1996c and 1997b). However, prior to selecting such alternatives, regulators should ensure that other exposures to contaminants in or from groundwater do not exist and the groundwater is not used for purposes not recognized in, for example, a "non-use" state designation. Regardless of the approach, clear final cleanup goals are important because they provide the target to which regulators and facilities should focus all activities. Establishing clear final cleanup goals generally will also help facilities determine what they will have to do to implement a successful final remedy.

EPA believes that intermediate performance goals can often serve as helpful milestones between short-term and final cleanup goals. EPA recognizes, as does the general scientific community (NRC, 1994), that achieving cleanup goals for contaminated groundwater can be very challenging. For some facilities, these challenges can appear to be so insurmountable that moving directly to, for example, returning all of the contaminated groundwater to its maximum beneficial use diminishes the ability for regulators and facilities to identify a realistic path forward. Therefore, for such facilities, EPA recommends that facilities and regulators consider developing a series of facility-specific intermediate performance goals designed to promote continuous progress toward the final cleanup goals.

How should facilities and regulators implement these goals?

EPA recommends that facilities implement short-term protectiveness, intermediate performance, and final cleanup goals in terms of clearly defined, facility-specific media cleanup objectives. These objectives typically include elements that clearly define "what, where and when." The

---

[6] See glossary to definition of "remedial expectation" used in the context of the RCRA Corrective Program.

[7] EPA recognizes that most states classify the majority of their groundwater as potential sources of drinking water. You should refer to the Final Remedy, Point of Compliance and Groundwater Use Designation sections of this Handbook for further discussion on final cleanup goals, the role of groundwater use in the RCRA Corrective Action program, as well as additional guidance concerning groundwater use decisions and exposures associated with various uses/purposes of groundwater.

first element defines what action the facility should conduct. The second element defines where the specific action should take place. The third element defines when the facility should implement and complete an action.

Along with defining "what, where and when," EPA also recommends that facilities and regulators describe actions in terms of "who, why, and how." Describing "who" performs an action helps communicate to the public the different roles and responsibilities of the facility and the regulator. Describing "why" provides the opportunity to explain the relationship between particular actions and how they help achieve short-term, intermediate or final goals. And lastly, describing "how" ensures that stakeholders understand the techniques and approaches that a facility will use to implement an activity.

This concept of implementing goals in terms of "what, where and when" is not a new approach to corrective action but rather a clarification of "cleanup objectives" as described in the May 1, 1996 Advance Notice of Proposed Rulemaking (ANPR - EPA, 1996a; page 19449). For example, to measure achievement of final groundwater cleanup goals, the ANPR described final cleanup objectives in terms of (1) groundwater cleanup levels, (2) the point of compliance, and (3) cleanup time frames[8] (see EPA, 1996a - page 19449). For such final groundwater remedies, groundwater cleanup levels represent the "what," point of compliance represents the "where" and cleanup time frames represent the "when" associated with implementing a groundwater remedy and estimates on how long it would take to achieve the final cleanup goals

EPA believes retaining the terms groundwater cleanup levels, point of compliance and cleanup time frame continue to be useful, but now recognizes that these terms may be applicable in certain circumstances to short-term and intermediate goals as well. For example, to demonstrate the environmental indicator "Migration of Contaminated Groundwater Under Control," you can consider the levels the facility needs to achieve along the plume boundary as "groundwater cleanup levels," the plume boundary as a "point of compliance," and the schedule to achieve this environmental indicator the "cleanup time frame."

On the other hand, certain groundwater objectives may be more appropriately expressed in terms of "what" "where" and "when." For example, if a facility needs to provide water to residential homes to meet the "Human Exposures Under Control" environmental indicator, the "what" could be the mechanism to provide water, the "where" could be defining the individuals which need the alternative water supply, and the "when" could describe the schedule for implementation.

EPA encourages facilities and regulators to describe short-term, intermediate and final cleanup goals in terms of "what, where, when, who, why and how" to enhance and clarify communication among all stakeholders.

---

[8] Previous guidance (EPA, 1996a) referred to "Cleanup time frames" as compliance time frames.

References:

EPA, 1999e. Interim Final Guidance for RCRA Corrective Action Environmental Indicators (February 5). Available at www.epa.gov/epaoswer/osw/ei_guida.pdf.

EPA, 1997b. Rules of Thumb for Superfund Remedy Selection (EPA 540-R-97-013). Available at http://www.epa.gov/superfund/resources/rules/rulesthm.pdf. Particularly relevant page: 17.

EPA, 1996a. Advance Notice of Proposed Rulemaking (61 FR 19432, May 1). Available at http://www.epa.gov/docs/fedrgstr/EPA-WASTE/1996/May/Day-01/pr-547.pdf. Particularly relevant pages: 19448-52.

EPA, 1996c. Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Groundwater at CERCLA Sites (EOA 540/R-96/023, October). Available at http://www.epa.gov/superfund/resources/gwguide/index.htm. Particularly relevant pages: 15-17.

EPA, 1991b. Protecting the Nation's Groundwater: EPA's Strategy for the 1990's. Office of the Administrator. Washington, D.C. For more information, refer to http://www.epa.gov/OGWDW/Pubs/11ground.html.

EPA, 1990. The Nation's Hazardous Waste Management Program at a Crossroads: The RCRA Implementation Study (EPA/530-SW-90-069).

NRC, 1994. *Alternatives for Ground Water Cleanup* / Committee on Ground Water Cleanup Alternatives, Water Science and Technology Board, Board on Radioactive Waste Management, Commission on Geosciences, Environment, and Resources, National Research Council. National Academy Press, 1994. Available at http://www.nap.edu/books/0309049946/html/.

2. Short-Term Protectiveness (Environmental Indicator) Goals
(Updated 7/20/01)

What are EPA's short-term protectiveness goals for groundwater?

EPA's short-term goals associated with groundwater[1] are to ensure that (1) humans are not being exposed to unacceptable levels of contamination, and (2) contaminated groundwater is not migrating above levels of concern[2] beyond its current extent (EPA, 1999e).

How does EPA monitor progress toward these goals?

EPA developed two facility-wide "environmental indicators" to help monitor progress in achieving these short-term protectiveness goals on a national basis. The two environmental indicators (EIs) are called **"Current Human Exposures Under Control"** and **"Migration of Contaminated Groundwater Under Control."** EPA commonly refers to these two environmental indicators as the Human EI and Groundwater EI, respectively. In general terms, these measures indicate current "environmental conditions"--whether people are currently being exposed to environmental contamination at unacceptable levels, and whether any existing plumes of contaminated groundwater are getting larger or adversely affecting surface water bodies. EPA is specifically tracking progress in meeting these two environmental indicator goals at 1,714 facilities that EPA considers to warrant attention in the near term; you can see this list of facilities at http://www.epa.gov/epaoswer/hazwaste/ca/facility.htm

Rationale for
Short-Term Protectiveness Goals

The highest short-term priorities of the RCRA Corrective Action program are to make sure that people are not being exposed to unacceptable levels of contaminants and to prevent further contamination of our nation's groundwater resources While final remedies remain the RCRA Corrective Action program's long-term objective, EPA developed two environmental indicators to focus efforts on early risk reduction, risk communication, and resource protection This focus on short-term protectiveness goals enables the Agency to achieve an increased overall level of protection by implementing a greater number of actions across many facilities

EPA is using these two environmental indicators to monitor progress in response to the Government Performance and Results Act (GPRA - see http://www.epa.gov/ocfo/planning/gpra.htm). EPA's specific GPRA goals for these indicators

---

[1] EPA's short-term goals apply to all contaminated media, not just groundwater For example, our short-term goals associated with protecting humans includes ensuring that humans are not being exposed to unacceptable levels of contaminants in soils However, we focus here on short-term goals associated with groundwater contamination because the focus of this Handbook is on groundwater.

[2] Levels of concern are concentrations of each contaminant in groundwater appropriate for the protection of the groundwater resource based on its maximum beneficial use

are as follows: by 2005, the states and EPA will verify and document that 95% of the GPRA baseline facilities have "Current Human Exposures Under Control" and 70% will have "Migration of Contaminated Groundwater Under Control." You can see the progress toward achieving these goals at http://www.epa.gov/oswfiles/snapshot/#eis.

Who evaluates and determines whether a facility meets environmental indicator goals?

The lead regulatory agency makes the actual environmental indicator determination. However, EPA, states, or the facility (or the facility's consultant) can conduct an environmental indicator evaluation. EPA developed environmental indicator forms to guide regulators and facilities through this evaluation. In some cases, facilities have voluntarily filled out environmental indicator forms to "self-assess" their status, and have even initiated activities on their own to meet the environmental indicators. You can obtain these environmental indicator forms at http://www.epa.gov/correctiveaction/eis.htm.

How should regulators and facilities evaluate environmental indicators?

EPA issued detailed guidance (EPA, 1999e) to help those conducting environmental indicator evaluations; you can access that guidance at http://www.epa.gov/epaoswer/hazwaste/ca/eis.htm. The guidance includes a series of questions and a flow chart to help arrive at one of the following three possible outcomes: **YES**, the facility has achieved an environmental indicator goal; **NO**, the facility has not achieved an environmental indicator goal; or, **IN**, there is insufficient information available to determine whether or not a facility has achieved an environmental indicator goal.

How does a facility get to YES?

For the Current Human Exposures Under Control environmental indicator, a facility should be able to demonstrate that there are no unacceptable human exposures to contamination[3] that can be reasonably expected under current land and groundwater use conditions. For the Migration of Contaminated Groundwater Under Control environmental indicator, a facility should be able to demonstrate that contaminant plumes throughout the entire facility are not continuing to get larger[4] or negatively impacting adjacent surface water bodies, and that the facility will monitor groundwater to verify whether the environmental indicator determination remains valid.

Facilities typically meet these goals either by: (1) demonstrating no cleanup actions are warranted; (2) taking short-term cleanup actions sometimes referred to as interim remedial

---

[3] Contamination in this context describes media containing contaminants in any form (e g , non-aqueous phase liquids, dissolved in water, vapors, solids, etc) that are subject to RCRA and present in concentrations in excess of appropriately protective levels of concern.

[4] A plume getting larger typically refers to groundwater contamination above levels of concern moving beyond a previously defined furthest three-dimensional extent of the contaminant plume.

measures, interim measures, interim actions, or stabilization[5] measures; or (3) implementing a final remedy that also meets short-term cleanup goals.

How should facilities and regulators implement short-term protectiveness goals?

Facilities and regulators should work together, with the public as appropriate, to develop clearly defined objectives to implement short-term protectiveness goals. As described in the Groundwater Protection and Cleanup Strategy in this Handbook, these objectives should generally be expressed, at a minimum, in terms of what actions the facility will take, and where and when the facility will take the action.

If some form of cleanup action is needed to achieve the Current Human Exposures Under Control indicator, stakeholders should understand:

- **What** action the facility will take to ensure that there are no current or near-term future unacceptable exposures to contaminated groundwater. For example, the facility might provide for alternative water supplies to eliminate exposure due to contaminated groundwater in residential wells

- **Where** the facility will implement an action to eliminate unacceptable human exposures to contamination from groundwater.

- **When** the facility will eliminate all unacceptable human exposures to contaminants from groundwater.

If some form of cleanup action is needed to achieve the Migration of Contaminated Groundwater Under Control indicator, stakeholders should understand:

- **What** are the levels of concern for defining the current limit of the groundwater contaminant plume.

- **Where** is the current three-dimensional limit of the groundwater contaminant plume as defined by the levels of concern, and where will the facility monitor groundwater to demonstrate that they achieved and will continue to achieve the prevention of further migration of contaminated groundwater above levels of concern.

- **When** will the facility demonstrate that the groundwater contaminant plume is not migrating above levels of concern.

---

[5] The term stabilization used in this context refers to "stabilizing" a situation so that, for example, the contamination does not represent unacceptable threats or does not continue to spread Stabilization used in this context does not refer to engineered treatment used to "solidify" wastes although such technologies could be used as a stabilization action For more information on stabilization actions, you should refer to (EPA, 1991a)

In addition, EPA believes stakeholders should also clearly understand **who** is taking the action(s), **why** they are taking the action(s), and **how** they will implement the action.

How should facilities and regulators consider groundwater use when evaluating "Current Human Exposures Under Control?"

You should first consider whether there is any current human exposure to contaminated groundwater. This determination relies on actual current facility conditions rather than on an aquifer's groundwater use designation or its potential uses. In making this environmental indicator determination, the regulator should consider all direct and indirect ways humans could currently be exposed to contaminated groundwater. Some examples of direct routes of exposure include drinking contaminated groundwater or having skin come into contact with contaminated groundwater from bathing. Examples of indirect exposure include breathing contaminated vapors entering buildings from underlying contaminated groundwater, and ingesting sediments, surface water or fish that are contaminated from groundwater discharging to surface water.

How should facilities and regulators evaluate the "Migration of Contaminated Groundwater Under Control" indicator?

The individual conducting the evaluation should first be reasonably confident that the furthest three-dimensional boundary of the groundwater contaminant plume(s) is defined using an appropriate number and location of groundwater monitoring wells. To achieve a **YES** determination, the evaluator should be able to demonstrate that the plume is not continuing to expand above contaminant-specific levels of concern. The evaluator should base this determination on whether the contaminant concentrations found in groundwater proximate to the outer perimeter of the plume remain below the levels of concern over time. Levels of concern used for this indicator would commonly be the groundwater clean-up levels developed to be consistent with the groundwater use designation and considering other current routes of exposure from contaminated groundwater. However, early in corrective action, regulators could be evaluating environmental indicators prior to designating groundwater use or developing final cleanup levels. In such situations, regulators often use readily available screening levels (e.g., drinking water standards) to define a plume boundary. Generally, drinking water standards will be acceptable to define the boundary of a plume when evaluating this environmental indicator unless more stringent levels are needed based on other actual exposures to contaminated groundwater.

Can a facility achieve the "Migration of Contaminated Groundwater Under Control" indicator when the plume extends beyond the facility boundary?

EPA's guidance (EPA, 1999e) does not differentiate on-site contaminated groundwater from off-site contaminated groundwater as a factor in determining whether a facility achieves the groundwater environmental indicator. The primary intent of this indicator is to demonstrate that groundwater problem is not expanding, regardless of whether the contamination is on-site or offsite. However, cleanup of the off-site plume will often be a high priority and may be an

appropriate intermediate performance goal because facilities typically have less ability to control exposures outside the boundary of their property.

Can a facility achieve the "Migration of Contaminated Groundwater Under Control" indicator when contaminated groundwater discharges to surface water?

A facility could achieve this indicator once the regulator determines that the current discharge of contaminated groundwater into surface water does not cause unacceptable impacts to surface water, sediments, or eco-systems. In making this assessment, you should consider the appropriate levels for protecting the surface water and its sediments.

Appropriate levels for surface water protection should be based on the use of the surface water body. States develop surface water body classifications and aquatic water quality criteria (AWQC) based on their uses. Facilities and regulators could use these AWQCs when available and appropriate. Unclassified surface water bodies require professional judgement. Furthermore, you should contact the state cleanup program because many states have specific groundwater cleanup levels based on protecting surface water bodies. Links to state cleanup programs are available at http://www epa gov/correctiveaction/state.htm. Additional resources you may also find helpful include the Proceedings of the Groundwater/Surface Water Interaction Workshop (EPA, 2000b) available at http //www.epa.gov/tio/tsp/download/gwsw/gwsw_part1.pdf and information regarding sediments available at http://www epa.gov/OST/cs/.

Facilities or regulators evaluating environmental indicators for situations where contaminated groundwater is entering surface water should also consider Total Maximum Daily Loads (TMDLs) for the receiving surface water. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources. For more information concerning TMDLs, you should refer to http //www.epa.gov/owow/tmdl/.

Will an environmental indicator evaluation require additional investigation?

Any investigations needed to evaluate environmental indicators would generally be a subset of the investigations needed to ultimately complete corrective action. However, pursuing environmental indicators may result in collecting information in advance of more thorough investigations associated with meeting intermediate or final cleanup goals

Do facilities need to perform additional investigation or cleanup, once they achieve the environmental indicator goals?

Achieving the environmental indicator goals is an important milestone but does not relieve a facility from meeting other investigation objectives or from meeting any facility-specific intermediate performance goals and final cleanup goals. The facility will often need to conduct further investigation to support evaluation and selection of final remedies. Furthermore, the facility may need to conduct remedial actions that might be outside the scope of these two

environmental indicators to achieve other short-term, intermediate and final goals for groundwater (e.g., returning contaminated groundwater to its maximum beneficial use)

Do facilities need to control sources to meet the environmental indicator goals?

Source control may not always be necessary to meet the environmental indicator goals. However, there are instances where source control would be essential to meeting these goals. For example, source control would typically be necessary to achieve the Human Exposures Under Control indicator if there were direct human exposures to the source material, such as an old disposal area with no covering and unrestricted access. Two examples of situations that would typically warrant source control to achieve the Contaminated Groundwater Migration Under Control would be if a non-aqueous phase liquid[6] (NAPL) was directly discharging to a stream, or where a mobile NAPL plume was migrating faster (and farther) than the dissolved contaminants moving with groundwater. Source control is often still desirable in many circumstances because minimizing any further releases into the environment is often easier to manage than trying to clean up contaminants after they have spread. Furthermore, to meet final cleanup goals, EPA expects that facilities will need to control or eliminate surface and subsurface sources of groundwater contamination as necessary to protect human health and the environment.

Are these two environmental indicators the only short-term protectiveness goals facilities should consider?

EPA chose these two indicators as significant short-term protectiveness goals to track on a national basis. However, facilities may need to take other short-term actions to protect receptors when site conditions warrant. For example, a facility might need to take action to protect ecological receptors that are currently exposed to facility contaminants. Furthermore, EPA's focus on the two environmental indicators should not deter facilities from taking any other short-term action to protect human health or the environment, or to take early action to prevent environmental problems from getting worse. Also, the two environmental indicators should certainly not distract facilities from conducting routine activities such as cleaning up inadvertent spills when they occur.

References:

EPA, 2000b. Proceedings of the Ground-Water/Surface-Water Interactions Workshop (EPA/542/R-00/007, July) Available at http://www.epa.gov/tio/tsp/download/gwsw/gwsw_part1.pdf, http://www.epa.gov/tio/tsp/download/gwsw/gwsw_part2.pdf, and http://www.epa.gov/tio/tsp/download/gwsw/gwsw_part3.pdf

EPA, 1999e. Interim Final Guidance for RCRA Corrective Action Environmental Indicators (February 5). Available at http://www.epa.gov/epaoswer/osw/ei_guida.pdf.

---

[6] Additional information and reports concerning NAPL contamination is available at http://www.epa.gov/oerrpage/superfund/resources/gwdocs/non_aqu.htm See also EPA, 1995b and 1994c

EPA, 1996a. Advance Notice of Proposed Rulemaking (61 FR 19432, May 1) Available at http://www epa.gov/docs/fedrgstr/EPA-WASTE/1996/May/Day-01/pr-547.pdf. Particularly relevant pages describing the stabilization initiative and environmental indicators on 19436-37, and discussion of interim measures on page 19446-47.

EPA, 1995b. Groundwater Issue: Light Non-Aqueous Phase Liquids (EPA/540/S-95/500). Available at http.//www epa gov/ada/download/issue/lnapl.pdf.

EPA, 1994c. DNAPL Site Characterization. EPA/540/F-94/049. Available at http://www.epa.gov/oerrpage/superfund/resources/gwdocs/dnapl.pdf.

EPA, 1991a. Managing the Corrective Action Program for Environmental Results: The RCRA Stabilization Effort (October 25). Available at http://yosemite.epa gov/osw/rcra nsf/d8382df2d09b6466852565280051974 5/27d1baa5c1dbb8f38525670f006be76d?OpenDocument.

3. Intermediate Performance Goals

(Updated 7/20/01)

What are intermediate performance goals for groundwater?

Intermediate performance goals are facility-specific environmental conditions or measures that demonstrate progress towards achieving the final cleanup goals. EPA refers to these goals as "intermediate" because actions taken to meet these goals will typically occur after a facility achieves its short-term protectiveness goals, but before they achieve all final cleanup goals. EPA encourages regulators and facilities to establish intermediate goals when they can use such goals to demonstrate progress toward the ultimate final cleanup goals and:

- help focus resources,
- improve environmental conditions, or
- enhance performance of a cleanup action

Achieving intermediate performance goals does not relieve a facility from meeting any facility-specific investigation or cleanup actions necessary in order to achieve final cleanup goals.

Rationale for Intermediate Performance Goals

EPA's approach for intermediate performance goals recognizes that, for many sites, using a "phased-approach" is often appropriate for complex groundwater cleanups. Establishing site-specific intermediate performance goals provides a mechanism to prioritize work and measure progress toward achieving long-term goals

How can intermediate performance goals help me?

Intermediate performance goals help facilities, regulators, and the public see and document environmental progress towards meeting final cleanup goals.

Intermediate performance goals also help to prioritize work necessary to meet the final cleanup goals. Facilities may use intermediate performance goals to outline a phased approach toward the cleanup. A phased approach allows a facility to use information obtained from previous phases to plan and refine subsequent work (EPA, 1996c). Facilities can also direct response actions to achieve intermediate performance goals at high-priority areas of the facility first, and address lower-priority areas at a later time.

Intermediate performance goals may also serve to bridge differences in opinion between regulators, facilities, and the public on the scope of environmental response at a facility. There may be consensus on intermediate actions that facilities can take that provide significant environmental benefit while stakeholders continue to negotiate issues associated with final cleanup goals.

Are intermediate performance goals appropriate for all facilities?

No. For example, intermediate performance goals may not be appropriate for those situations where facilities can achieve final cleanup goals in a relatively short period of time (e.g., months to several years).

When should facilities and regulators establish intermediate performance goals?

Regulators and facilities should establish intermediate performance goals as part of a final remedy to create milestones of environmental progress. However, where significant uncertainties exist as to what a final remedy should involve and could achieve, EPA believes it may also be appropriate to establish and strive to achieve intermediate performance goals prior to a formal evaluation and selection of a final remedy. In this latter situation, stakeholders could use the information gained from implementing actions to achieve the intermediate performance goals to help improve the effectiveness and efficiency of the subsequent final remedy.

How should facilities and regulators implement intermediate performance goals?

Once facilities and regulators establish intermediate performance goals, they should work together to develop clearly defined objectives to implement these goals. As described in the Groundwater Protection and Cleanup Strategy, these objectives should generally be expressed, at a minimum, in terms of:

- **What** the specific goals are and what actions will the facility take to achieve those goals.
- **Where** the facility will implement an action and/or **where** the facility will measure to determine if the action has been successful.
- **When** the facility can implement a remedy and achieve facility-specific intermediate goals (cleanup time frame).

In addition to these three elements, EPA believes stakeholders should also clearly understand who is taking the responsibility for implementing an action designed to achieve a particular intermediate performance goal, why they are taking the action, and how they are going to implement the action

What are some examples of intermediate performance goals?

Some examples of intermediate performance goals include: source control (e.g., various combinations of removal, treatment and containment), plume size reduction, cleaning up off-site plumes, prioritizing work, and remedy performance enhancements. For example:

Source control: A facility is pumping and treating groundwater to prevent a contaminant plume from migrating offsite. The site investigation identifies an area of soil contaminated with chlorinated solvents which appears to be contributing to the groundwater contamination. The

facility estimates if they clean up the contaminated soil (using soil vapor extraction) to a particular level as an intermediate performance goal, monitored natural attenuation[7] will have a greater likelihood of being able to address the remaining groundwater contamination.

Cleaning up off-site plumes: A facility has an off-site plume and had to install vapor recovery systems under individual homes to eliminate exposures to indoor air impacted by contaminated groundwater. By focusing on achieving cleanup levels in groundwater off site as an intermediate performance goal, the facility is able to reduce their long-term liabilities associated with relying just on the in-home vapor recovery systems to ensure protection.

Prioritizing work: A large industrial facility identifies several areas which need to be addressed, but has limited resources available for cleanup The regulator and facility work together to establish a sequence of intermediate goals directed toward achieving the final cleanup goal. In establishing the sequence of work to be conducted, the regulator and facility consider the relative risk and/or potential environmental harm associated with the current contamination in the different areas, and establish a series of intermediate goals with different cleanup time frames for the different areas based on the relative risk. The result is that the most environmentally significant areas are cleaned up first, and the facility is able to budget resources efficiently.

Why is it important to establish intermediate performance goals on a facility-specific basis?

Intermediate performance goals should be specific to the environmental problem(s) that need to be solved at a facility. The environmental benefit of a particular intermediate performance goal will vary for different facilities based on the type of contaminants, environmental receptors, anticipated timing of groundwater use, and the current extent of contamination, among other factors. Therefore, EPA cautions stakeholders against automatically applying an intermediate performance goal that makes sense at one facility to another facility since no two facilities are exactly alike. For example, controlling a source of contamination at one facility as an intermediate performance goal may be appropriate, while at another facility, controlling a source might be more appropriately addressed as part of a short-term or final cleanup action.

References:

EPA, 1996a. Advance Notice of Proposed Rulemaking (61 FR 19432, May 1). Available at www.epa.gov/docs/fedrgstr/EPA-WASTE/1996/May/Day-01/pr-547.pdf. Particularly relevant pages: 19448-52.

EPA, 1996c. Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Groundwater at CERCLA Sites (EOA 540/R-96/023, October). Available at http://www.epa.gov/superfund/resources/gwguide/index.htm.

[7] For more information, you should refer to the Monitored Natural Attenuation section of this Handbook.

4. Final Cleanup Goals
(Updated 7/20/01)

What are EPA's final cleanup goals for corrective action?

EPA's goals for final cleanup are to:

1 Protect human health and the environment[1]

2. Achieve media cleanup objectives[2]

3. Control the source(s) of releases so as to reduce or eliminate, to the extent practicable, further releases of hazardous waste or hazardous constituents that may pose a threat to human health and the environment[3].

These three goals represent threshold criteria[4] that EPA recommends regulators and facilities use as general goals for cleanup and as screening tools for potential remedies, including final groundwater remedies.

Rationale for
Final Cleanup Goals

This policy on final cleanup goals for contaminated groundwater is important to ensure the short- and long-term availability of our nation's groundwater resources and to preserve and protect hydraulically connected surface waters and their ecosystems EPA's policy on final cleanup goals states that the situations where long-term containment would be acceptable should generally be limited to when cleaning up contaminated groundwater is technically impracticable, or to where EPA or the State designates the groundwater as having no use or value

[1] Protecting the environment means, among other factors, that you should consider the ecological setting at and around a facility in evaluating and selecting final remedies This is especially important for groundwater remedies where contaminated groundwater discharges into surface water

[2] Media cleanup objectives for final remedies typically includes the more specific concepts of media cleanup levels, points of compliance and cleanup time frames. In previous guidance (EPA, 1996a - page 19449), EPA referred to media cleanup objectives as media cleanup standards, we now use media cleanup objectives to avoid confusion over the term "standard" that is often associated with just numeric values

[3] EPA expects (see glossary for a definition of "remedy expectations") facilities to control or eliminate surface and subsurface sources of groundwater contamination In controlling sources, EPA generally prefers approaches that lead to permanent reductions in toxicity, mobility, or volume Additionally, EPA typically expects that treatment will be used to address source materials considered to be "principal threats," i e., materials that are highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur Also, you should refer to the glossary of this Handbook for a definition of cleanup expectation A complete list of EPA's general expectations for final remedies is available in EPA, 1996a (page 19448)

[4] The 1996 ANPR lists four remedy threshold criteria EPA believes that the fourth criterion "complying with applicable standards for waste management" is not necessary since complying with applicable waste management standards is automatically required under existing RCRA Subtitle C and D regulations

Protecting human health and the environment is the mandate from the RCRA statute and regulations; therefore, it is appropriate to include this goal as the first and overarching threshold criterion for final RCRA corrective action remedies. Use of this threshold criterion also serves to ensure that remedies include protective activities (e.g., providing an alternative drinking water supply) that would not necessarily be needed to achieve the other recommended criteria. However, EPA also believes that remedies should generally meet the second and third criteria as a means to demonstrate progress toward achieving the overall mandate to protect human health and the environment.

What are EPA's final cleanup goals for groundwater?

EPA generally expects final remedies to return "usable" groundwaters to their maximum beneficial use[5], wherever practicable, within a time frame that is reasonable given the particular circumstances of the facility. Facilities and regulators should establish specific media cleanup objectives (see below) that will meet this expectation. EPA also generally expects final remedies to control or eliminate surface and subsurface sources of groundwater contamination. In determining appropriate and protective media cleanup objectives for groundwater remedies, stakeholders should consider the use, value and vulnerability of the groundwater resource, and all potential pathways that could result in human or ecological exposure to contaminants in or from groundwater.

When does EPA consider groundwater "usable" for selecting final cleanup goals?

EPA recognizes that "usable" groundwater may serve a variety of purposes. Common purposes of groundwater include, for example, drinking water, agricultural irrigation, car washes, manufacturing, etc. Groundwater also has less formally acknowledged purposes such as replenishing adjacent aquifers or surface water bodies. Regulators should consider purposes such as these to acknowledge whether groundwater is "usable" and to determine appropriate cleanup goals. For more guidance regarding groundwater use, see the groundwater use designation policy in this Handbook.

What if groundwater is not usable?

For groundwater formally designated by EPA or a State[6] as having no use or value at all, final cleanup goals such as source control and/or long-term containment, rather than meeting a particular cleanup level throughout the groundwater, may be acceptable as long as the remedy

---

[5] Within the range of reasonably expected uses and exposures, the maximum beneficial groundwater use is the one which that warrants the most stringent groundwater cleanup levels and approaches

[6] EPA recognizes that most states classify the majority of their groundwater as potential sources of drinking water

protects human health and the environment[7]. However, stakeholders should consider all potential pathways that could result in human or ecological exposure before deciding that not cleaning up the entire groundwater plume is acceptable.

Even in those rarer instances when groundwater is not usable, final remedies should still achieve the three threshold criteria described above. In addition, regulators generally should: (1) ensure that EPA or the State has designated the groundwater as having no use or value; (2) ensure that humans or ecological receptors would not be exposed to contaminants in or from groundwater[8]; (3) ensure that the approaches used to achieve the final cleanup goals would be effective in the long-term; (4) consider the potential impacts to human health or the environment if the remedy were to fail; and (5) ensure that the facility has the financial ability to maintain the remedy for as long as necessary[9] to ensure protection of human health and the environment. Maintaining financial assurance for corrective action is a RCRA statutory (3004 (u)) and regulatory obligation (40 CFR 264 101b) and is particularly important for final remedies involving long-term containment.

When significant uncertainties associated with the reliability of a containment system exist, regulators should strongly consider establishing the goal of cleaning up the groundwater so that containment wouldn't be needed to ensure long-term protection.

What if returning contaminated groundwater to its maximum beneficial use is not practicable?

Where returning contaminated groundwater to its maximum beneficial use is not practicable, EPA expects facilities to prevent or minimize the further migration of a plume, prevent exposure to the contaminated groundwater, and evaluate further risk reduction. For more information on what to do if returning contaminated groundwater to its maximum beneficial use is technically impracticable, see the policy on technically impracticability in this Handbook.

---

[7] In the Superfund program, final cleanup goals or objectives that are not associated with returning contaminated groundwater to its beneficial use are often referred to as "non-restoration" goals or objectives (EPA, 1997b)

[8] For example, humans could be exposed to indoor air contamination resulting from contaminants that volatilize from underlying groundwater, and aquatic organisms could be exposed to contaminants in groundwater that discharge into surface water.

[9] Similar to long-term monitoring of closed hazardous waste landfills (see 40 CFR 264.117), regulators have discretion to extend or shorten the duration a facility needs to operate, maintain, and monitor a long-term containment system for contaminated groundwater Some cleanup programs (e g , New York state- see http //www clu-in org/eiforum2000/prez/ppframe1 cfm?id=81) have referred to long-term containment of contaminated groundwater in terms of "perpetual care" obligations

How should facilities and regulators evaluate final remedies that meet the threshold criteria?

EPA recommends facilities should consider the following seven balancing criteria when developing and evaluating a cleanup alternative or alternatives for a final groundwater remedy, and when choosing among several alternatives anticipated to meet the threshold criteria.

(1) Long-term reliability and effectiveness, along with the degree of certainty that remedies will remain protective of human health and the environment, considering, as appropriate. the magnitude of risks that will remain at a site from untreated hazardous wastes and hazardous constituents and treatment residuals; and, the reliability of any containment systems and institutional controls;

(2) Reduction of toxicity, mobility or volume through treatment of hazardous wastes and hazardous constituents, including how treatment is used to address principal threats posed by the facility, and the degree to which remedies employ treatment that reduces the toxicity, mobility or volume of hazardous waste and hazardous constituents, considering, as appropriate: the treatment processes to be used and the amount of hazardous waste and hazardous constituents that will be treated; the degree to which treatment is irreversible; and the types of treatment residuals that will be produced;

(3) Short-term effectiveness and short-term risks remedies pose, along with the amount of time it will take for remedy design, construction and implementation,

(4) Ease or difficulty of remedy implementation, considering, as appropriate: the technical feasibility of constructing, operating and monitoring the remedy; the administrative feasibility of coordinating with and obtaining necessary approvals and permits from other agencies, and the availability of services and materials, including capacity and location of needed treatment, storage and disposal services,

(5) Capital as well as operation and maintenance costs, and the net present value of these costs.

(6) The degree to which remedies are acceptable to the surrounding community; and

(7) The degree to which remedies are acceptable to the state in which the facility is located[10]

How thorough of an assessment should facilities conduct when evaluating one or more remedial options?

EPA encourages facilities to focus their evaluation on realistic remedies and tailor the scope and substance of studies to the complexity of contamination and hydrogeologic conditions at a given facility. EPA emphasizes that it does not expect facilities to undertake studies simply for the purpose of completing procedural steps. We believe that there are a number of opportunities to

---

[10] The last two recommended balancing criteria (state and community acceptance) were not explicitly stated in the May 1, 1996 ANPR (EPA, 1996) EPA believes these criteria are important considerations to ensure that both regulators and facilities consider public views and opinions, as well as state requirements, guidance and policies. Considering state input is especially important for those situations where EPA and not the state is selected the final remedy Including these last two balancing criteria also has the added benefit of improving consistency between the RCRA Corrective Action program and EPA's Superfund program

significantly streamline remedy evaluation. For example, where there are straightforward solutions (e.g , when standard engineering solutions have proven effective in similar situations) or where presumptive remedies[11] are appropriate and can be applied, it may not be necessary to evaluate more than one alternative. However, when facilities only evaluate one alternative, they should still justify their recommendation based on EPA's recommended threshold and balancing criteria.

How should facilities and regulators implement final groundwater cleanup goals?

Facilities and regulators should work together to develop clearly defined media cleanup objectives to implement final cleanup goals. As described in the Groundwater Protection and Cleanup Strategy, these objectives should be expressed in terms of what actions the facility will take, and where and when the facility will take the action.

For final groundwater cleanup remedies, stakeholders should understand:

- **What** is the groundwater cleanup level for contaminants in groundwater.
- **Where** will the facility demonstrate that they have achieved groundwater cleanup levels (i.e., the groundwater point of compliance).
- **When** does the facility anticipate it can implement a remedy and can achieve a groundwater cleanup (cleanup time frame).

In addition to these three elements, EPA believes stakeholders should also clearly understand who is implementing the final remedy, why they are taking the action, and how they are going to implement the action.

What are the media cleanup objectives if containment is the final goal rather than meeting cleanup levels throughout contaminated groundwater?

When containment is a part of the final remedy, facilities and regulators should develop systems to monitor the effectiveness of the containment For example, the **what** could include the cleanup levels the facility needs to meet outside the containment area. The **where** could include locations at which the facility will be monitor. The **when** could include how often and for how long the monitoring will continue. In addition, facilities and regulators should identify the specific measures or conditions that will indicate whether the containment is effective, and what actions the facility will take if the containment fails

[11] Presumptive remedies are preferred technologies for common categories of sites, based on historical patterns of remedy selection and EPA's scientific and engineering evaluation of how well technologies perform You can access EPA's guidance on presumptive remedies at http //www epa gov/superfund/resources/presump

Key References:

EPA, 1997b. Rules of Thumb for Superfund Remedy Selection (EPA 540-R-97-013). Available at http://www.epa.gov/superfund/resources/rules/rulesthm.pdf .

EPA, 1996a. Advance Notice of Proposed Rulemaking (61 FR 19432, May 1). Available at http://www.epa.gov/docs/fedrgstr/EPA-WASTE/1996/May/Day-01/pr-547.pdf. Particularly relevant pages: 19448-52.

EPA, 1991b. Protecting the Nation's Groundwater: EPA's Strategy for the 1990's. Office of the Administrator. Washington, D.C. For more information, refer to http://www.epa.gov/OGWDW/Pubs/11ground.html.

5. Groundwater Cleanup Levels
(updated 7/20/01)

What are groundwater cleanup levels?

Groundwater cleanup levels are facility-specific chemical concentrations in groundwater that regulators generally establish when defining groundwater cleanup objectives for final remedies. Groundwater cleanup levels should generally be based on the maximum beneficial use of the groundwater to ensure protection of human health and the environment. Additionally, groundwater cleanup levels often serve as the basis for identifying the "level of concern" used for the Migration of Contaminated Groundwater Under Control environmental indicator (i.e., short-term protectiveness goals), and may be a component of a facility-specific intermediate performance goal.

Rationale for Groundwater Cleanup Levels

Groundwater cleanup levels provide clear numerical targets that stakeholders can use to measure the success of groundwater cleanup actions Groundwater cleanup levels should generally be based on the maximum beneficial use to ensure that groundwater is cleaned up to levels that protect both current and future uses of the resource

How should groundwater cleanup levels be developed?

Groundwater cleanup levels for human health should typically be developed by using existing cleanup standards (e.g., drinking water standards) when they are available and when using them is protective of current and reasonably expected exposures.

If a cleanup standard is not available for a constituent, a facility should first assess all actual and potential exposures to a groundwater contaminant Then, a groundwater cleanup level should be developed based on the magnitude of exposure to a groundwater contaminant, (i.e., dose[1]) and the toxicity of the contaminant resulting in an estimate of risk. Groundwater cleanup levels are then calculated to fall within generally acceptable levels of risk. EPA recommends that regulators choose risk-based cleanup levels as follows:

(1) For known or suspected carcinogens, regulators should establish groundwater cleanup levels at concentrations which represent an excess upper bound lifetime risk[2] to an individual of

---

[1] Dose is the amount of substance to which a person or other organism is exposed Dose often takes body weight into account Total dose is the sum of doses received by a person or organism from a contaminant in a given time interval resulting from interaction with all environmental media that contain the contaminant

[2] EPA expresses cancer risk in terms of the likelihood that a person might develop cancer from exposure to contaminants from a facility For example, a risk assessment might say that a receptor has an upper bound excess cancer risk of 10^{-4} The numerical estimate means that for people receiving this level of exposure averaged over a 70-year lifetime, approximately one person out of every 10,000 would develop cancer as a result of the exposure

(continued...)

between 10^{-4} and 10^{-6} (commonly referred to as EPA's cancer risk range[3]). Note that EPA generally prefers cleanup levels at the more protective end of the risk range. For facilities with multiple contaminants or exposure pathways, cleanup levels should generally be set so that cumulative (total) excess upper bound lifetime risk from all contaminants still falls within the risk range.

(2) For toxicants associated with adverse effects other than cancer, regulators should establish groundwater cleanup levels at concentrations to which human populations, including sensitive subgroups, could be exposed on a daily basis without appreciable risk of negative effect during a lifetime. Such levels are generally interpreted as equal to or below a hazard quotient[4] of one. For facilities with multiple contaminants or exposure pathways, groundwater cleanup levels should generally be equal to or below a hazard index[5] of one.

Are there other factors that should be considered when developing groundwater cleanup levels?

Yes. Groundwater cleanup levels that are higher or lower than the levels described above, might be appropriate in circumstances such as those described below, provided such cleanup levels protect human health and the environment:

(1) Higher cleanup levels may be appropriate, for a given facility, when groundwater is also contaminated by hazardous constituents that are naturally occurring[6], or have originated from a source not associated with the subject facility, and those hazardous constituents are present in concentrations such that remediation of the release would not provide significant

---

[2](...continued)
Depending on facility-specific factors, EPA's threshold of acceptable cancer risk ranges from 10^{-6} to 10^{-4}, or from one in one million to one in ten thousand Screening values are generally set at a cancer risk of 10^{-6}

[3] You should also refer to state guidance on risk and risk ranges For example, the state of Florida specifies 10^{-6} for risk assessments. Links to state hazardous waste programs are available at http //www epa.gov/correctiveaction/state htm

[4] EPA expresses non-cancer health risk as a ratio, known as the Hazard Quotient (HQ), which is defined as the calculated exposure from a single contaminant in a single medium divided by a reference dose. The reference dose is the level of exposure that EPA believes will not cause adverse affect in human populations, including sensitive individuals Note that some chemicals may be associated with both carcinogenic as well as non-carcinogenic effects (such as liver or kidney disease), both should be considered when setting the cleanup level.

[5] The hazard index (HI) assesses potential for toxicity following exposure to multiple contaminants It is equal to the sum of the hazard quotients. However, where information is available to identify the critical toxic effect for non-carcinogens, only hazard quotients associated with similar critical effects (target organs) are combined

[6] A naturally occurring substance is in its unaltered form, or is altered solely through naturally occurring processes or phenomena, in a location where it is naturally found (Superfund, Section 104(a)(3)(A))

reduction[7] in risks to actual or potential receptors; or, the groundwater is not a current or reasonably expected source of drinking water and would not result in unacceptable impacts to hydraulically connected surface water bodies; or, where achieving groundwater cleanup levels is technically impracticable.

(2) Lower groundwater cleanup levels may be necessary because of unacceptable risks to human receptors from combined effects of hazardous wastes or hazardous constituents, or to protect ecological receptors[8], or to protect potential receptors exposed through cross media transfer.

For additional guidance on human health and ecological risk issues, you should refer to numerous resources by found at the following internet sites:
http://www.epa.gov/epaoswer/osw/docs/riskfinal.pdf,
http://www.epa gov/superfund/programs/risk/tooltrad.htm#gp, and
http://www.epa.gov/superfund/programs/risk/commeng htm.

What is the role of groundwater use in setting cleanup levels?

Regulators and facilities should base groundwater cleanup levels on the maximum beneficial groundwater use. The maximum beneficial use is the current or reasonably expected use which warrants the most stringent groundwater cleanup levels. Typically the groundwater use designation is the starting point for determining the appropriate reasonably expected uses and exposures to evaluate risks and identify groundwater cleanup levels. Stakeholders should consider groundwater use designations when evaluating the reasonably expected future uses of groundwater The groundwater use designation may define whether the groundwater is a current or potential source of drinking water, or has value or uses other than drinking water.

What are the groundwater cleanup levels for a current or potential source of drinking water?

For groundwater that is currently used or designated as a current or reasonably expected source of drinking water, regulators should, as a starting point, select cleanup levels protective for use as a residential drinking water source. Even if no one is currently drinking the groundwater, the cleanup level should generally be based on drinking water use if the aquifer is considered by EPA or the state to be a reasonably expected future source of drinking water. For each constituent, regulators should determine whether a maximum contaminant level (MCL) has been established under the Safe Drinking Water Act (see http://www.epa.gov/safewater/sdwa/sdwa.html); and should also determine whether the State has adopted the Federal MCL for that constituent, or has promulgated a more stringent State MCL

---

[7] What would or would not constitute "significant reductions in risk" should be defined on a case-by-case basis by the regulator EPA's primary intent with this guidance is to convey that regulators have the flexibility to adjust cleanup levels to avoid, where appropriate, creating a groundwater "island of purity" in the midst of regional contamination from sources outside the facility in question.

[8] You should make sure to contact the cleanup program for the state in which a particular facility is located to determine applicability of any state-specific ecologic risk guidance and assessment procedures Links to state hazardous waste programs are available at http //www epa gov/correctiveaction/state htm

for drinking waters. Regulators should compare the Federal MCL and State MCL for each constituent and typically should use the more stringent of the two as the cleanup level[9].

For constituents for which no MCLs have been promulgated, regulators typically rely on other established drinking water standards or a risk assessment incorporating residential exposure assumptions (for example, ingestion rate of 2 liters/day, exposure frequency of 350 days/year, etc.) to estimate contaminant dose, derive risk estimates, and determine groundwater cleanup levels. Also, for chemicals that do not have federal MCLs, you should contact the particular state program in which the facility is located to determine whether that state has a list of their own drinking water standards. Internet links to state hazardous waste programs are available at http://www.epa.gov/correctiveaction/state.htm.

What is the cleanup level if the groundwater is designated as something other than a current or potential source of drinking water?

Regulators should develop cleanup levels which are consistent with the groundwater use designation. However, you should first verify that the groundwater use designation is valid. For example, even if a state-wide designation system defines (or would define) the aquifer as a non-drinking water resource, regulators and facilities should still verify that no one is drinking the groundwater and that no other unacceptable exposure to contaminants from groundwater is occurring.

Once verified, a non-drinking groundwater use designation could serve as a starting point for establishing groundwater cleanup levels. Some states have established generic cleanup levels for groundwater in non-drinking water aquifers. In those states, facilities and regulators should consider these levels when appropriate. However, at a facility-specific level, there may be uses of groundwater or exposures to contaminants from groundwater that might not be considered in a state-wide groundwater use designation. Regulators should, therefore, verify that the generic values are protective of the known or reasonably expected groundwater uses and the potential exposures through cross-media transfer, such as volatilization into buildings[10] and hydraulic connections to surface waters and other aquifers.

For example, a state designation may identify groundwater in a particular area as industrial and provide a generic value, but the groundwater discharges into an adjacent surface water body. In

---

[9] In the Superfund program non-zero maximum contaminant level goals (MCLGs) established under the Safe Drinking Water Act are also used as cleanup levels. At Superfund sites, regulators should compare the Federal MCL, Federal non-zero MCLG and the State MCL for each constituent and use the most stringent of the these as the cleanup level Relatively few chemicals have a non-zero MCLG, and for most of these the non-zero MCLG is equal to the MCL

[10] For information on one tool designed to assess impacts from contaminated groundwater to indoor air, you should refer to USEPA's User's Guide for the Johnson and Ettinger (EPA, 1991d) Model for Subsurface Vapor Intrusion into Buildings which is available at http //www epa gov/oerrpage/superfund/programs/risk/airmodel/guide pdf The model itself can be downloaded from http //www epa gov/oerrpage/superfund/programs/risk/airmodel/johnson_ettinger htm.

this case, regulators and facilities should determine the designated uses of the impacted surface waters and whether Federal water quality criteria or state water quality standards have been established for any of the contaminants found in the discharging ground water. Regulators and facilities should also evaluate possible adverse effects of the ground water discharge for actual pathways of exposure to humans or aquatic life. Based on these evaluations, facilities and regulators should verify whether available generic cleanup values are protective of the surface water and its sediments, and if they are not, facilities should propose facility-specific ground water cleanup levels designed to prevent appropriate water quality standards in the surface water body from being exceeded, and prevent unacceptable risks to human health or the environment.

Additionally, in the absence of generic values for non-drinking water, facilities should identify the various actual and potential uses and exposures (i.e., pathways) to contaminants from groundwater to develop protective groundwater cleanup levels for the facility. To estimate dose, you should evaluate all current and potential routes of exposure within each pathway, such as inhalation, dermal contact, and inadvertent ingestion. Since EPA does not currently have standard exposure assumptions for non-residential uses of groundwater, facilities and regulators will generally need to quantify facility-specific exposure assumptions for all expected pathways by collecting facility-specific or other relevant data to develop an appropriate numerical value for those exposures. These exposure values along with toxicity values for each contaminant can then be used to calculate contaminant-specific concentrations (groundwater cleanup levels) to achieve protective risk levels (i e , an excess upper bound lifetime cancer risk of 10^{-4} to 10^{-6} or a hazard index of one).

Are there any situations where regulators might not establish specific groundwater cleanup levels?

Yes. In some cases, the groundwater will already be at acceptable levels for its designated use(s). In other situations, regulators might not establish specific groundwater cleanup levels if: the contaminated groundwater is within a designated non-drinking water aquifer; has no current or foreseeable beneficial use; does not discharge to surface water or to a drinking water aquifer at levels that could cause concern; and does not cause other exposures through media transfer (e.g., indoor air). However, the regulator may still require facilities to conduct monitoring or to perform containment to ensure continued protection of human health and the environment. If containment is warranted, then cleanup levels may be needed to help evaluate the effectiveness of the containment system. Other EPA policies dealing with issues, such as source control, would still likely apply in this situation.

Do alternate concentration limits for RCRA regulated units apply to setting groundwater cleanup levels for facility-wide corrective action?

Alternate concentration limits (ACLs) are defined in regulation (40 CFR 264.94(b)) and apply to

corrective action for RCRA regulated units[11] for the purposes of detecting, characterizing and responding to releases to the uppermost aquifer; therefore, they do not apply to facility-wide corrective action of solid waste management units under 40 CFR 264.101. Alternate concentration limits are levels that may be used under certain defined circumstances, as appropriate, to establish groundwater protection standards[12] for RCRA regulated land based units. These units are subject to groundwater monitoring and corrective action requirements contained in 40 CFR Part 264, Subpart F[13].

Alternate concentration limits (see 40 CFR 264.94(b)) allow regulators to develop groundwater protection standards based on risk, and to consider natural attenuation processes in cleaning up groundwater contamination from RCRA regulated units, where appropriate (EPA, 1987). Both of these concepts (i.e., risk-based standards and natural attenuation approaches) are available for facility-wide corrective action as explained in other policies discussed in this Handbook. If you have a regulated unit and want to explore the use of alternate concentration limits, you should read the Alternate Concentration Limit Guidance (EPA, 1987) and seek guidance from the appropriate regulator.

Under limited circumstances specified in CERCLA 121(d)(2)(B)(ii), alternate concentration limits may also be used at Superfund sites. Guidance for using Superfund ACLs is found in the "Rules of Thumb for Superfund Remedy Selection" (EPA, 1997b).

What are cleanup levels for groundwater if a facility is clean closing a RCRA regulated unit?

To achieve "clean closure," facilities should remove or decontaminate all hazardous waste, liners and environmental media contaminated by releases from the unit. However, hazardous constituents may remain at some level in environmental media, such as groundwater, after clean closure provided that the constituents are below levels that may pose a risk to human health or the environment.

In 1998, EPA issued a memorandum (EPA, 1998d) broadening the interpretation of acceptable levels of residual constituents. This expanded interpretation allows the use of non-residential exposure assumptions[14] to be incorporated into the development of closure standards (i.e., the concentrations that each medium should achieve for the unit to be clean closed). When the

---

[11] Regulated units are defined in 40 CFR 264.90 as surface impoundments, waste piles, land treatment units, and landfills that received hazardous waste after July 26, 1982

[12] Groundwater protection standards are constituent concentrations established in permits which trigger corrective action and demonstrate satisfaction of closure requirements. See 40 CFR 264 92-94 which is available through http //www access gpo gov/nara/cfr/cfr-retrieve html#page1

[13] See footnote number 7 in the Overview section of this Handbook to read how EPA's Post Closure regulations (63 FR 56710, EPA 1998e) can provide additional flexibility for cleanup of regulated units.

[14] Note that some state programs do not allow non-residential scenarios to be used in determining criteria for clean closure.

groundwater protection standards are based on a groundwater use designation other than drinking water standards, EPA or the state should be confident that the exposure assumed remains valid (e g., periodic evaluations of actual use, zoning and/or easements to third parties) since no further regulatory control will be required under subtitle C. For more information on risk based closure, you should read the Risk-Based Clean Closure Memorandum (EPA, 1998d) and call your overseeing regulator.

References:

EPA, 1998d. Memorandum from Elizabeth Cotsworth to RCRA Senior Policy Advisors titled, Risk-Based Clean Closure (March 16). Available at http://www.epa.gov/correctiveaction/resource/guidance/risk/cclosfnl.pdf

EPA, 1998e. Standards Applicable to Owners and Operators of Closed and Closing Hazardous Waste Management Facilities: Post-Closure Permit Requirement and Closure Process; Final Rule (63 FR 56710). Available at http://www.epa.gov/fedrgstr/EPA-WASTE/1998/October/Day-22/f28221.pdf

EPA, 1997b. Rules of Thumb for Superfund Remedy Selection (EPA 540-R-97-013). Available at http://www epa gov/superfund/resources/rules/rulesthm.pdf

EPA, 1997f. Exposure Factors Handbook (EPA/600/P-95/002F). Available at http://www.epa gov/ncea/exposfac.htm.

EPA, 1996a. Advance Notice of Proposed Rulemaking (61 FR 19432, May 1). Available at http://www.epa.gov/docs/fedrgstr/EPA-WASTE/1996/May/Day-01/pr-547.pdf. Particularly relevant pages 19448-52.

EPA, 1991d. USEPA's User's Guide for the Johnson and Ettinger Model for Subsurface Vapor Intrusion into Buildings. Available at http://www.epa.gov/oerrpage/superfund/programs/risk/airmodel/guide.pdf. The model itself can be downloaded from http://www.epa gov/oerrpage/superfund/programs/risk/airmodel/johnson_ettinger.htm.

EPA, 1989c. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part A). Available at http://www.epa gov/superfund/programs/risk/ragsa/index.htm

EPA, 1987. Alternate Concentration Limit Guidance (EPA/530-SW-87017).

6. Point of Compliance

(Updated 7/20/01)

What is a point of compliance for groundwater?

As a general definition, the point of compliance for groundwater is where a facility should monitor groundwater quality and/or achieve specified levels of groundwater quality to meet facility-specific goals[1]. For RCRA regulated units[2], EPA defines the location of the point of compliance in regulation (40 CFR 264.95). EPA provides recommendations in guidance for establishing the point of compliance for all other groundwater contamination subject to facility-wide RCRA corrective action.

Where is the point of compliance for RCRA regulated units?

For RCRA regulated units, federal regulations define the point of compliance as the "vertical surface located at the hydraulically down gradient limit of the waste management area[3] that extends down to the uppermost aquifer underlying the regulated units"(40 CFR 264.95). The purpose of this point of compliance is to define where the facility must monitor groundwater and evaluate compliance with groundwater protection standards (i.e., cleanup levels). Additionally, the regulations require facilities to take action,

Rationale for Point of Compliance

Defining where a facility should achieve specified levels of groundwater quality provides stakeholders a way to assess progress toward achieving cleanup goals. EPA recognizes that facilities often use a series of goals to address contaminated groundwater

EPA's policies in this Handbook reflect different approaches for points of compliance depending on whether the facility is pursuing a short-term, intermediate, or final cleanup goal. EPA believes the recommended throughout-the-plume/unit boundary point of compliance for final clean up goals is consistent with EPA's overarching goal of protecting the integrity of the nation's groundwater resources by returning "usable" groundwater to its maximum beneficial use.

The approaches described in this policy also help ensure that operation and maintenance, including monitoring, continues as long as necessary to ensure protection of human health and the environment. Such monitoring is important because contamination represents a potential threat to human health and the environment as long as the contamination is present above levels of concern.

---

[1] Progress toward meeting a particular cleanup goal is typically measured at the point of compliance using groundwater monitoring wells The locations of these monitoring wells may change during different stages of a groundwater cleanup action

[2] Regulated Units are defined in 40 CFR 264.90 as surface impoundments, waste piles, land treatment units, and landfills that received hazardous wastes after July 26, 1982

[3] If the facility contains more than one regulated unit [in close proximity to each other], the waste management area is described by an imaginary line circumscribing the several regulated units (40 CFR 264.95(b)(2))

if necessary, to achieve cleanup levels within the volume of contaminated groundwater at and beyond the point of compliance (40 CFR 264.100). For more information regarding the point of compliance for regulated units, you should refer to 40 CFR 264.92-100 which is available through http://www access gpo gov/nara/cfr/cfr-retrieve.html#page1. Furthermore, see footnote number 7 in the Overview to read how EPA's Post Closure regulations (63 FR 56710, EPA 1998e) can provide additional flexibility for cleanup of regulated units.

Where is the groundwater point of compliance for RCRA (facility-wide) corrective action?

EPA recognizes that the general definition of the point of compliance (see above) can apply to short-term protectiveness goals[4], intermediate performance goals, and final cleanup goals. Therefore, EPA recognizes the point of compliance may vary depending on the particular goal the facility and regulator are pursuing[5]. EPA recommends consideration of the following factors when developing a facility-specific groundwater point of compliance: proximity of sources of contamination; technical practicability of achieving particular cleanup levels; vulnerability of the groundwater and its possible uses; and, exposure and likelihood of exposure and similar considerations (EPA, 1996a)

Where is the groundwater point of compliance for final cleanup goals?

The location of the point of compliance should depend on whether the final cleanup is selected to (1) return usable groundwater to its maximum beneficial use; or (2) contain contamination within groundwater that EPA or a State has designated as not being usable (see final cleanup goals and groundwater use designation).

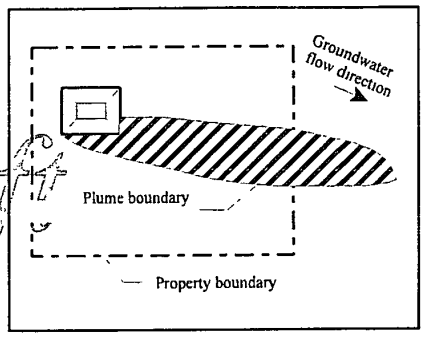


Figure 1 Example groundwater point of compliance for final cleanup goal involving returning contaminated groundwater to its maximum beneficial use The shaded area represents a throughout the plume/unit boundary point of compliance corresponding to the volume of contaminated groundwater that needs to achieve specific groundwater cleanup levels

For final cleanups selected to return groundwater to its maximum beneficial use, regulators should generally set the point of compliance throughout the area of contaminated groundwater, or when waste is left in-place, at and beyond the boundary of the waste

[4] The groundwater point of compliance in the context of short-term goals refers primarily to the Migration of Contaminated Groundwater Under Control Environmental Indicator, which is one of two environmental indicators used to track the progress of the RCRA Corrective Action program (see short-term protectiveness goals)

[5] EPA's intent in recognizing that there could be various locations for the groundwater point of compliance is to illustrate flexibility available to program implementers EPA does not, however, want to create confusion over the names we attach to certain elements of corrective action Facilities and regulators often have to define where facilities need to meet specified levels of groundwater quality in order to achieve a particular goal Whenever facilities and regulators define such locations, they are in essence establishing a point of compliance, but it is not necessary to refer to these locations as a point of compliance unless they find it beneficial to do so.

management area encompassing the original source(s) of groundwater contamination (EPA, 1996a - page 19450); EPA typically refers to this area (more accurately described as a volume) as the "throughout-the-plume/unit boundary" point of compliance[6] (See Figure 1). If a final corrective action remedy involves leaving wastes in place[7] in multiple areas close to each other, then the point of compliance should generally be at and beyond the boundary of a "waste management area" encompassing those areas. This approach is similar to the waste management area defined for RCRA regulated units (see previous footnote number 3).

If the final groundwater cleanup objective is to contain the plume rather than return the groundwater to be suitable for a maximum beneficial use, then in general the point of compliance would most appropriately be located at the boundary of the containment zone. This point of compliance could be similar to the approach regulators could use to measure whether a facility achieves the Migration of Contaminated Groundwater Under Control environmental indicator (see answer to next question below).

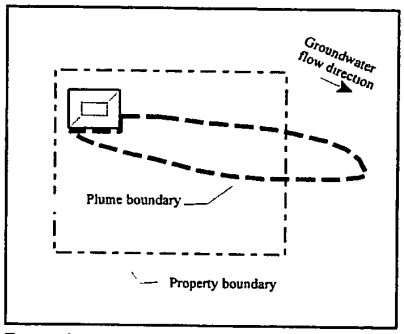


Figure 2 Plume boundary point of compliance for short-term protectiveness goal associated with the Migration of Contaminated Groundwater Under Control environmental indicator. The heavy dashed line represents the point of compliance (i e , boundary of the plume) defined by "contaminated" and "uncontaminated" monitoring wells

Where is the groundwater point of compliance for short-term protectiveness goals?

Achieving the Migration of Contaminated Groundwater Under Control environmental indicator should involve documenting that contaminated groundwater is expected to remain within an existing 3-dimensional boundary(ies) of the plume[8] (EPA, 1999e). Based on the general definition of a point of compliance described above, regulators and facilities could recognize a plume boundary (see Figure 2) as a point compliance for the Migration of Contaminated Groundwater Under Control environmental indicator. Evaluators should recognize that they need to account for all plumes of contaminated groundwater at a facility since EPA designed this indicator to reflect facility-wide conditions.

---

[6] This definition of a point of compliance for final remedies is consistent with the "area of attainment" (EPA, 1988) and "point of compliance" (EPA, 1997b) used in EPA's Superfund cleanup program.

[7] In the context of RCRA corrective action, "waste in place" typically refers to the waste management area encompassing the original source(s) of a release that the regulator determined is acceptable to leave in place as part of a final remedy. For example, a properly-closed landfill represents a waste management area commonly allowed to stay in place as part of a final remedial action EPA typically does not refer to contamination that has migrated from the original source(s) (e g , non-aqueous phase liquid (NAPL)) as a waste management area or waste left in place (EPA, 1996c - page 17)

[8] Facilities and regulators typically define a plume boundary based on estimating a division between where groundwater is contaminated above and below levels of concern. They commonly make this estimate based on professional interpretation (often with the aid of computer software) of chemical analysis of groundwater samples collected from properly located monitoring wells or other monitoring devices

Where is the groundwater point of compliance for intermediate performance goals?

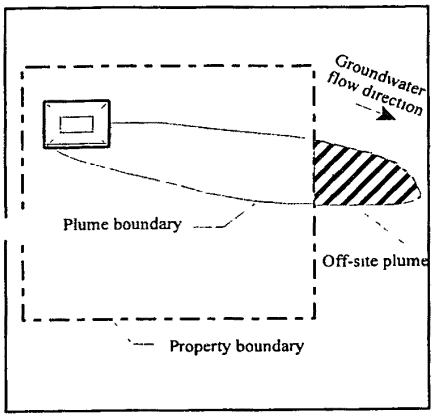


Figure 3 Example of a point of compliance for an intermediate performance goal In this example, the point of compliance is considered to be throughout the portion of the contaminant plume that extends beyond the facility boundary

The need for, and location of, a point of compliance for an intermediate performance goal is facility-specific. Many intermediate performance goals for contaminated groundwater will not warrant establishing a point of compliance (e.g., source removal actions). In general, establishing a point of compliance as a component of an intermediate performance goal is only beneficial when a facility takes an action that includes assessment through groundwater monitoring If the facility and the regulator wish to establish a point of compliance as a component of an intermediate performance goal, it should be located between the existing boundary of the plume and the original source of groundwater contamination For example, establishing a facility boundary point of compliance may make sense when a groundwater contaminant plume extends offsite (see Figure 3). In this case, a facility boundary point of compliance establishes a way of measuring when a facility achieves an intermediate goal of cleaning up the offsite groundwater.

In contrast, EPA believes a facility boundary point of compliance would generally not be an appropriate component of an intermediate performance goal when a groundwater contaminant plume has not yet reached a property boundary because: (1) it is inconsistent with EPA's general pollution prevention goals; (2) it is inconsistent with the EPA's short-term protectiveness goal of preventing the spread of contaminated groundwater; (3) monitoring clean wells at the facility boundary would not show progress toward achieving the final cleanup goal; and, (4) as a practical matter, preventing groundwater contamination is usually much less costly than cleaning up the contamination after it has spread.

References:

EPA, 1996a. Advance Notice of Proposed Rulemaking (61 FR 19432, May 1). Available at www.epa.gov/docs/fedrgstr/EPA-WASTE/1996/May/Day-01/pr-547.pdf. Particularly relevant page: 19450

EPA, 1997b. Rules of Thumb for Superfund Remedy Selection (EPA 540-R-97-013). Available at http://www epa.gov/superfund/resources/rules/rulesthm.pdf.

EPA, 1996c. Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Groundwater at CERCLA Sites (EOA 540/R-96/023, October). Available at http://www.epa.gov/superfund/resources/gwguide/index.htm.

EPA, 1988. OSWER Directive 9283.1-2, "Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites," (December 1)

7. Cleanup Time Frame
(Updated 7/20/01)

What is the cleanup time frame?

The cleanup time frame is an estimate of when groundwater quality will achieve a certain level at a specified location and/or the schedule developed to take an action or construct a remedy designed to achieve a particular short-term protectiveness, intermediate performance, or final cleanup goal.

EPA believes that cleanup time frames should be reasonable, linked to specific goals, and based on facility-specific conditions Examples of factors regulators and facilities should, where appropriate, take into account when developing cleanup time frame(s) for a given facility include:

- potential risks from exposures to contamination
- current and reasonably expected future land and water use(s)
- type, source(s) and extent of contamination
- hydrogeologic characteristics
- reliability of exposure controls
- design and capabilities of cleanup technologies
- availability of treatment and/or disposal options
- community preferences
- financial resources of the facility

Rationale for Cleanup Time Frame

Establishing reasonable time frames based on specific goals offer facilities realistic objectives, provides flexibility, helps prioritize resources efficiently, and maintains protectiveness

EPA's short-term goals are directed toward eliminating unacceptable exposures to contamination and preventing plumes from spreading as soon as possible After achieving the short-term goals, facilities can move toward final cleanup goals in a time frame commensurate with the technical difficulties and potential risks Considering these factors to determine acceptable cleanup time frames allows the RCRA Corrective Action program to direct its resources toward reducing potential threats at more facilities, while maintaining its long term environmental cleanup goals

What is the cleanup time frame for EPA's short-term goals?

In the short-term, EPA's general goals are to eliminate human exposures to unacceptable levels of contamination and to control plumes from spreading beyond their current limits. To focus the Corrective Action program on these short-term goals, EPA established nationwide goals which are as follows:

By 2005, EPA's goal is to verify and document that 95% of a baseline of 1,714 RCRA corrective action facilities (see http://www epa.gov/correctiveaction/facility.htm) will have human exposures under control and 70% will have the migration of contaminated groundwater under control. EPA encourages regulators and facilities to work together to establish appropriate cleanup time frames, based on the particular circumstances of each facility, that will help meet

these near-term objectives. If people are currently using or being exposed to contaminated groundwater, or contaminants transferred from groundwater (e.g., indoor air), facilities and regulators should take action as soon as possible to prevent these exposures and to achieve short-term protectiveness goals.

How should facilities and regulators establish cleanup time frames for intermediate performance goals?

If an intermediate performance goal is warranted, the time frame to achieve that goal should be reasonable and based on facility specific factors In situations where facilities and regulators anticipate the time to achieve final cleanup goals will be long, establishing cleanup time frames for intermediate goals can help provide meaningful measures to assess and communicate progress among interested stakeholders. Time frames for intermediate goals should generally help to prioritize actions at a facility. For example, at a complex site with many areas of contamination, the regulator and facility may choose to establish a sequence of intermediate goals for the purpose of demonstrating progress toward final cleanup goals. A key consideration in prioritizing actions should be the relative risk and/or potential environmental harm associated with the current contamination.

How should facilities and regulators establish cleanup time frames for achieving final cleanup goals?

EPA recognizes that uncertainties associated with the cleanup may make it impossible to specify with a high level of confidence when a remedy will achieve final cleanup goals. Regulators and facilities can't always accurately predict how long it will take to return groundwater to its maximum beneficial use because of the following kinds of complexities: type of contaminants; hydrogeologic characteristics; contaminant interactions; technology limitations among other factors. In these circumstances, facilities should generally still attempt to predict the time needed to achieve final cleanup goals, but you should recognize that such predictions are best used in a relative sense for comparing one cleanup option to another. Where such predictions are difficult, EPA recommends that cleanup time frames primarily focus on the schedules associated with implementing the remedy and perhaps anticipated time frames associated with achieving certain other facility-specific milestones.

In general, a regulator is more likely to accept a longer cleanup time frame for final cleanup goals when there is adequate monitoring and reliable controls are in place to prevent exposure (e.g., drinking water wells are prohibited). For example, a regulator might allow a facility to have an extended time frame to clean up groundwater when the facility overlies groundwater designated as a future source of drinking water but where no one is currently using or anticipated to use the water in the foreseeable future.

Reference:

EPA, 1996a. Advance Notice of Proposed Rulemaking (61 FR 19432, May 1). Available at http://www.epa.gov/docs/fedrgstr/EPA-WASTE/1996/May/Day-01/pr-547.pdf. Particularly relevant page: 19450.

8. Source Control
(Updated 7/20/01)

What does source control mean?

Source control refers to a range of actions (e.g., removal, treatment in place, containment, etc.) designed to protect human health and the environment from sources of contamination.

Rationale for Source Control

EPA's continuing emphasis on source control reflects the Agency's mission to ensure r remedies are protective in the long term For groundwater, EPA believes source control will generally be a critical component of a facility's cleanup strategy aimed at returning contaminated groundwater to its maximum beneficial use in a reasonable time frame. Controlling sources of contamination is also consistent with the Agency's long-standing pollution prevention policy, it is generally easier to deal with the contamination at the source than to clean up wide-spread contamination

What are sources of contamination?

EPA defines sources as contaminated material that acts as a reservoir for the continued migration of contamination to surrounding environmental media (i.e., soil, groundwater, surface water, sediment, or air), or provides a direct threat to a receptor. Sources are not always stationary, but can migrate from a location, such as a landfill or surface impoundment, where the contamination was originally released. For example, dense non-aqueous phase liquids (DNAPLs) may be present as a "mobile" phase that continues to migrate deeper into the subsurface, migrate along a subsurface feature, or accumulate in a subsurface feature, such as a depression in a low permeable layer of clay[1].

What are EPA's general expectations for source control regarding groundwater?

As conveyed in the 1996 Advance Notice of Proposed Rulemaking (ANPR), EPA generally expects[2] to control or eliminate surface and subsurface sources of groundwater contamination (EPA, 1996a) Therefore, EPA believes most facilities will need to control sources of contamination to achieve facility-specific cleanup goals. Sometimes facilities may need to implement source controls to achieve short-term protectiveness goals. For example, controlling a source of contamination may be important for a facility that wants to rely on monitored natural attenuation to achieve the Migration of Contaminated Groundwater Under Control environmental indicator. EPA believes that source control at many facilities will be an important component of intermediate performance goals used to demonstrate progress toward achieving final cleanup goals. Furthermore, as addressed in the final cleanup goal section of this Handbook, EPA identifies source control as a recommended threshold criterion for final corrective action

---

[1] Additional information and reports concerning DNAPL contamination is available at http //www epa gov/oerrpage/superfund/resources/gwdocs/non_aqu.htm

[2] See glossary for a definition of "remedy expectations "

remedies More specifically, EPA believes facilities should generally propose final remedies that control the source(s) of releases so as to reduce or eliminate, to the extent practicable[3], further releases of hazardous wastes or hazardous constituents that may pose a threat to human health or the environment. EPA generally expects facilities to control the sources of contamination regardless of the current groundwater use or the groundwater use designation.

When should facilities and regulators consider source control measures?

You should consider source control measures as early as possible in corrective action. For example, you should consider whether source controls will be necessary to achieve short-term protectiveness goals, or whether they would be more appropriate to implement as part of an intermediate performance goal or a final remedy. Furthermore, early consideration of potential source control technologies can help facilities focus their data collection to ensure they have adequate evaluation and design information.

When can facilities contain the sources rather than treat them?

EPA generally expects to use treatment to address wastes and contaminated media that EPA considers "principal threats." EPA considers sources or "source materials" to be principal threats when they are highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. EPA generally expects to use engineering controls, such as containment, for wastes and contaminated media which can be reliably contained, pose relatively low long-term threats, or for which treatment is impracticable. The exact balance between treating, removing, and containing the source is best determined on a case-by-case basis during remedy evaluation and selection, and may depend on whether the facility is trying to achieve short-term, intermediate or final cleanup goals. Along with identifying principal threats, you should also generally consider other factors such as long-term reliability, short-term risks, and community acceptance when evaluating the right balance between containment and treatment.

In some situations, it may be appropriate to contain rather than treat even principal threat wastes due to difficulties in treating the wastes. For example, the following situations (EPA, 1997b) could, depending on facility-specific circumstances, justifiably lead a regulator to decide that containment rather than treatment would be acceptable for principal threat wastes:

- Treatment technologies are not technically feasible or are not available within a reasonable time frame.

- The extraordinary volume of materials or complexity of the site may make implementation of treatment technologies impracticable (e.g., large landfills).

---

[3] EPA recognizes that finding subsurface sources of contamination can be very challenging. Therefore, EPA interprets "practicable" in this context to refer to both finding as well as cleaning up sources of contamination Decisions pertaining to the practicability of source control actions are best determined on a facility-specific basis.

- Implementation of a treatment-based remedy would result in greater overall risk to human health and the environment due to risks posed to workers, the surrounding community, or impacted ecosystems during implementation (to the degree that these risks cannot otherwise be controlled during implementation).

- Implementation of the treatment technology would have severe effects across environmental media.

Why should facilities control sources when they have already achieved environmental indicators goals?

Environmental Indicators are only milestones on the way to meeting final cleanup goals and completing corrective action. In most cases, source control will be necessary to return groundwater to its maximum beneficial use within a reasonable time frame.

References:

EPA, 1997b. Rules of Thumb for Superfund Remedy Selection, OSWER Directive No. 9355.0-69 (August). Available at http://www epa gov/oerrpage/superfund/resources/rules/index htm. Particularly relevant text pertaining to applicability to RCRA corrective action found on page 1, and on Treatment of Principal Threat Wastes on pages 11 and 12.

EPA, 1996a. Advance Notice of Proposed Rulemaking (61 FR 19432, May 1). Available at http://www.epa.gov/docs/fedrgstr/EPA-WASTE/1996/May/Day-01/pr-547.pdf. Particularly relevant pages 19448.

EPA, 1991c. A Guide to Principal Threats an Low Level Threat Wastes. Superfund Publication 9380.3-06FS (November). Available at http://www.epa.gov/oerrpage/superfund/resources/gwdocs/threat.pdf.

9. Groundwater Use Designations
(Updated 7/20/01)

What is a groundwater use designation?

A groundwater use designation is a determination of the reasonably expected use(s)[1], resource value, (e.g., priority), and/or vulnerability of groundwater in a particular area. A system used to make protective groundwater use designations should account for these factors and be: (1) based on an overall goal that is no less protective than EPA's groundwater protection goal[2]; (2) applied consistently to all groundwaters of a state; and (3) developed with thorough opportunity for public participation. EPA and states can use the designation as a factor in determining the maximum[3] (highest) beneficial use of the groundwater in order to establish facility-specific corrective action goals.

Rationale for Groundwater Use Designations

EPA believes that states should have the primary responsibility for managing and protecting their groundwater resources. Therefore, EPA prefers, where appropriate, to rely on state groundwater use designations when developing groundwater cleanup objectives

EPA supports state groundwater use designation systems which promote a consistent and comprehensive approach to groundwater protection based on varying groundwater characteristics. EPA's primary objectives are to advocate approaches for groundwater use designations that protect both the current as well as reasonably expected uses of groundwater and to foster equivalent levels of protection for this valuable national resource. In particular, EPA wants to avoid inappropriate groundwater use designations and associated cleanup decisions that would rely on the lack of current drinking water use at an individual facility as the only justification for a non-drinking water use designation

How does EPA define use, value and vulnerability?

The term "use" refers to the current use and reasonably expected use of the groundwater. When people think about groundwater use, they often consider only drinking water use; however, there are many other groundwater uses besides drinking water. These uses include, for example, sanitary water, cooling water, car washes, livestock watering, and agricultural irrigation. "Value" depends on the current and reasonably expected use, but it also considers groundwater's

---

[1] Further guidance on defining "reasonably expected uses of groundwater" is available in Appendix B of the EPA guidance titled, Final Comprehensive State Groundwater Protection Program Guidance (EPA, 1992a, EPA 100-R-93-001 which is available through http://www.epa.gov/OGWDW/Pubs/06ground.html.

[2] EPA's overall groundwater protection goal is to prevent adverse effects to human health and the environment and to protect the environmental integrity of the nation's groundwater resources (EPA, 1991b; http://www.epa.gov/OGWDW/Pubs/11ground.html).

[3] Within the range of reasonably expected uses and exposures, the maximum beneficial groundwater use is the one which that warrants the most stringent groundwater cleanup levels.

potential impact on other media; exposures to contaminants from groundwater can occur even when there is no direct use of the groundwater. For example, groundwater may recharge adjacent or underlying aquifers that are used for drinking water, or discharge to surface water to support aquatic life, recreation, drinking water, etc. In addition, exposure to contaminated indoor air can result from underlying groundwater contaminated with volatile chemicals. Value also refers to the irreplaceability of groundwater either as a source of drinking water (e g., sole source aquifer) or to support vital ecological systems.

Groundwater "vulnerability" is the relative ease with which a contaminant introduced into the environment can migrate to an aquifer under a given set of management practices, contaminant properties, and aquifer hydrogeologic characteristics.

What factors should states consider when making groundwater use designations?

To promote consistency, where appropriate, EPA issued guidance to states (EPA, 1992a) that included a list of factors (see adjacent box) they should generally consider in assessing use, value and vulnerability of their groundwater resources.

Factors to Assess Use, Value and Vulnerability of Groundwater Resources

- Vulnerability to contamination
- Hydrogeologic regimes (recharge and discharge areas)
- Flow patterns
- Quantity and potential yield
- Ambient and/or background quality
- Wide-spread contamination
- Current use and exposures (including public water supply systems and private drinking water supply wells)
- Reasonably expected future uses (based on demographics, [remoteness], and availability of alternative water supplies)
- Connections to surface waters
- Impacts to ecological receptors
- Value attributed to groundwater resource, including public opinion
- Governmental and legal boundary considerations (e g , groundwater migrating across state boundaries)

(based on EPA, 1992a)

How does EPA's policy on groundwater use designations affect states which consider all of their groundwater to be a potential drinking water supply?

EPA recognizes that some states have statutes, regulations, or policies designating all groundwater to be a potential drinking water supply, and requiring that all contaminated groundwater be cleaned up to drinking water standards. Neither the federal RCRA statute, nor any of EPA's guidance prevent states from taking a more stringent approach than what EPA would use for making groundwater use and cleanup decisions. However, EPA still encourages such states to develop methods for prioritizing groundwater resources to focus clean up actions on facilities in more sensitive areas first. Examples of factors or criteria that states can use to distinguish among potential drinking waters on a facility-specific basis are:

- expected time frame of future use

- likelihood of use within a certain time period (e.g., 30 years)
- relative priority or value
- relative vulnerability
- proximity to existing public and private water supply
- presence of elevated concentrations of naturally occurring contaminants
- likelihood of impacting sensitive area (e.g., wetland) or environmental receptors[4]

States are already acquiring this kind of information for other EPA programs. For example, Section 1453 of the Safe Drinking Water Act (SDWA) as amended in 1996 requires states to develop and implement Source Water Assessment Programs (SWAPs). These programs must assess source waters within the state which support public drinking water systems. A source water assessment program will consist of: (1) a delineation of the source water area; (2) an inventory of potential sources of contaminants; and (3) a susceptibility analysis of public drinking water systems.

States were required to submit their Source Water Assessment Programs for approval by February 1999, and have three and a half years to complete the assessment following program approval. Most states will have completed their assessments by November 2002. The results of these assessments must be made available to the public, and may prove to be helpful in identifying areas needing greater protection of groundwater resources. For more information on Source Water Assessment Programs, you should refer to State Source Water Assessment and Protection Programs Guidance, EPA Doc. No. EPA-816-R-97-009 (EPA, 1997d). Electronic information is available at http://www.epa.gov/OGWDW/swp/swappg.html.

Who makes groundwater use designations?

The regulator typically identifies the groundwater use designation since regulators are responsible for ensuring that corrective action is protective of human health and the environment. However, a facility can provide the information the regulator needs to make a groundwater use designation.

EPA generally prefers to rely on states to develop groundwater use designations. In particular, EPA generally intends to defer to a state groundwater use designation when it is part of an EPA-endorsed Comprehensive State Groundwater Protection Program ("CSGWPP") that provides for facility-specific decision making in EPA's remediation programs[5]. Also, in the absence of such

---

[4] Risks to ecological receptors may in some situations be the primary reasons for cleanups, especially for groundwater that is not designated as source of drinking water. Furthermore, to protect particularly sensitive ecological receptors, concentrations of groundwater cleanup levels sometimes may have to be lower than concentrations associated with drinking water standards designed to protect humans.

[5] A Comprehensive State Groundwater Protection Program (CSGWPP) is a groundwater management strategy developed by a state EPA reviews CSGWPPs and "endorses" those that successfully meet six strategic activities. EPA outlined specific criteria for each strategic activity in CSGWPP guidance In particular, EPA remediation programs review state guidelines in the CSGWPP to prioritize groundwater based upon use, value and

(continued...)

an EPA-endorsed CSGWPP, EPA may, where appropriate, rely on an alternative protective state groundwater use designation; EPA typically makes such determinations by considering the same factors listed in the CSGWPP guidance. States authorized for corrective action have the lead in making groundwater use designations. However, states may choose to use EPA's groundwater use classification (see next question) in the absence of a state groundwater use designation system

Depending on facility-specific circumstances, EPA may find it appropriate to use its own classification (see next question) to make groundwater use designations. These circumstances could include, for example, when: (1) EPA has the lead role in implementing corrective action at a facility, and (2) a state designation system is not available or is not in EPA's opinion adequately protective of our nation's groundwater resources. States may also choose to use EPA's groundwater use classification in the absence of a state groundwater use designation system. You should consult the lead regulatory agency to determine how they generally determine reasonably expected groundwater use [6].

What is EPA's groundwater use classification?

EPA's groundwater classification system is found in "Guidelines for Groundwater Classification under the EPA Ground-Water Protection Strategy" (EPA, 1986 - executive summary available at http://www.epa.gov/correctiveaction/resource/guidance/gw_use/gwclass.pdf). These guidelines describe three classes of groundwater that represent a hierarchy of groundwater resource values to society: Class I is groundwater which is an irreplaceable source of drinking water and/or ecologically vital. Class II is groundwater currently used or potentially usable as a source of drinking water; and Class III includes groundwater that is not a current or potential source of drinking water Under this system groundwater is designated on a site-specific basis, but the overall recommended criteria are comprehensive.

How can state groundwater use designations enhance protection and flexibility for RCRA cleanups?

Regulators can prioritize their workload to address those facilities overlying more highly valued groundwaters first. In addition, groundwater use designations can serve as a starting place for predicting the reasonably expected use(s) of groundwater. Therefore, for states with protective groundwater use designation systems, regulators may modify groundwater cleanup objectives

---

[5](...continued)
vulnerability. In 1997, EPA's Office of Solid Waste and Emergency Response issued a directive (EPA, 1997e) encouraging EPA's remediation programs generally to defer to state determinations of current and future use when based on an EPA-endorsed CSGWPP that has provisions for facility-specific decisions. A map of states with EPA-endorsed CSGWPPs is available at http //www epa gov/OGWDW/csgwpp html

[6] Some states have groundwater classification schemes based on specific parameters (e g , total dissolved solids) that mandate particular cleanup standards (e g , primary and secondary drinking water standards). Links to state hazardous waste programs are available at http //www epa gov/correctiveaction/state htm.

while still ensuring protection of human health and the environment based on both current and potential future uses.

Flexibility associated with groundwater use designations provides more cleanup options to facilities and regulators. For example, regulators could allow a facility to have an extended cleanup time frame to clean up groundwater when the facility overlies groundwater designated as a future drinking water source, but where no one is currently using or anticipated to use the water in the foreseeable future.

Another example is that some states have developed groundwater cleanup levels based on industrial or non-drinking water use. These non-drinking water cleanup levels may be less stringent than drinking water standards, and may facilitate redevelopment of facilities (e.g., brownfields - http://www.epa.gov/swerosps/bf/new.htm) that might otherwise remain unused. However, it is important to evaluate various uses of and exposures to groundwater on a facility-specific basis prior to relying on generic cleanup levels to ensure these levels would be protective.

Some states also formally identify groundwater that has no beneficial use. For such situations, as described in the Final Cleanup Goals section of this Handbook, regulators could consider source control and long-term containment rather than cleaning up the groundwater to achieve a particular cleanup level(s) throughout the contaminant plume. When long-term containment is the cleanup objective, regulators should generally establish a point of compliance at the boundary of the containment zone.

Facilities should not interpret that accepting a higher groundwater cleanup level based on a groundwater use designation means that less stringent prevention measures are acceptable. Regardless of the groundwater use designation, facilities should comply with all state and federal laws for preventing new releases of contamination, and do their part to minimize hazardous waste generation.

How do groundwater management or containment zones relate to groundwater use designations?

Some states[7] formally define existing areas of broadly contaminated groundwater as groundwater management zones. States typically do not use these groundwater management zones to change a groundwater use designation; rather, they generally use groundwater management zones as a type of institutional control[8] to publically acknowledge that the contaminated groundwater is

---

[7] Illinois and Delaware are examples of states that have adopted groundwater management zone approaches. California has a adopted a similar approach called a "containment zone," but does not use them for facilities subject to RCRA corrective action.

[8] To provide overlapping assurances of protection from contamination, EPA recommends that various forms of institutional controls be "layered" (i.e , use of multiple institutional controls) or implemented in a series

(continued...)

currently unsuitable for its designated use, and to provide reasonable flexibility[9] to facilities that are implementing long-term groundwater remedies. While some differences exist among states, groundwater management zones typically are granted only if a facility satisfies specific provisions; some of the more common conditions, which are also consistent with the policies in this Handbook, include:

- the facility has controlled sources of contamination where appropriate;
- the facility has defined existing boundaries of the contaminated groundwater;
- the facility is currently conducting a groundwater cleanup action, under regulatory oversight, that is designed to prevent migration of contamination outside the groundwater management zone; and,
- the facility recognizes that their obligations to ensure protection of human health and the environment continue until the groundwater is returned to its designated use.

In general, EPA supports and encourages creative and flexible approaches to address contaminated groundwater. As such, EPA supports the use of groundwater management zones when they streamline corrective action decision making, while still ensuring that facilities achieve protective short- and long-term cleanup goals.

References:

EPA, 1997d. State Source Water Assessment and Protection Programs Guidance (August). Available at http://www.epa.gov/OGWDW/source/swpguid.html .

EPA, 1997e. The Role of Comprehensive State Groundwater Protection Programs (CSGWPPS) is OSWER Remediation Programs. OSWER Directive 9283.1-09 Available at http://www.epa.gov/superfund/resources/csgwpp/role.pdf.

EPA, 1996a. Advance Notice of Proposed Rulemaking (61 FR 19432, May 1). Available at http://www.epa.gov/docs/fedrgstr/EPA-WASTE/1996/May/Day-01/pr-547.pdf. Particularly relevant page stating EPA's expectation for contaminated groundwater on 19448.

EPA, 1992a. Final Comprehensive State Groundwater Protection Program Guidance, EPA 100-R-93-001. For more information, refer to http://www.epa.gov/OGWDW/Pubs/06ground.html.

EPA, 1991b. Protecting the Nation's Groundwater: EPA's Strategy for the 1990's. For more information, refer to http://www.epa.gov/OGWDW/Pubs/11ground.html .

---

[8](.continued)
For example, prohibitions against installing drinking water wells could be used in conjunction with defining a groundwater management zone.

[9] For example, establishing a groundwater management zone can make it easier in some states to select monitored natural attenuation as a cleanup approach, or to justify long-term containment when completely restoring contaminated groundwater is particularly challenging or even technically impracticable

EPA, 1986. Guidelines for Groundwater Classification under the EPA Groundwater Protection Strategy. Available at http://www.epa.gov/correctiveaction/resource/guidance/gw_use/gwclass.pdf.

10. Institutional Controls
(Updated 7/20/01)

What are institutional controls?

EPA defines institutional controls as non-engineered measures[1] such as administrative and/or legal controls that minimize the potential for human exposure[2] to contamination by limiting land or resource use. EPA expects to use institutional controls, such as water and land use restrictions, primarily to supplement engineering controls as appropriate to prevent or limit exposure to hazardous waste and constituents. Institutional controls are appropriate to use during all stages of the cleanup process to accomplish various cleanup-related objectives. To provide overlapping assurances of protection from contamination, institutional controls should be "layered" (i.e., use of multiple institutional controls) or implemented in a series.

Rationale for Institutional Controls

EPA recognizes that, depending on the site-specific circumstances, facilities can achieve short-term, intermediate, or final cleanup goals through various combinations of removal, treatment, engineering and institutional controls For groundwater that will likely remain contaminated for a considerable period of time, EPA believes that some form of institutional control will typically be a critical part of the groundwater remedy to prevent exposures Therefore, institutional controls should be designed, implemented and monitored just like any other component of a remedy needed to ensure protection

What are the general categories and some specific examples of institutional controls?

There are four general categories of institutional controls· governmental controls; proprietary controls; enforcement tools with institutional control components; and informational devices. Each of these categories is briefly described below. For more detailed descriptions of these categories, including benefits and limitations of different institutional control mechanisms, you should refer to the institutional control matrix available at. http://www.epa.gov/epaoswer/hazwaste/ca/resource/guidance/ics/matrxrv3.pdf.

---

[1] Fences that restrict access to sites are often termed institutional controls, however, EPA does not consider fences to be institutional controls because fences are physical barriers instead of administrative or legal measures For more detailed guidance on institutional controls, you should refer to a recent document (EPA, 2000a) issued by EPA titled, "Institutional Controls A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups " You can download this document as well as supporting materials at http //www epa gov/epaoswer/hazwaste/ca/resource/guidance htm#InstitutionalControls.

[2] While institutional controls may limit exposure to human populations, facilities and regulators should ensure that cleanup actions also protect ecologic receptors

Governmental Controls - These controls are usually implemented and enforced by state or local governments. Once implemented, local and state entities often use traditional police powers to regulate and enforce the controls. Since this category of institutional control is put in place under local jurisdiction, they may be changed or terminated with little notice to EPA, and EPA generally has no authority to enforce such controls. Examples include zoning, ordinances (e.g., restricting well drilling or water use), statutes, building permits, or other provisions that restrict land or resource use.

Proprietary Controls - These controls rely on legal instruments placed in the chain of title for the subject site or property. The specific instrument may convey a property interest from the owner (grantor) to a second party (grantee) for the purpose of restricting land or resource use. One example of this type of control is an easement that provides access rights for monitoring and inspection. Another example is a covenant not to dig or drill wells in certain areas. A major benefit of these controls is that they can be binding on subsequent purchasers of the property and transferable. However, enforcement of proprietary controls depends on the party to which the property interest has been granted. Unlike EPA's Superfund Program, RCRA does not authorize EPA to acquire property interests to conduct a cleanup, and, therefore, EPA cannot generally hold on directly enforce proprietary controls.

Enforcement Tools - Federal, state and local governments can, in some circumstances, issue or negotiate permits, orders, or other enforceable agreements which direct a facility to refrain from using a property in specific ways. These tools can be very effective but the major limitation is that most enforcement agreements are only binding on those that enter into the agreement. Furthermore, restrictions based on enforcement tools are not typically transferable through a property transaction.

Informational Devices - These tools are typically used to provide information or notification regarding contamination present at a property. Common examples include state registries of contaminated properties, deed notices[1] and advisories. Informational devices are not typically enforceable; therefore, they are best used as a secondary "layer" to help ensure the overall reliability of other institutional controls.

How can facilities and regulators use institutional controls to address contaminated groundwater?

For contaminated groundwater, the most common purpose of institutional controls is to protect human health by preventing exposure. As described previously, institutional controls "layered" or used in series provide the best means to ensure protection from contaminated groundwater. For example, to prevent exposure to contaminated groundwater associated with a given facility, institutional controls could include all or various combinations of the following components: (1) state or local governmental controls prohibiting well drilling and use of groundwater in

[1] Deed restriction is a phrase often used in remedy decision documents to describe easements or other forms of institutional controls; however, this is not a traditional property law term and should be avoided.

designated area; (2) a proprietary easement or covenant providing access to monitor groundwater and/or restrictions on using groundwater; (3) enforceable conditions in a state or EPA permit or administrative order preventing use of contaminated groundwater and requiring training for those who could come in contact with contaminated groundwater; (4) placing a notice on the deed about the existence of contaminated groundwater under the property; and (5) distributing an advisory notice to local citizens in a given area that they should avoid drinking or contact with groundwater. Facilities and regulators should also consider procedures for terminating and institutional control when it is no longer necessary to protect human health and the environment.

How should facilities develop and stakeholders evaluate institutional controls?

EPA believes that it is helpful for stakeholders to consider institutional controls in a similar manner to how they would evaluate, implement and monitor an engineered remedy. Therefore, EPA believes that institutional controls should go through an evaluation, selection, implementation, and an operation and maintenance phase. EPA believes that all four phases are important because, just like physically constructed components of a remedy, institutional controls can work well, work somewhat, or not work at all.

The evaluation phase should involve assessing the need for, purpose and type of institutional control based on how well it would meet a specific short-term protectiveness, intermediate performance, or final cleanup goal. This phase should identify all parties that would need to be involved to successfully implement the institutional control. Additionally, this phase should include evaluation of the approaches facilities and regulators will use to assess the effectiveness of the institutional control.

As with other components of a remedy, the facility should recommend a specific institutional control approach, and regulators should determine, with input from public, whether the facility's recommendation is satisfactory. This selection phase should be based on the three threshold criteria and the seven balancing criteria as described in the policy for final cleanup goals.

The implementation phase typically involves negotiating, drafting, and recording documents to put into place the institutional controls that successfully made it through the evaluation phase. For example, selecting an implementation of an institutional control could involve placing provisions in an state permit, creating an easement, putting a notice in a deed, and distributing advisories.

Operation and maintenance should include periodic actions serving to ensure that the institutional control approach is working as designed. Examples of operation and maintenance of an institutional control include: physical inspection of legal documents including deeds, enforcing institutional controls if necessary, and routine distribution of advisories to local citizens.

References:

EPA, 2000a. Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups (September). OSWER Directive 9355.0-74FS-P. Available at http://www.epa.gov/epaoswer/hazwaste/ca/resource/guidance.htm#InstitutionalControls.

EPA, 1996a. Advance Notice of Proposed Rulemaking (61 FR 19432, May 1). Available at http://www.epa.gov/docs/fedrgstr/EPA-WASTE/1996/May/Day-01/pr-547.pdf. Particularly relevant pages: 19448-49

11. Monitored Natural Attenuation
(Updated 7/20/01)

What is monitored natural attenuation?

The term "monitored natural attenuation" refers to an approach to clean up environmental contamination by relying on natural processes and monitoring. Natural attenuation processes include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume or concentration of contaminants in groundwater.

Rationale for
Monitored Natural Attenuation

This policy reflects advancements in EPA's understanding of how natural attenuation processes can be part of an effective cleanup strategy Monitored natural attenuation is not a "no action" cleanup option Appropriate use of monitored natural attenuation supports EPA's cleanup objectives which include source control, prevention of plume migration, and returning contaminated groundwater to maximum its beneficial use

When is monitored natural attenuation a likely cleanup option?

Monitored natural attenuation may be an appropriate cleanup option when the facility can demonstrate that the remedy is capable of achieving facility-specific groundwater cleanup levels in a reasonable cleanup time frame. Facilities should evaluate and justify monitored natural attenuation remedies using the evaluation and selection criteria discussed in the policy on final cleanup goals. Monitored natural attenuation should be justified on a facility-specific basis and compared with, where appropriate, other plausible options. In general, monitored natural attenuation proposals are more likely to be acceptable to regulators[1] when·

- the facility can demonstrate that monitored natural attenuation will be able to achieve groundwater cleanup objectives;
- measures for source control of groundwater contamination are already in place;
- the dominant natural attenuation processes cause degradation or destruction of contaminants as opposed to those processes that merely dilute contamination or prevent its movement;
- the contaminant plume(s) is already stable or shrinking in extent;

[1] Some states may have specific guidelines, requirements or restrictions associated with monitored natural attenuation remedies For example, some states have specific guidelines for when monitored natural attenuation would be acceptable, based on (1) contaminant concentrations, (2) plume location (i e , off-site), and (3) anticipated time frame to clean up the groundwater For a more complete list of factors as well as a list of advantages and disadvantages of monitored natural attenuation remedies, you should refer EPA's 1999 policy directive available at http //www epa.gov/swerust1/directiv/d9200417 pdf

- the estimated cleanup time frame[2] to meet cleanup levels is reasonable considering factors such as groundwater use and time frames required for other remedies; and,

- the facility uses monitored natural attenuation in conjunction with an active remedial system or as a follow-up measure.[3]

For a more complete list of factors as well as a list of advantages and disadvantages of monitored natural attenuation remedies, you should refer to EPA's 1999 monitored natural attenuation policy directive (Directive 9200.4-17P; EPA, 1999d) available at http://www.epa.gov/swerust1/directiv/d9200417.pdf.

Is monitored natural attenuation acceptable when contaminated groundwater is off-site?

The regulator should determine whether monitored natural attenuation will be acceptable for off-site contaminated groundwater[4]. In making this determination the regulator should consider facility-specific circumstances and specific requirements, guidance, or policies of the state in which the facility is located. One situation where a regulator might accept a monitored natural attenuation remedy is where no one is currently exposed to unacceptable levels of contamination and the plume is not expanding (i.e., the facility meets EPA's short-term protectiveness goals). Other very important factors to consider when deciding whether to rely on monitored natural attenuation for off site contamination include the thoroughness of public participation[5], the ability to conduct long-term monitoring and prevent exposures, and whether the facility is controlling the source of the groundwater contamination.

Should monitored natural attenuation remedies include formal contingency plans?

In general, EPA recommends that facilities and regulators consider whether they should include one or more contingency measures when evaluating monitored natural attenuation as a cleanup option. A contingency plan (or contingency remedy or a contingency measure) is a cleanup approach specified in a remedy decision document that functions as a "backup" remedy in the event that the "selected" remedy fails to perform as anticipated. Contingency plans should generally be flexible allowing for new information about risks and technologies. EPA believes

---

[2] EPA recommends that proposals for monitored natural attenuation remedies include estimates of the time needed to achieve groundwater cleanup levels EPA realizes that such estimates are based on numerous assumptions, but they are still helpful for relative comparisons between cleanup options.

[3] While EPA believe regulators will generally be more likely to approve monitored natural attenuation remedies that involve other more active source control and treatment measures, we recognize that there will be some situations where monitored natural attenuation may be sufficient as a stand-alone remedial alternative

[4] EPA's policy (EPA, 1999d) on monitored natural attenuation does not distinguish between on-site and off-site contaminated groundwater

[5] Some state programs might require formal concurrence of adjacent property owners for monitored natural attenuation remedies proposed to address off-site contaminated groundwater.

that contingency plans are especially appropriate for a monitored natural attenuation remedy that is selected based primarily on predictive analyses rather than documented trends of decreasing contaminant concentrations

How long should a facility monitor a monitored natural attenuation remedy?

A facility should monitor until the groundwater cleanup levels are met at the point of compliance for the final cleanup goals, and longer as appropriate, if the final remedy involves a component designed for long-term containment. EPA specifically added the term "monitored" to the name of this cleanup alternative to emphasize the importance of long-term performance monitoring. EPA's Policy Directive states, "Performance monitoring should continue until remediation objectives have been achieved, and longer if necessary to verify that the facility no longer poses a threat to human health or the environment." However, the Directive also emphasizes that it is important to include flexibility sufficient to adjust the frequency (more frequent or less frequent) of monitoring as the situation warrants.

References:

EPA, 1999d. Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action and Underground Storage Tank Sites (April 21). OSWER Policy Directive 9200.4-17P. Available at http://www.epa.gov/swerust1/directiv/d9200417.htm. Other helpful links regarding MNA available at http.//www epa.gov/swerust1/mna/index.htm and http://www.epa gov/swerust1/oswermna/mnalinks.htm .

EPA, 1998b. Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater EPA/600/R-98/128. Available at http://www.epa gov/correctiveaction/resource/guidance/rem_eval/protocol.pdf

EPA, 1996a. Advance Notice of Proposed Rulemaking (61 FR 19432, May 1). Available at http://www.epa.gov/docs/fedrgstr/EPA-WASTE/1996/May/Day-01/pr-547.pdf. Particularly relevant pages· 19451-52.

NRC, 2000. Natural Attenuation for Groundwater Remediation. Committee on Intrinsic Remediation, Water Science and Technology Board, Board on Radioactive Waste Management, National Research Council. Available at http://www.nap edu/catalog/9792 html

12. Technical Impracticability
(Updated 7/20/01)

What does technical impracticability mean?

EPA generally uses the concept of technical impracticability (TI) for contaminated groundwater to refer to a situation where achieving groundwater cleanup levels associated with final cleanup goals is not practicable from an "engineering perspective." The term "engineering perspective" refers to factors such as feasibility, reliability, scale or magnitude of a project, and safety. For example, a certain cleanup approach might be technically possible, but the scale of the operation might be of such magnitude, that it was not technically practicable.

Rationale for Technical Impracticability

EPA believes that it is appropriate to recognize the limitations of current technologies to clean up groundwater to its maximum beneficial use This policy offers facilities a framework to technically justify such limitations and to focus resources on protective alternative remedial strategies EPA's policy concerning technical impracticability does not, however, signal a scaling back of efforts to address contaminated groundwater. Rather, this policy reaffirms EPA's commitment to protect our nation's groundwater resources from contamination at RCRA corrective action facilities In particular, the policy encourages regulators to (1) base their technical impracticability decisions on sound science, and (2) where technical impracticability is adequately justified, ensure that facilities maintain their alternative remedial strategies (e.g , containment) as long as necessary to protect both human health and the environment

What are the primary factors that might lead to a technical impracticability determination?

Reasons for technical impracticability generally fall into one of two categories[1]:

(1) Hydrogeologic factors
(2) Contaminant-related factors

Examples of limiting hydrogeologic factors could include very low-permeable or highly heterogeneous soils, or complex fractures or solution cavities in bedrock. A contaminant-related factor could be presence of residual non-aqueous phase liquids (NAPLs). Other examples of contaminant-related factors could be associated with extensive volume of or limited access to contaminated material.

EPA expects that poor cleanup performance due to inadequate remedial design would not be sufficient justification for a technical impracticability determination. Design inadequacies could stem from, for example, inadequate characterization, selecting inappropriate technologies, or

[1] Readers should refer to *Alternatives for Ground Water Cleanup* (NRC, 1994), available at http://www.nap.edu/books/0309049946/html/, for further information regarding challenges associated with groundwater cleanups Also, you can find numerous resources concerning cleanup technologies at EPA's Technology Innovation Office's web site (http://www.clu-in.org/), including the feature called "Technology Innovation Office's Perspectives" (http://www.clu-in.org/tiopersp/default.htm) where you can view several recent articles summarizing current cleanup technology practices and developments

deficiencies associated with implementing a particular technology.

Is the mere presence of non-aqueous phase liquids (NAPLs) sufficient to justify a technical impracticability determination?

No. In determining that it is technically impracticable to achieve a set cleanup level, regulators should not rely solely on the presence of NAPLs[2]. The presence of NAPL is just one of many factors facilities and regulators should consider when evaluating technical impracticability. Other factors to consider are the type, amount, and location of NAPL, as well as the technologies that are available to clean up the NAPL. Facilities should avoid basing their technical impracticability demonstration on just the presence of NAPL or the apparent inability of any one technology (e.g., pump-and-treat). A technical impracticability demonstration should be based on a comprehensive understanding of hydrogeologic factors, chemical characteristics, and conventional as well as innovative technologies.

What should facilities include in a technical impracticability demonstration?

EPA generally expects that technically impracticability determinations would be based on a demonstration by the facility. EPA's guidance (EPA, 1993) on technical impracticability suggests that this demonstration generally include the following.

- Spatial area (the TI zone) over which the TI decision would apply
- Specific groundwater cleanup levels, consistent with the groundwater use designation, that are considered technically impracticable to achieve
- Conceptual site model that describes geology, hydrology, groundwater contamination sources, transport and fate
- Evaluation of the "restoration potential" of the TI zone
- Cost estimates
- Any additional information EPA or the state program deems necessary
- Description of an alternative remedial strategy

When should a facility recommend technical impracticability?

Considering technical impracticability early in corrective action (e.g., during facility characterization) is a good idea if available information suggests that a facility has hydrogeologic or chemical-related cleanup limitations. The facility should submit a technical impracticability demonstration along with a recommendation for a final remedy. However, we recommend facilities do not devote significant resources on a technical impracticability demonstration until they achieve short-term protectiveness goals (i.e., environmental indicators).

---

[2] Additional information and reports concerning NAPL contamination is available at http //www.epa gov/oerrpage/superfund/resources/gwdocs/non_aqu htm See also EPA, 1995b and 1994c

If a regulator makes a formal technical impracticability determination, has the facility satisfied all of their corrective action obligations for groundwater?

A technical impracticability determination does not override the RCRA statutory obligation that remedies protect human health and the environment. When the regulator determines that achieving groundwater cleanup levels associated with final cleanup goals is technically impracticable, the regulator should select an "alternative remedial strategy" that protects human health and the environment and:

- is technically practicable
- achieves short-term protectiveness goals and, if appropriate, intermediate performance goals
- controls the sources of contamination
- achieves the groundwater cleanup levels outside the TI zone
- provides for appropriate long-term[3] operation, maintenance and monitoring, and
- is consistent with the overall cleanup goals for the facility

Why should facilities conduct investigations within the technical impracticability zone?

Facilities should characterize within the TI zone to: (1) support the technical impracticability demonstration; (2) identify sources that they should control, even within the TI zone; (3) evaluate the potential for cross-media transfer of contamination they may need to manage (e.g., from groundwater to air) as part of an alternative remedial strategy; and (4) support the development of an alternative remedial strategy as discussed above. The circumstances of the facility will govern the amount of characterization needed to accomplish these objectives.

Why should facilities control sources within the technical impracticability zone?

Source control is generally an important part of an acceptable alternative remedial strategy and is one EPA's three recommended threshold criteria associated with final cleanup goals. Source control prevents the continued input of contamination into surrounding environmental media and can help improve the likelihood that the alternative remedial strategy will be effective in the long-term. Controlling sources within the technical impracticability zone will help to limit the amount of contamination facilities will need to address if and when achieving the groundwater cleanup levels becomes technically practicable in the future. However, as mentioned previously in this Handbook (see final cleanup goals and source control sections), EPA believes the exact balance between treating, removing, and containing the source, even in the context of a TI determination, is best evaluated on a case-by-case basis.

---

[3] Some cleanup programs (e.g , New York state- see http://www clu-in org/eiforum2000/prez/ppframe1 cfm?id=81) have referred to long-term containment of contaminated groundwater in terms of "perpetual care" obligations.

How does a technical impracticability determination affect the point of compliance?

Until the technical impracticability determination is no longer valid, regulators may choose to establish a point of compliance throughout the contaminated groundwater located outside the TI zone. Typically, a point of compliance located outside the boundary of the TI zone means that regulators would not require actions to meet groundwater cleanup levels within the TI zone as long as the TI determination remains valid.

How long should a technical impracticability determination last?

EPA recommends that, for RCRA corrective action, technical impracticability determinations and the responsibility of the facility to maintain its alternative remedial strategy remain in place until subsequent advances in technology make achievement of the groundwater cleanup levels within the TI zone technically practicable. Facilities should realize that a technical impracticability determination for many circumstances could warrant ongoing care to ensure long-term protection.

Should regulators and/or facilities revisit technical impracticability determinations?

Technical impracticability determinations are based on current understanding of capabilities and limitations of cleanup technologies. Cleanup goals which are technically impracticable today could become technically practicable at some point in the future. Therefore, EPA's 1993 guidance on technical impracticability (EPA, 1993) recognizes that regulators overseeing RCRA corrective action may require facilities to revisit technical impracticability determinations in the future and implement new approaches that are designed to achieve final cleanup goals. Examples could include situations where new information or new technologies become available that indicate the facility could achieve groundwater cleanup levels that were previously determined to be technically impracticable. Sometimes, the facility might want to revisit the technical impracticability determination without prompting by the regulator. For example, the facility might want to try a new technology that has the ability to achieve the original cleanup objectives rather than continuing to implement an alternative remedial strategy. Therefore, EPA recommends that both facilities and regulators periodically re-evaluate the technical impracticability decision as part of routine performance monitoring.

References:

EPA, 1996a. Advance Notice of Proposed Rulemaking (61 FR 19432, May 1). Available at http://www.epa.gov/docs/fedrgstr/EPA-WASTE/1996/May/Day-01/pr-547.pdf. Particularly relevant page. 19451.

EPA, 1995a. Consistent Implementation of the FY 1993 Guidance on Technical Impracticability of Ground Water Restoration at Superfund Sites (January). OSWER Directive 9200.4-14. Additional information available at http://www.epa.gov/oerrpage/superfund/resources/gwdocs/tec_imp.htm.

EPA, 1995b. Groundwater Issue: Light Non-Aqueous Phase Liquids (EPA/540/S-95/500). Available at http://www.epa.gov/ada/download/issue/lnapl.pdf.

EPA, 1994c. DNAPL Site Characterization. EPA/540/F-94/049. Available at http://www.epa.gov/oerrpage/superfund/resources/gwdocs/dnapl.pdf.

EPA, 1993. Guidance for Evaluating the Technical Impracticability of Groundwater Restoration EPA/540-R-93-080, (September). Available at http://www.epa.gov/oerrpage/superfund/resources/gwdocs/techimp.htm.

NRC, 1994. *Alternatives for Ground Water Cleanup* / Committee on Ground Water Cleanup Alternatives, Water Science and Technology Board, Board on Radioactive Waste Management, Commission on Geosciences, Environment, and Resources, National Research Council. National Academy Press, 1994. Available at http://www.nap.edu/books/0309049946/html/.

13. Re-injection of Contaminated Groundwater
(Updated 7/20/01)

Can facilities re-inject groundwater that is contaminated with hazardous wastes back in the subsurface as part of corrective action?

RCRA section 3020(a) bans hazardous waste disposal by underground injection into or above an underground source of drinking water located within 1/4 mile from an injection well. However, RCRA section 3020(b) exempts from that ban the injection of groundwater contaminated with hazardous wastes provided that certain conditions are met.

Rationale for Re-injection of Contaminated Groundwater

This policy allows more opportunities for using in-situ bioremediation and other in-situ treatments where such technologies are protective and offer advantages over other cleanup alternatives.

What are the specific conditions facilities have to meet prior to re-injecting groundwater contaminated with hazardous waste into the subsurface?

The exemption provided by RCRA section 3020(b) will allow facilities to re-inject groundwater, which is contaminated with hazardous wastes, back into the aquifer from which it was withdrawn if the contaminated groundwater is treated to substantially reduce hazardous constituents prior to such re-injection. Additionally, the re-injection needs to be part of a response action under section 104 or 106 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), or part of RCRA corrective action intended to clean up such contamination; and, the cleanup will, upon completion, be sufficient to protect human health and the environment.

Can treatment prior to re-injection include adding nutrients or other in-situ treatment products to the contaminated groundwater?

Yes. This approach is consistent with section 3020(b)(2), as long as the hazardous constituents are substantially reduced, either before re-injection or as a result of subsequent in-situ treatment, and the remedy complies with sections 3020(b)(1) and (3) The substantial reduction should occur in a reasonable period of time (i.e., in a time period consistent with the CERCLA and/or RCRA cleanup objectives made for the groundwater) and the regulator should consider whether hydraulic containment would be appropriate to ensure protection of the groundwater resource. Furthermore, stakeholders should be aware that while the RCRA statute could allow for such re-injection, facilities may also have to comply with requirements of state Underground Injection Control (UIC) programs. Therefore, facilities should coordinate with state regulators to obtain, as necessary, variances, waivers, construction permits, approvals, etc.

What if a facility wants to re-inject groundwater that is contaminated with non-hazardous wastes as part of corrective action?

If the groundwater is not contaminated with hazardous wastes, then the ban on injecting hazardous wastes described in RCRA Section 3020(a) does not apply. However, facilities should consult with their state regulator because many states have strict groundwater protection laws that could prohibit the re-injection of any contaminated groundwater, regardless of whether it is hazardous or not.

References:

EPA, 2001b. Applicability of RCRA Section 3020 to In-Situ Treatment of Ground Water. Memorandum from Elizabeth Cotsworth, Director, Office of Solid Waste to RCRA Senior Policy Advisors (January). Available at http://www.epa.gov/epaoswer/hazwaste/ca/resource/guidance/remwaste/refrnces/ pol-mem3.pdf.

EPA, 1989a. OSWER Directive 9234.1-06, "Applicability of Land Disposal Restrictions to RCRA and CERCLA Groundwater Treatment Reinjection Superfund Management Review: Recommendation No. 26," (November 27). Available at http://www.epa.gov/tio/products/regs/9234106.htm.

14. Performance Monitoring
(Updated 7/20/01)

What is performance monitoring?

EPA defines performance monitoring as the periodic measurement of physical and/or chemical parameters to evaluate whether a remedy is performing as expected. Facilities should conduct performance monitoring to evaluate whether the facility is making progress toward achieving short-term protectiveness goals, intermediate performance goals, or final cleanup goals.

Rationale for Performance Monitoring

Properly designed performance monitoring programs are especially important for groundwater cleanups because the concentration and distribution of contamination in groundwater often change with time Likewise, natural and human factors (e g , seasonal precipitation or nearby groundwater usage) can influence the ability of cleanup actions to control migration of contaminated groundwater Performance monitoring can assess changes in groundwater so that facilities can modify cleanup actions to ensure maximum efficiency and protectiveness Performance monitoring can also demonstrate whether or not a cleanup action is performing as expected

What should the performance monitoring accomplish?

Facilities should design performance monitoring programs to, for example.

- detect changes in environmental conditions (e.g., hydrogeologic, geochemical, microbiological, or other changes) that may reduce the efficacy of the remedy
- identify any potentially toxic and/or mobile transformation products
- verify that the plume(s) is not expanding above levels of concern (either down gradient, laterally or vertically)
- assess effectiveness of the cleanup or treatment system[1]
- evaluate whether advances in technologies or approaches could improve the ability of a remedy to achieve cleanup goals
- verify no unacceptable exposure to down gradient receptors
- detect new releases of contaminants to the environment that could impact the effectiveness of the remedy
- demonstrate the effectiveness of institutional controls that were put in place to protect potential receptors, and
- verify attainment of short-term, intermediate or final goals

[1] Such evaluations can also provide information facilities can use to verify or adjust their estimates of cleanup time frames

What should a performance monitoring program include?

Facilities should include the specific approaches they intend to use to periodically assess remedy effectiveness towards meeting short-term, intermediate or final goals. The performance monitoring program should include a description of the location(s), frequency, type[2] and quality of samples, techniques and measurements that a facility will use to collect information needed to make decisions associated with a particular cleanup goal. However, EPA urges facilities and regulators to design performance monitoring approaches to be flexible and easily adaptable to account for changing conditions and information needs.

How often should a facility monitor?

The frequency of monitoring should be adequate to detect, in a timely manner, the potential changes in facility conditions listed above. This means that the rate of groundwater flow and contaminant movement are important factors to consider when facilities and regulators determine monitoring frequency. The monitoring plan should include flexibility for adjusting the monitoring requirements over the life of the remedy. For example, it may be appropriate to decrease the monitoring frequency and number of constituents once it has been determined that the remedy is performing as expected and very little change is observed from one sampling round to the next. In contrast, the monitoring frequency may need to be increased: (1) if unexpected conditions (e.g., plume migration or change in groundwater use) occur, or (2) to determine the effect of modifications to a cleanup action (e.g., changes in pumping rates).

How long should performance monitoring continue?

For final remedies that involve restoring contaminated groundwater to its maximum beneficial uses, facilities should generally continue performance monitoring for a specified period (e.g., three years) after the facility achieves the groundwater cleanup levels at the throughout-the-plume/unit boundary point of compliance. Extending the performance monitoring to this point in time helps to verify that the groundwater no longer poses a threat, and that concentrations of contaminants will not rise (i.e., "rebound") after the facility shuts down their active cleanup system. In general, regulators will typically determine how long performance monitoring needs to continue for any given facility[3]. For final cleanup objectives based on containment, performance monitoring should generally continue as long as the containment is necessary to protect human health and the environment.

---

[2] Many stakeholders only associate performance monitoring with chemical analysis of groundwater samples For some cleanup actions, especially those involving hydraulic containment, facilities can often demonstrate performance with frequent hydrogeologic measurements (e g , groundwater elevation monitoring) supplemented with less frequent groundwater quality measurements.

[3] Similar to long-term monitoring of closed hazardous waste landfills (see 40 CFR 264 117), regulators have discretion to extend or shorten the duration a facility needs to conduct performance monitoring.

References:

EPA, 1997b. Rules of Thumb for Superfund Remedy Selection (EPA 540-R-97-013). Available at http://www.epa.gov/superfund/resources/rules/rulesthm.pdf.

EPA, 1997g. Groundwater Issue Paper: Design Guidelines for Conventional Pump and Treat Systems (EPA/540/S-97/504). Available at http://www.epa.gov/oerrpage/superfund/resources/gwdocs/pmptreat.htm

EPA, 1996c. "Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Ground Water at CERCLA Sites, Final Guidance," October 1996. OSWER Publication 9283.1-12, EPA/540/R-96/023, NTIS Order Number PB96-963508, 39p Available at http://www.epa.gov/oerrpage/superfund/resources/gwdocs/pum_tre.htm

EPA, 1996a. Advance Notice of Proposed Rulemaking (61 FR 19432, May 1) Available at http://www.epa.gov/docs/fedrgstr/EPA-WASTE/1996/May/Day-01/pr-547.pdf. Particularly relevant pages: 19452-53.

EPA, 1994a. Guidance for the Data Quality Objective Process (September). EPA/600/R-96/055. Available at: http://www.epa.gov/correctiveaction/resource/guidance/qa/epaqag4.pdf.

EPA, 1992b. RCRA Groundwater Monitoring Draft Technical Guidance (November). Available at http://www.epa.gov/correctiveaction/resource/guidance/sitechar/gwmonitr/rcra_gw.pdf.

EPA, 1992c. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities - Addendum to Interim Final Guidance (July). Available at: http://www.epa.gov/correctiveaction/resource/guidance/sitechar/gwstats/gritsstat/download/addendum.pdf.

EPA, 1992d. Methods for Evaluating Attainment of Cleanup Standards Volume 2: Groundwater (EPA/230/R-92/014). Available at http://www.clu-in.org/download/stats/vol2gw.pdf

15. Completion of Groundwater Remedies
(Updated 7/20/01)

What does completion mean with respect to RCRA Corrective Action?

EPA's Corrective Action Program recognizes two separate phases of completion[1] on a nationwide basis. This Handbook refer to these phases as "Construction Completion" and "Corrective Action Completion."

Rationale for Completion of Groundwater Remedies

EPA's intent for this policy is to recognize when facilities implement (i e , construct) successful remedies, but to discourage facilities from prematurely considering that they have fulfilled all of their corrective action obligations when further operation, maintenance or monitoring is needed to protect human health or the environment.

Construction Completion[2] refers to situations when the facility completes implementation of the remedy, it is operating as intended, and cleanup activities are limited to operation, maintenance and monitoring.

Corrective Action Completion[3] typically refers to situations where the facility has achieved its final cleanup goals by: (1) achieving all media cleanup objectives[4]; (2) controlling sources; and (3) satisfying specified procedures for removal and decontamination of units, equipment, devices, and structures associated with the remedy. In addition, the regulator should ensure that the public and affected community have been given an meaningful opportunity to comment on the Agency's tentative decision that corrective action is complete prior making a final determination.

---

[1] The Office of Solid Waste is currently developing a new guidance memorandum addressing "Completion of Corrective Action at RCRA Facilities " That document, when issued, will be available at http://www epa gov/correctiveaction EPA acknowledges that this Handbook may need to be updated to be consistent with the new completion guidance memorandum

[2] EPA's RCRA data management system (EPA, 1999f, available at http://www epa gov/oswfiles/rcrisbrs/rcris720/ded/ded720 pdf - see page 27 18) describes construction completion as code CA550 titled "Certification of a Remedy Completion or Construction Completion."

[3] EPA's RCRA data management system (EPA, 1999f; available at http://www.epa gov/oswfiles/rcrisbrs/rcris720/ded/ded720 pdf - see page 27.31) describes corrective action completion using the code CA999 titled "Correction Action Process Terminated." This event code can apply to the cleanup of an entire facility or the cleanup of an individual area or portion of a facility.

[4] Media cleanup objectives refers to broad cleanup objectives that often include the more specific concepts of media cleanup levels, points of compliance and cleanup time frames In the Overview Section of this Handbook, we explained that you could consider these three concepts can as the "what, where and when" elements of a cleanup. In the 1996 ANPR (EPA, 1996a), EPA referred to media cleanup objectives as media cleanup standards, we now use media cleanup objectives to avoid confusion with term "standard" that is often associated with just numeric values.

What does Construction Completion mean for a groundwater remedy?

Construction Completion for a groundwater remedy refers to the situation where the facility installed[5] the groundwater remedy, it is operating as intended, and cleanup activities are limited to operation, maintenance and monitoring.

What does Corrective Action Completion mean for a groundwater remedy?

Corrective Action Completion[6] for groundwater refers to situations where a facility has met the general elements described above for "Corrective Action Completion." In essence, this means that the facility has fulfilled all corrective action obligations for contaminated groundwater, including long-term monitoring obligations.

More specifically, for final remedies that involve returning the groundwater to its maximum beneficial use, regulators should consider corrective action for the groundwater to be complete when: all releases[7] to groundwater of hazardous waste and hazardous constituents have been cleaned up as necessary to achieve groundwater cleanup levels at the throughout the plume/unit boundary point of compliance; and, no additional monitoring is necessary to protect human health and the environment.

For final remedies where groundwater cleanup is either technically impracticable or involve long-term containment of "unusable"groundwater (see groundwater use designation), regulators should generally not consider corrective action to be complete as long as operation, maintenance, and/or monitoring are necessary to ensure protection of human health and the environment.[8]

What documentation should facilities provide to demonstrate corrective action completion for contaminated groundwater?

For groundwater cleanup remedies, facilities should provide documentation that demonstrates the facility achieved its groundwater cleanup levels at the throughout-the-plume/unit boundary point of compliance, and no ongoing operation, maintenance or monitoring is required to protect human health or the environment.

---

[5] In the case where monitored natural attenuation is selected for the contaminated groundwater, there would not typically be "installed" engineered components apart from monitoring wells

[6] See EPA, 1996a (page 19453) for additional guidance on corrective action completion.

[7] "All releases" in this context includes releases from solid waste management units and areas of concern, as well as those releases that have migrated off-site

[8] Some cleanup programs (e g., New York state- see http //www clu-in org/eiforum2000/prez/ppframe1 cfm?id=81) have referred to long-term containment of contaminated groundwater in terms of "perpetual care" obligations

How do facilities and regulators decide when a groundwater remedy achieves a specific cleanup goal?

Facilities and regulators typically rely on statistical procedures to determine whether a remedy is successful. Interested stakeholders should refer to EPA's detailed guidance on this subject contained in "Methods for Evaluating the Attainment of Cleanup Standards Volume 2: Groundwater" (EPA, 1992d) which is available at http://www.clu-in.org/download/stats/vol2gw.pdf. Some of the helpful topics and resources addressed in that guidance include:

- Introduction to statistical concepts and decisions;
- Defining attainment objectives (i.e., cleanup levels);
- Design of the sampling and analysis plan used to determine success of cleanup;
- Descriptive statistics (e.g., mean, variance, etc.) and hypothesis testing;
- Deciding to terminate treatment; and,
- Statistical tables, example and blank worksheets.

References:

EPA, 1999f. Resource Conservation and Recovery Act Data Element Dictionary - version 7.2.0. Available at http://www.epa.gov/oswfiles/rcrisbrs/rcris720/ded/ded720.pdf. Particularly relevant pages: 27.18 and 27.31.

EPA, 1996a. Advance Notice of Proposed Rulemaking (61 FR 19432, May 1). Available at http://www.epa.gov/docs/fedrgstr/EPA-WASTE/1996/May/Day-01/pr-547.pdf. Particularly relevant page: 19453.

EPA, 1992d. Methods for Evaluating Attainment of Cleanup Standards Volume 2: Groundwater (EPA/230/R-92/014). Available at http://www clu-in org/download/stats/vol2gw.pdf

Appendix 1 - References

EPA, 2001a. RCRA Cleanup Reforms Round II - Fostering Creative Solutions (EPA-530-F-01-001, January). Available at http://www.epa.gov/epaoswer/hazwaste/ca/reforms.htm.

EPA, 2001b. Applicability of RCRA Section 3020 to In-Situ Treatment of Ground Water. Memorandum from Elizabeth Cotsworth, Director, Office of Solid Waste to RCRA Senior Policy Advisors (January). Available at http://www.epa.gov/epaoswer/hazwaste/ca/resource/guidance/remwaste/refrnces/ pol-mem3.pdf

EPA, 2000a. Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups (September). OSWER Directive 9355.0-74FS-P. Available at http://www.epa.gov/epaoswer/hazwaste/ca/resource/guidance.htm#InstitutionalControls.

EPA, 2000b. Proceedings of the Ground-Water/Surface-Water Interactions Workshop (EPA/542/R-00/007, July). Available at http://www.epa gov/tio/tsp/download/gwsw/gwsw_part1.pdf, http://www.epa.gov/tio/tsp/download/gwsw/gwsw_part2.pdf, and http://www.epa gov/tio/tsp/download/gwsw/gwsw_part3.pdf.

EPA, 1999a. Corrective for Solid Waste Management Units at Hazardous Waste Management Facilities (64 FR 54604, October 7). Available at http://www.epa.gov/correctiveaction/resource/guidance/gen_ca/withdrwl.htm.

EPA, 1999b. Safe Drinking Water Act, Section 1429 Groundwater Report to Congress. EPA-816-R-99-016; October, 1999. Available at http://www.epa gov/ogwdw000/gwr/finalgw pdf.

EPA, 1999c. RCRA Cleanup Reforms (EPA530-F-99-018; July 1999). For more information, refer to http://www.epa gov/epaoswer/hazwaste/ca/reforms htm

EPA, 1999d. Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action and Underground Storage Tank Sites (April 21). OSWER Policy Directive 9200 4-17P Available at http://www.epa.gov/swerust1/directiv/d9200417.htm. Other helpful links regarding MNA available at http://www epa.gov/swerust1/mna/index.htm and http://www.epa.gov/swerust1/oswermna/mnalinks.htm

EPA, 1999e. Interim Final Guidance for RCRA Corrective Action Environmental Indicators (February 5). Available at http://www.epa.gov/epaoswer/osw/ei_guida pdf.

EPA, 1999f. Resource Conservation and Recovery Act Data Element Dictionary - version 7.2.0. Available at http://www.epa.gov/oswfiles/rcrisbrs/rcris720/ded/ded720 pdf.

EPA, 1998a. RCRA Orientation Manual (EPA530-R-98-004). Available at http://www.epa.gov/epaoswer/general/orientat/index.htm.

EPA, 1998b. Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater (September). EPA/600/R-98/128. Available at http://www.epa.gov/correctiveaction/resource/guidance/rem_eval/protocol.pdf.

EPA, 1998c Plain Language in Government Writing (June 1). Available at http://www.npr.gov/library/direct/memos/memoeng.html.

EPA, 1998d. Memorandum from Elizabeth Cotsworth to RCRA Senior Policy Advisors titled, Risk-Based Clean Closure (March 16). Available at http://www.epa.gov/epaoswer/hazwaste/ca/.

EPA, 1998e. Standards Applicable to Owners and Operators of Closed and Closing Hazardous Waste Management Facilities: Post-Closure Permit Requirement and Closure Process; Final Rule (63 FR 56710). Available at http://www.epa.gov/fedrgstr/EPA-WASTE/1998/October/Day-22/f28221.pdf.

EPA, 1997a. Memorandum from Elliott P. Laws and Steven A. Herman to RCRA/CERCLA Senior Policy Managers titled, "Use of the Corrective Action Advance Notice of Proposed Rulemaking as Guidance" (January 17). Available at http://yosemite.epa.gov/osw/rcra.nsf/documents/8BF009F9B3672563852566110072DA71.

EPA, 1997b. Rules of Thumb for Superfund Remedy Selection (EPA 540-R-97-013). Available at http://www epa.gov/superfund/resources/rules/rulesthm.pdf.

EPA, 1997c. A Citizen's Guide to Understanding Presumptive Remedies (EPA-540-F-97-019, October). Available at http://www.epa.gov/superfund/resources/presump/finalpdf/citizen.pdf.

EPA, 1997d. State Source Water Assessment and Protection Programs Guidance (August). Available at http://www.epa.gov/OGWDW/source/swpguid.html.

EPA, 1997e. The Role of Comprehensive State Groundwater Protection Programs (CSGWPPS) is OSWER Remediation Programs. OSWER Directive 9283.1-09. Available at http://www.epa.gov/superfund/resources/csgwpp/role.pdf.

EPA, 1997f. Exposure Factors Handbook (EPA/600/P-95/002F). Available at http://www.epa.gov/ncea/exposfac.htm.

EPA, 1997g. Groundwater Issue Paper: Design Guidelines for Conventional Pump and Treat Systems (EPA/540/S-97/504). Available at http://www.epa.gov/oerrpage/superfund/resources/gwdocs/ pmptreat.htm

EPA, 1996a. Advance Notice of Proposed Rulemaking (61 FR 19432, May 1). Available at http://www.epa.gov/docs/fedrgstr/EPA-WASTE/1996/May/Day-01/pr-547.pdf.

EPA, 1996b. Memorandum from Steven A. Herman and Elliott P. Laws to RCRA/CERCLA Senior Policy Managers titled, "Coordination between RCRA Corrective Action and Closure and CERCLA Site Activities" (September 24). Available at http://www.epa.gov/correctiveaction/resource/guidance/gen_ca/coordmem.pdf.

EPA, 1996c. Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Groundwater at CERCLA Sites (EPA/540/R-96/023, October). Available at http://www.epa.gov/superfund/resources/gwguide/index.htm.

EPA, 1996d. RCRA Public Participation Manual (EPA/530-R-96-007). Available at http://www.epa.gov/epaoswer/hazwaste/permit/pubpart/manual.htm. Particularly relevant pages: 2 5-2.7.

EPA, 1995a. Consistent Implementation of the FY 1993 Guidance on Technical Impracticability of Ground Water Restoration at Superfund Sites (January). OSWER Directive 9200.4-14. Additional information available at http://www.epa.gov/oerrpage/superfund/resources/gwdocs/tec_imp.htm.

EPA, 1995b. Groundwater Issue: Light Non-Aqueous Phase Liquids (EPA/540/S-95/500). Available at http //www.epa.gov/ada/download/issue/lnapl.pdf.

EPA, 1994a. Guidance for the Data Quality Objective Process (September). EPA/600/R-96/055. Available at http://www.epa gov/correctiveaction/resource/guidance/qa/epaqag4 pdf.

EPA, 1994b. The RCRA Corrective Action Plan. OSWER Directive 9920.3-2A. Available at http://www.epa.gov/correctiveaction/resource/guidance/gen_ca/rcracap.pdf .

EPA, 1994c. DNAPL Site Characterization. EPA/540/F-94/049. Available at http://www.epa.gov/oerrpage/superfund/resources/gwdocs/dnapl.pdf.

EPA, 1993. Guidance for Evaluating the Technical Impracticability of Groundwater Restoration EPA/540-R-93-080, (September). Available at http://www.epa gov/oerrpage/superfund/resources/gwdocs/techimp.htm

EPA, 1992a. Final Comprehensive State Groundwater Protection Program Guidance, EPA 100-R-93-001. For more information, refer to http //www.epa.gov/OGWDW/Pubs/06ground html

EPA, 1992b. RCRA Groundwater Monitoring Draft Technical Guidance (November). Available at http://www.epa.gov/correctiveaction/resource/guidance/sitechar/gwmonitr/rcra_gw.pdf.

EPA, 1992c. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities - Addendum to Interim Final Guidance (July). Available at: http.//www.epa gov/correctiveaction/ resource/guidance/sitechar/gwstats/gritsstat/download/addendum.pdf.

EPA, 1992d. Methods for Evaluating Attainment of Cleanup Standards Volume 2: Groundwater (EPA/230/R-92/014). Available at http://www.clu-in.org/download/stats/vol2gw.pdf

EPA, 1991a. Managing the Corrective Action Program for Environmental Results: The RCRA Stabilization Effort (October 25). Available at http://yosemite.epa.gov/osw/rcra.nsf/d8382df2d09b6466852565280051974 5/27d1baa5c1dbb8f38525670f006be76d?OpenDocument.

EPA, 1991b. Protecting the Nation's Groundwater: EPA's Strategy for the 1990's. Office of the Administrator. Washington, D.C. For more information, refer to http://www.epa.gov/OGWDW/Pubs/11ground.html.

EPA, 1991c. A Guide to Principal Threats an Low Level Threat Wastes. Superfund Publication 9380.3-06FS (November). Available at http://www.epa.gov/oerrpage/superfund/resources/gwdocs/threat.pdf.

EPA, 1991d. USEPA's User's Guide for the Johnson and Ettinger Model for Subsurface Vapor Intrusion into Buildings. Available at http://www.epa.gov/oerrpage/superfund/programs/risk/airmodel/guide.pdf. The model itself can be downloaded from http://www.epa.gov/oerrpage/superfund/programs/risk/airmodel/johnson_ettinger.htm.

EPA, 1990. The Nation's Hazardous Waste Management Program at a Crossroads: The RCRA Implementation Study (EPA/530-SW-90-069).

EPA, 1989a. OSWER Directive 9234.1-06, "Applicability of Land Disposal Restrictions to RCRA and CERCLA Groundwater Treatment Reinjection Superfund Management Review: Recommendation No. 26," (November 27). Available at http://www.epa.gov/tio/products/regs/9234106.htm.

EPA, 1989b. National Priorities List for Uncontrolled Hazardous Waste Sites - Final Rule Covering Sites Subject to the Subtitle C Corrective Action Authorities of the Resource Conservation and Recovery Act (commonly referred to as the RCRA Deferral Policy). Available in Section V which appears on 54 FR 41004-41006. Available at http://www.epa.gov/superfund/sites/npl/f891004.htm#41000.

EPA, 1989c. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part A). Available at http://www.epa.gov/superfund/programs/risk/ragsa/index.htm.

EPA, 1988. OSWER Directive 9283.1-2, "Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites," (December 1).

EPA, 1987. Alternate Concentration Limit Guidance (EPA/530-SW-87017).

EPA, 1986. Guidelines for Ground-water Classification under the EPA Ground-Water Protection Strategy. Available at http://www.epa.gov/correctiveaction/resource/guidance/gw_use/gwclass.pdf.

NRC, 2000. *Natural Attenuation for Groundwater Remediation*. Committee on Intrinsic Remediation, Water Science and Technology Board, Board on Radioactive Waste Management, National Research Council. Available at http://www.nap.edu/catalog/9792 html

NRC, 1994. *Alternatives for Ground Water Cleanup* / Committee on Ground Water Cleanup Alternatives, Water Science and Technology Board, Board on Radioactive Waste Management, Commission on Geosciences, Environment, and Resources, National Research Council. National Academy Press, 1994 Available at http.//www.nap.edu/books/0309049946/html/.

Appendix 2 - Links to Other Helpful Internet Resources

EPA's Corrective Action Programs Branch	http://www.epa.gov/correctiveaction/
EPA's Superfund Program	http://www.epa.gov/superfund/
EPA's Enforcement Program	http://es.epa.gov/oeca/main/enforce/solid_waste.html
EPA's Water Program	http://www.epa.gov/OW/
EPA's Technology Innovation Office	http://www.clu-in.org/
– Sign up for TechDirect remediation and site assessment information service	http://www.clu-in.org/techdrct/Default.htm
EPA's Remediation and Characterization Innovative Technologies (REACH IT)	http://www.epareachit.org/index3.html
EPA's Office of Underground Storage Tanks	http://www.epa.gov/swerust1/index.htm
Government Performance and Results Act	http://www.epa.gov/ocfo/planning/gpra.htm
EPA's Brownfields Homepage	http://www.brownfieldstsc.org/
EPA's Office of Research and Development - Subsurface Protection & Remediation Division (ADA, OK lab)	http://www.epa.gov/ada/
Association of States and Territorial Solid Waste Management Officials	http://www.astswmo.org/
Tribal Association on Solid Waste and Emergency Response	http://www.taswer.org/
RCRA Hotline	http://www.epa.gov/epaoswer/hotline/index.htm
National Environmental Publications Internet Site (NEPIS)	http://www.epa.gov/cincl/

Appendix 3 - Glossary

Glossary Internet Links

Terms of Environment (including a list of common acronyms) produced by EPA's Office of Communication, Education and Public Affairs (OCEPA) - available at http://www epa.gov/OCEPAterms/

Glossary of Terms and Acronyms from Guide to Environmental Issues produced by EPA's Office of Enforcement and Compliance Assurance - available at http://es epa.gov/oeca/guide/glossary.htm#glossary

Superfund Acronyms Glossary - available at http://www epa gov/superfund/gloss1.htm

Office of Water Glossary - available at http //www epa gov/safewater/glossary htm

Handbook Glossary of Terms[1]

cleanup - The term "cleanup" or the phrase "cleaning up" refers to the range of activities that could occur in the context of addressing environmental contamination at RCRA facilities. For example, cleanup activities could include removing waste or contaminated media (e.g., excavation, pumping groundwater, etc.), in-place treatment of the waste or contaminated media (e g , bioremediation), containment of the waste or contaminated media (e g., barrier walls, low-permeable covers, liners, etc), or various combinations of these approaches. The term cleanup is often used interchangeably with the term remediate

cleanup time frames - The cleanup time frame, with respect to groundwater, is an estimate of when groundwater quality will achieve a certain level at a specified location and/or the schedule developed to take an action or construct a remedy designed to achieve a particular short-term protectiveness, intermediate performance, or final cleanup goals. (source - EPA, 1996a)

Comprehensive State Groundwater Protection Program (CSGWPP) - a groundwater management strategy developed by a state EPA reviews CSGWPPs and "endorses" those that successfully meet six strategic activities EPA established recommended adequacy criteria for each strategic activity in CSGWPP guidance In particular, EPA remediation programs review state guidelines in the CSGWPP to prioritize groundwater based upon use, value and vulnerability EPA's Office of Solid Waste and Emergency Response issued a directive (EPA, 1997e) encouraging EPA's remediation programs to defer, where appropriate, to state determinations of current and future use when based on an EPA-endorsed CSGWPP that has provisions for facility-specific decisions. (source - EPA, 1992a)

contamination - describes, in the context of this Handbook, media containing contaminants in any form (e g., non-aqueous phase liquids, dissolved in water, vapors, solids, etc.) that are subject to cleanup under RCRA and present in concentrations in excess of appropriately protective levels of concern. (source - EPA, 1999e)

---

[1] The definitions in this Glossary are for the purposes of this Handbook only.

contingency plan - (or contingency remedy or a contingency measure) is a cleanup approach specified in a remedy decision document that functions as a "backup" remedy in the event that the "selected" remedy fails to perform as anticipated. (source - EPA, 1999d)

dense non-aqueous phase liquids (DNAPLs) - such as chlorinated solvents, creosote based wood-treating oils, coal tar wastes, and pesticides are immiscible (i.e., they are not dissolved in water) fluids [most commonly organic] with a density greater than water. (source - EPA, 1994c and EPA, 1995b)

environmental indicators (for RCRA corrective action) - two corrective action environmental indicators, Current Human Exposures Under Control and Migration of Contaminated Groundwater Under Control, are measures of program progress and are being used by the Agency to track whether it meets the goals set under the Government Performance and Results Act (GPRA). In general terms, these measures indicate current "environmental conditions"-- whether people are currently being exposed to environmental contamination at unacceptable levels, and whether any existing plumes of contaminated groundwater are getting larger or adversely affecting surface water bodies. Environmental indicator guidance for the RCRA Corrective Action program is available at http://www.epa.gov/correctiveaction/eis.htm (source - EPA, 1999e)

groundwater use designation - a determination of reasonably anticipated use, resource value (e.g., priority), and/or vulnerability of groundwater in a particular area. (source - adapted from EPA, 1992a)

groundwater cleanup levels - facility-specific chemical concentrations in groundwater that regulators generally establish when defining groundwater cleanup levels for final remedies. (source - adapted from EPA, 1996a)

groundwater cleanup objectives - includes three components: groundwater cleanup levels, point of compliance, and cleanup time frames (source - EPA, 1996a)

institutional controls - defined as non-engineered instruments such as administrative and/or legal controls that minimize the potential for human exposure to contamination by limiting land or resource use. (source - EPA, 2000a).

maximum beneficial groundwater use - within the range of reasonably expected uses, the maximum (or highest) beneficial groundwater use is the one which that warrants the most stringent groundwater cleanup levels (source - adapted from EPA, 1996a)

monitored natural attenuation - refers to the reliance on natural attenuation processes (within the context of a carefully controlled and monitored site cleanup approach) to achieve site-specific remediation objectives within a time frame that is reasonable compared to that offered by other more active methods. The natural attenuation processes that are at work in such a remediation approach include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume or concentration of contaminants in soil or groundwater. (source - EPA, 1999d)

non-aqueous phase liquids (NAPLs) - are hydrocarbons that exist as a separate immiscible phase when in contact with water or air. Differences in the physical and chemical properties of water and NAPL result in the formation of a physical interface between the two fluids which prevent the two fluids from mixing. NAPLs are typically classified as either light non-aqueous phase liquids (LNAPLs) which have densities less than that of water, or dense non-aqueous phase liquids which have densities greater than

that of water. (source - EPA, 1995b) [Note, some professionals have referred to NAPLs with a densities close to that of water as neutrally buoyant non-aqueous phase liquids (NNAPLs)]

presumptive remedies - preferred technologies for common categories of sites, based on historical patterns of remedy selection and EPA's scientific and engineering evaluation of how well technologies perform You can access EPA's guidance on presumptive remedies at http://www epa gov/superfund/resources/presump (source - EPA, 1997c)

principal threats - source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. (Source - EPA, 1997a and EPA, 1991c)

point of compliance - for groundwater, represents where a facility should monitor groundwater quality and/or achieve specified levels of groundwater quality to achieve facility-specific cleanup goals. (source - adapted from EPA, 1996a)

RCRA regulated units - are surface impoundments, waste piles, land treatment units, and landfills that received hazardous waste after July 26, 1982. (source - 40 CFR 264 90)

remedy expectations - are not binding requirements; rather, they reflect collective experience and guide development of remedial alternatives. In effect, the remedial expectations help focus regulators and facilities on the more generally acceptable remedial alternatives (source - EPA, 1996a, page 19448)

source control - refers to a range of actions (e g., removal, treatment in place, containment, etc.) designed to protect human health and the environment from sources of contamination. (source - adapted from EPA, 1996a)

source materials - defined as material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir [either stationary or mobile] for migration of contamination to groundwater, to surface water, to air, [or other environmental media], or acts as a source for direct exposure Contaminated groundwater generally is not considered to be a source material although non-aqueous phase liquids (NAPLs [occurring as residual or free-phase]) may be viewed as source materials (Source - EPA, 1991c)

stabilization - refers to "stabilizing" a situation so that, for example, the contamination does not represent unacceptable threats or does not continue to spread Stabilization used in this context does not refer to engineered treatment used to "solidify" wastes although such technologies could be used as a stabilization action (source - EPA, 1991a)

stakeholders - term used in this Handbook collectively referring to state and EPA regulators, owners and operators of facilities subject to RCRA corrective action, and members of the public and affected community The "public" in the context of RCRA refers not only to private citizens, but also representatives of consumer, environmental, and minority associations, trade, industrial, agricultural, and labor organizations, public health, scientific, and professional societies; civic associations, public officials; and government and educational associations

technical impracticability - Technical impracticability (TI) refers to a situation where achieving groundwater cleanup objectives is not possible from an "engineering perspective." The phrase "engineering perspective" refers to how factors such as feasibility, reliability, scale and safety influence the ability to achieve groundwater cleanup objectives (source - EPA, 1993)

usable groundwater - EPA recognizes that "usable" groundwater may serve a variety of purposes. Common purposes of groundwater include, for example, drinking water, agricultural irrigation, car washes, manufacturing, etc. Groundwater also has less formally acknowledged purposes such as replenishing adjacent aquifers or surface water bodies. For more guidance regarding groundwater use, see the groundwater use designation policy in this Handbook.