ATTACHMENT 6

PROJECT XL PROPOSAL
DATED SEPTEMBER 1999

PROJECT XL PROPOSAL

IBM East Fishkill Facility F006 Sludge Recycling Project

SEPTEMBER 1999

International Business Machines Corporation

EAST FISHKILL FACILITY/
HUDSON VALLEY
RESEARCH PARK
HOPEWELL JUNCTION, NY

Project XL
Environmental Excellence and Leadership

PREPARED BY

William F. Cosulich Associates, P.C.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS

RLA/IBM1506(6/8/00)

International Business Machines Corporation

East Fishkill Facility
1580 Route 52
Hopewell Junction, NY 12533-6531
914 / 894-2121

September 27, 1999

Lisa Lund, Deputy Associate Administrator
Office of Reinvention Programs
Mail Code: 1802
U.S. Environmental Protection Agency
401 M Street Southwest
Washington DC 20460

Re: Project XL Proposal
International Business Machines Corporation
East Fishkill Facility
F006 Sludge Recycling Project

Dear Ms. Lund:

As a follow-up to our discussions with the EPA Regional Office, International Business Machines (IBM) Corporation is submitting a formal proposal to implement a recycling project at the East Fishkill Facility pursuant to the Agency's Project XL Program. The specific project involves utilizing F006 sludge generated at the IBM East Fishkill facility as an ingredient in the manufacture of Portland cement.

Towards that end, we are enclosing six copies of the following document:

"Project XL Proposal –
IBM East Fishkill Facility
F006 Sludge Recycling Project"

By copy of this letter, the attached proposal is also being submitted to Mr. William Muszynski, Mr. George Meyer and Mr. Bartholomew George at the USEPA-Region 2 office, as well as Mr. Lawrence Nadler of the New York State Department of Environmental Conservation Central office located in Albany, New York.

Please contact me at (914) 892-1629 if you have any questions or require further information.

Sincerely,

INTERNATIONAL BUSINESS MACHINES CORPORATION

Salvatore J. Tranchina

Salvatore J. Tranchina, P.E.
Manager, Environmental/Chemical
Engineering and Operations

SJT/BMVt/ajm
Enclosures
cc: W. Muszynski (EPA-Region 2)
G. Meyer (EPA-Region 2)
B. George (EPA-Region 2)
L. Nadler (NYSDEC-Albany)
N. Ayengar (IBM)
R. Walka (WFC)
♦ 1506\MISC99-12.LTR(R01)

PROJECT XL PROPOSAL
IBM EAST FISHKILL FACILITY
F006 SLUDGE RECYCLING PROJECT

Prepared for:

INTERNATIONAL BUSINESS MACHINES CORPORATION

EAST FISHKILL FACILITY/HUDSON VALLEY RESEARCH PARK

HOPEWELL JUNCTION, NEW YORK

Prepared by:

WILLIAM F. COSULICH ASSOCIATES, P.C.
WOODBURY, NEW YORK

September 1999

PROJECT XL PROPOSAL
IBM EAST FISHKILL FACILITY
F006 SLUDGE RECYCLING PROJECT

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Correspondence from NYSDEC to International Business Machines Corporation (IBM), dated April 16, 1987 ..... B

Correspondence from NYSDEC to IBM, dated March 22, 1991 C

Correspondence from EPA to IBM, dated June 10, 1991 ..... D

Correspondence from NYSDEC to EPA, dated January 10, 1992 ..... E

Correspondence from EPA to NYSDEC, dated August 18, 1992 ..... F

Internal Memorandum from USEPA - Region 2 to USEPA - Headquarters, dated January 15, 1993 ..... G

Correspondence from IBM to USEPA - Region 2, dated February 19, 1993 ..... H

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1.0 Introduction

In 1987, IBM petitioned the New York State Department of Environmental Conservation (NYSDEC) and the United States Environmental Protection Agency (USEPA) Region 2 to allow the recycling of F006 sludge as an ingredient in the manufacture of Portland cement. At that time, based on the review of the petition submitted by IBM, USEPA and the NYSDEC approved the "use/reuse" exemption for the recycling of sludge as an ingredient in Portland cement. Based on the available federal and New York State exemption in the Resource Conservation and Recovery Act (RCRA) hazardous waste management regulations, IBM entered into a contract with Independent Cement Corporation (ICC) to initiate the reuse of the sludge at ICC's cement kiln. The IBM sludge was reused as an ingredient in the manufacture of Portland cement at ICC for approximately 3 years. During this timeframe IBM recycled approximately 2,300 tons of sludge at this particular cement kiln.

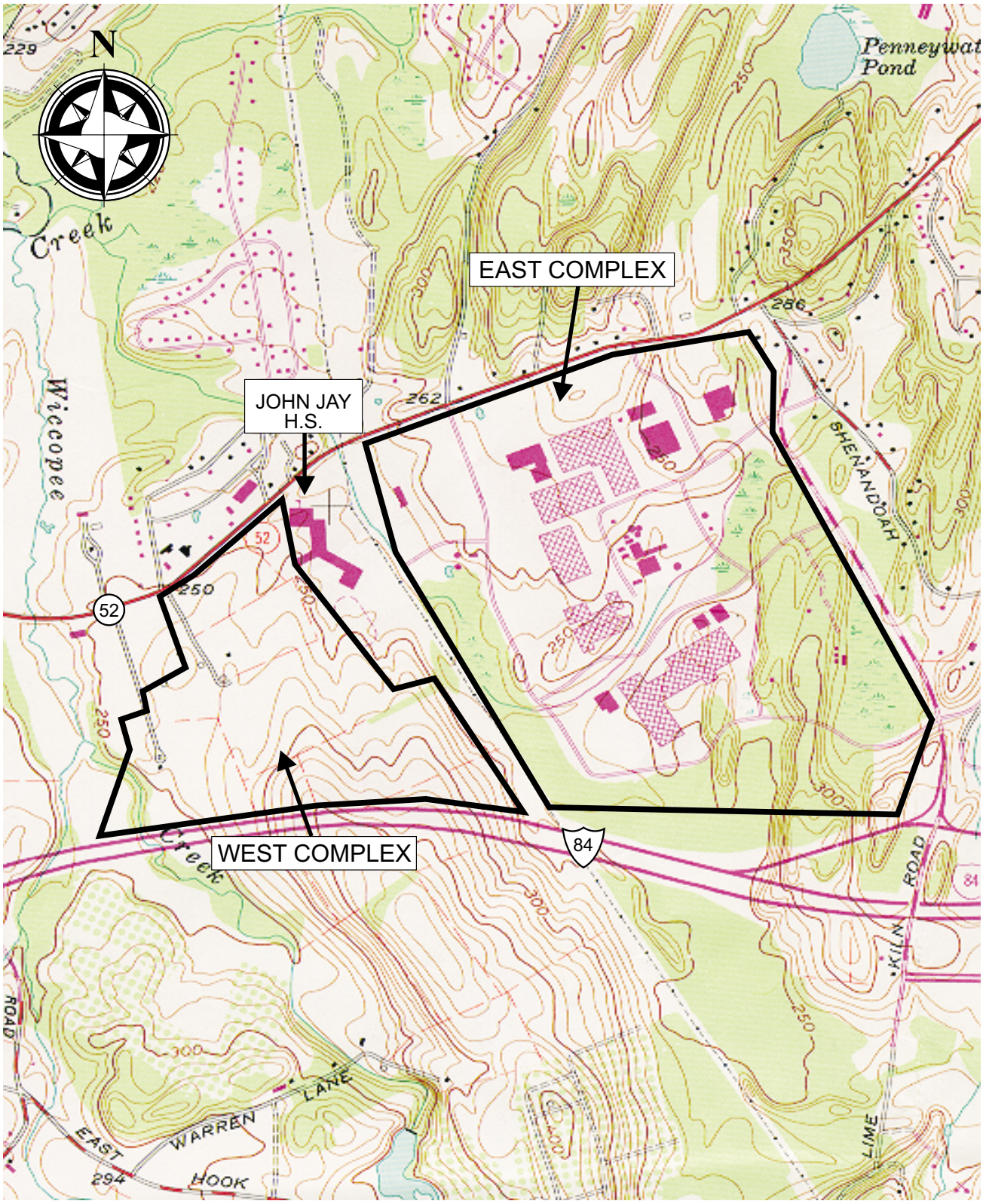
On February 21, 1991 USEPA published its final rule regarding the regulation of boilers and industrial furnaces (BIFs). In addition, as discussed in greater detail later in this document, the USEPA had promulgated a number of new requirements in a continuing series of Land Disposal Restriction rules. In light of this regulatory situation, IBM and ICC discontinued the program pending discussions with USEPA and the NYSDEC. After discussions with the USEPA and NYSDEC, the sludge recycling project was discontinued.

At this time, IBM believes new initiatives have emerged which may have changed the regulatory complexion of the situation which warrant a closer examination of this environmentally beneficial proposal. Therefore, IBM has prepared this Project XL Proposal in an attempt to reinitiate its F006 sludge recycling program as an ingredient in the manufacture of Portland cement.

1.1 Facility Description

The International Business Machines Corporation East Fishkill facility is located on Lime Kiln Road in the Town of East Fishkill. The facility is bordered on the north by U.S. Route 52, to the south by U.S. Route 84 and is located approximately 10 miles east of the Hudson River. The facility location map is depicted on the United States Geological Survey topographic map (Hopewell Junction quadrangle) presented in Figure 1.

Manufacturing operations were initiated at the facility in April 1963 and currently houses various research and development operations as well as the facilities and operations involved in the manufacturing of semiconductor and electronic computing equipment. Applicable Standard Industrial Classification (SIC) Codes include the following:



SOURCE: U.S.G.S. HOPEWELL JUNCTION, NEW YORK QUADRANGLE (Photorevised 1981)

MAPSIBM1506(6/8/000)

INTERNATIONAL BUSINESS MACHINES CORPORATION
EAST FISHKILL, NEW YORK

SITE LOCATION MAP

William F. Cosulich Associates, P.C.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS

FIGURE 1

- 3674 Semiconductor related devices - primary
- 3573 Electronic computing equipment - secondary.

The facility consists of two complexes: an East Complex and a West Complex. All of IBM's principal product manufacturing areas are located within the East Complex, while the West Complex is primarily dedicated to advanced semiconductor research and development operations. In addition, a portion of the East Complex has been designated as the Hudson Valley Research Park, with both manufacturing and nonmanufacturing tenants. Figures 2 and 3 present the site plans for the East and West Complexes, respectively.

The International Business Machines Corporation East Fishkill facility has a comprehensive, long-standing and aggressive pollution prevention/waste minimization program that has been ongoing for over 20 years. The facility has been formally recognized by the U.S. Environmental Protection Agency – Region 2 offices for its outstanding achievements in pollution prevention by selecting IBM East Fishkill as the recipient of its 1996 Environmental Quality Award. IBM East Fishkill was also the recipient of the First Annual New York State Governor's Award for Pollution Prevention offered in 1994. In addition to the specific pollution prevention awards indicated above, IBM East Fishkill has received recognition for environmental protection from IBM Corporate and other private organizations. Examples include:

- IBM Corporation Environmental Affairs Technical Excellence Award for the development of a new process that minimizes waste generation during the manufacture of DRAM devices (1999)

- Industrial Achievement Award of the New York Water Environment Association (1998)

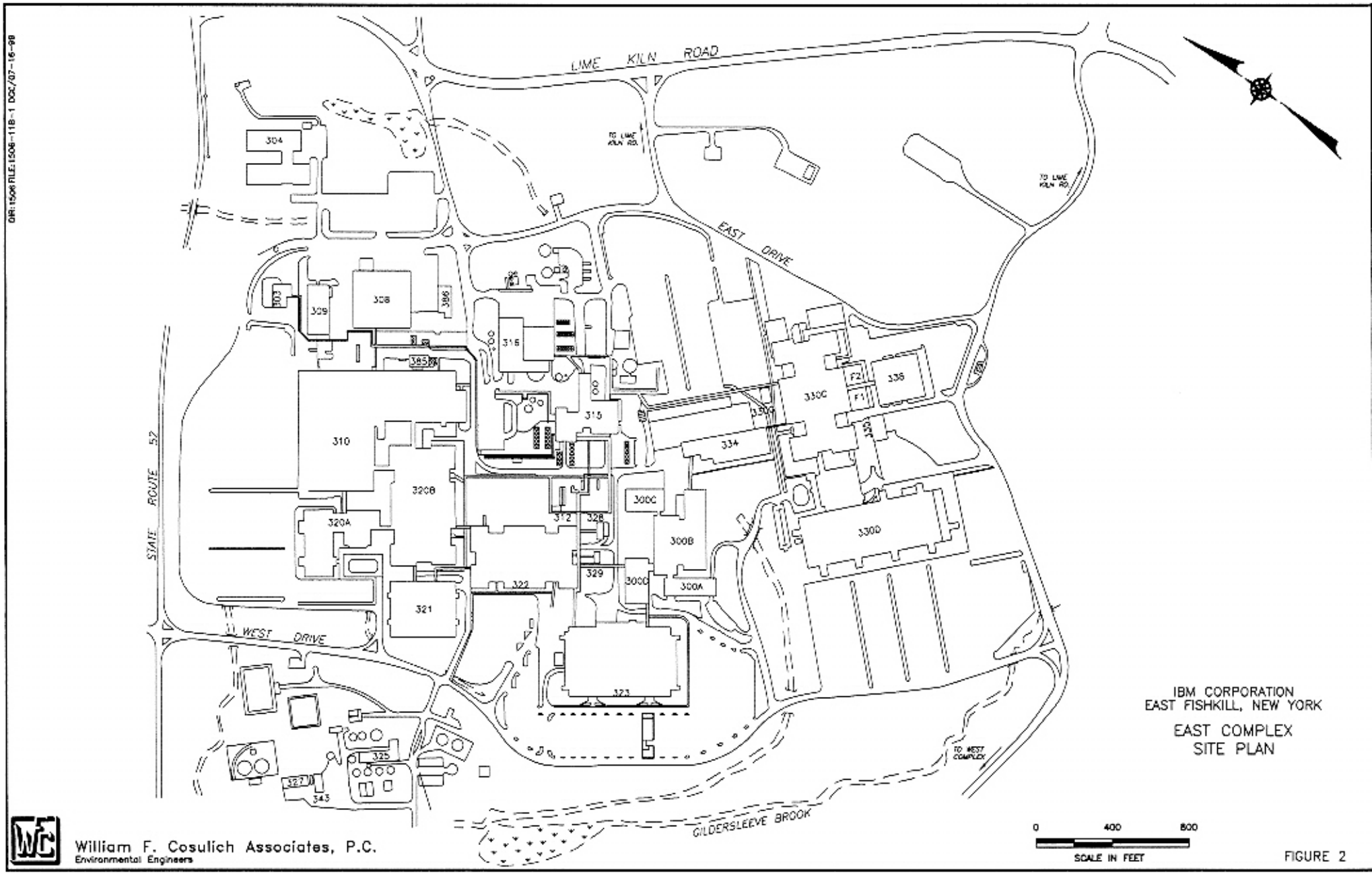
- IBM Corporation Environmental Affairs Technical Excellence Award for development of cryogenic aerosol surface cleaning process (1995)

- IBM Corporation Environmental Affairs Technical Excellence Award for replacement of J-100 (1992)

- IBM Corporation Environmental Award for development and implementation of a new process that utilizes ozonation to regenerate ferricyanide etching baths (1989)

- Industrial Achievement Award of the New York Water Pollution Control Association (1986)

- IBM Corporation Environmental Award in recognition of outstanding accomplishments in sampling, monitoring and analysis (1984)



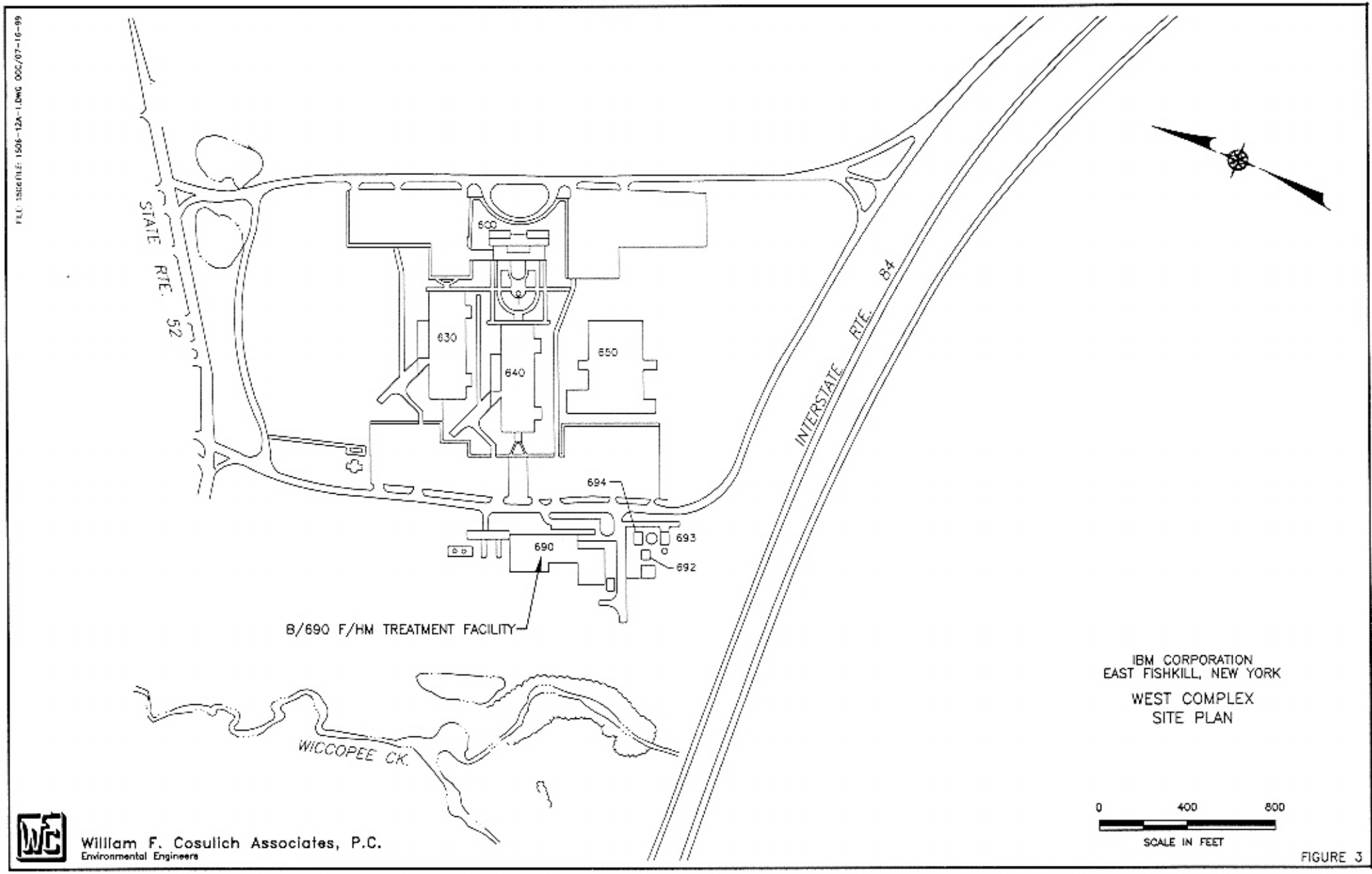
IBM CORPORATION
EAST FISHKILL, NEW YORK

EAST COMPLEX
SITE PLAN

William F. Cosulich Associates, P.C.
Environmental Engineers

FIGURE 2

DIR: 1506 FILE: 1506-11B-1 DGC/07-16-98



IBM CORPORATION
EAST FISHKILL, NEW YORK

WEST COMPLEX
SITE PLAN

William F. Cosulich Associates, P.C.
Environmental Engineers

FIGURE 3

- IBM Corporation Environmental Award in recognition of outstanding accomplishments in groundwater protection monitoring and control (1982)
- IBM Corporation Environmental Award in recognition of outstanding accomplishments in all areas of environmental control (1978)
- Izaak Walton League of America Award for outstanding efforts in the field of water pollution control (1977)
- Safety Award of the New York Water Pollution Control Association in recognition of outstanding accomplishments in the interest of safety for wastewater treatment facilities (1976)

However, notwithstanding these achievements, IBM continues to investigate advancements on not only the pollution prevention and waste minimization fronts, but the recycling, reuse and reclamation frontiers as well. This is demonstrated by its commitment to re-implement a project designed to recycle the F006 sludge generated at its facility by utilizing it as an ingredient in the manufacture of a commercially available product—Portland cement.

1.2 Contact Information

For additional information regarding the IBM East Fishkill Facility F006 Sludge Recycling Project, interested parties can contact the following individuals:

- Salvatore J. Tranchina, P.E., Manager
  Environmental/Chemical
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  International Business Machines
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2.0 PROJECT DESCRIPTION

2.1 Overview of Project

As part of IBM's long-term commitment to and success with its ongoing waste reduction/pollution prevention program, IBM is proposing to reinitiate the recycling program which utilizes the sludge generated as a result of the treatment of electroplating wastewater as an ingredient in the manufacture of Portland cement.

2.2 Background

During the late 1980s and early 1990s, F006 sludge that was generated at the IBM East Fishkill facility was utilized in the manufacture of Portland cement at the Independent Cement Corporation located in Catskill, New York. Background information regarding this sludge recycling program is provided below:

- In early 1987, IBM East Fishkill petitioned NYSDEC and EPA Region 2 to allow the recycling of its wastewater treatment sludge as an ingredient (raw material) in the manufacture of Portland cement.

- In April of 1987, both NYSDEC and EPA Region 2 in consultation with EPA-HQ concurred in written correspondence that IBM sludge utilized in manufacturing Portland cement was exempt from Federal and New York State regulation as a solid waste since it was to be used as an ingredient in the manufacturing of a commercially available product (see Exhibits A and B).

- IBM entered into a contract with Independent Cement Corporation (ICC) to initiate the reuse of the sludge at ICC's cement kiln.

- The IBM sludge was utilized to manufacture Portland cement at ICC's facility for approximately 3 years (approximately 1988-1991).

- On February 21, 1991, EPA published its final rule regarding the regulation of boilers and industrial furnaces (BIF).

- In light of the BIF Rule, as well as changes/updates to both EPA's and NYSDEC's solid and hazardous waste regulations particularly regarding the Land Disposal Restriction rule, IBM and ICC requested the reconcurrence of EPA-Region 2 and NYSDEC regarding the "use/reuse" exemption.

- On March 21, 1991, IBM met with representatives of the NYSDEC in Albany to brief state regulators regarding the matter and present the regulatory rationale preserving the exemption.

- NYSDEC responded to IBM in correspondence dated March 22, 1991 – NYSDEC reaffirmed its position (based on New York State regulation) that the sludge, when used in the manufacture of Portland cement, was not a solid or hazardous waste (see Exhibit C).

- In the March 22, 1991 correspondence, NYSDEC also stated that EPA be formally requested to reconcur on the matter in light of the BIF Rule and that NYSDEC Division of Solid Waste rule on the applicability of a "Beneficial Use Determination" pursuant to its Part 360 regulations.

- On April 19, 1991, IBM briefed EPA Region 2 regarding this matter and summarized its regulatory rationale regarding the nonapplicability of the BIF Rule in a letter to EPA on April 22, 1993.

- In correspondence dated June 10, 1991, EPA Region 2 (after consultation with EPA-HQ) reaffirmed its position that the exemption of the sludge as a solid waste was valid and advised NYSDEC and IBM regarding the inapplicability of the BIF Rule in this instance (see Exhibit D).

- In October of 1991, IBM discontinued the shipment of sludge to ICC's facility.

- On December 20, 1991, IBM and ICC met with NYSDEC to reexamine regulatory issues raised to the state by correspondence from ICC dated December 3, 1991.

- On January 10, 1992, after meeting with IBM and ICC regarding the correspondence from ICC, NYSDEC requested EPA to again reexamine the recycling aspect of the project based on the EPA-HQ guidance from Sylvia Lowrance (see Exhibit E).

- In correspondence dated August 18, 1992, EPA responded to NYSDEC by reexamining the project in light of the "Sylvia Lowrance Guidance" regarding determining legitimate recycling as well as the Land Disposal Restrictions rule (see Exhibit F).

- The August 18, 1992 EPA correspondence concluded that sufficient information was not available to determine if the recycling exemption should continue.

- In late August through October 1992, IBM and EPA Region 2 conducted numerous telephone communications and exchanged fax transmittals concerning chemical constituents of sludge versus Land Disposal Restrictions rule, as well as the chemical make-up of naturally occurring quarry material.

- On November 20, 1992, IBM provided EPA Region 2 with analytical results of 106 samples of sludge for comparison to Land Disposal Restrictions treatment standards.

- On December 15, 1992, IBM correspondence to EPA reaffirmed its position to sample and analyze each batch of sludge destined for transport off-site as an ingredient in cement manufacturing. Results would be compared to the Land Disposal Restrictions rule.

- On January 15, 1993, EPA Region 2 provided an internal agency memorandum to Mr. Michael Petruska, Chief, Regulatory Development Branch, supporting IBM's request to continue to use its sludge in the manufacture of Portland cement (see Exhibit G).

- On February 19, 1993, IBM responded in writing to EPA Region 2 addressing two key areas of concern with Region 2's memorandum of support for the project (i.e., use constituting disposal, exemption as a solid waste) (see Exhibit H).

- On May 27, 1993, EPA Region 2 prepared a second internal agency memorandum to Mr. Michael Petruska, Chief, Regulatory Development Branch, continuing to support the IBM request while attempting to further address and support the contention that the issues of use constituting disposal (and, implicitly, the exemption as a solid waste) were not applicable in this instance. Due to the lack of a written response from EPA-Headquarters regarding this matter the project was not reimplemented (see Exhibit I).

2.3 Project Description

2.3.1 General Description

As a result of manufacturing operations, wastewater containing dissolved heavy metal and fluoride compounds is produced by various process operations in a number of buildings throughout the facility.

Currently, IBM East Fishkill generates approximately 825 tons of sludge annually and transports the material approximately 350 miles to Canada, to ultimately dispose of the material in a permitted landfill. The sludge is generated at two separate fluoride heavy metal (F/HM) wastewater treatment facilities, one serving the West Complex located in Building 690 and one serving the East Complex at Building 386. After processing, the sludge is accumulated in 25 cubic yard roll-off containers housed in sludge container loading bays inside the F/HM waste treatment facility buildings. After a careful evaluation of the chemical constituents of the sludge from the two segregated sources, we believe the sludge from the West Complex is eligible for the recycling exemption found at 40 CFR 261.2(e)(1)(i), and 6 NYCRR 371.1(c)(6)(i) in federal and state regulations, respectively. The exemption allows for the use of "hazardous waste" as an ingredient in the manufacture of a commercially available product, in this case, Portland cement.

As part of this project, IBM is proposing to utilize only the sludge generated in the B/690 F/HM waste treatment facility as an ingredient in the manufacture of Portland cement. It is IBM's position that the recycling of the sludge in this manner qualifies for the "use/reuse" exemption contained in 40 CFR 261.2 (e)(1)(i). As discussed in greater detail in Section 3.4.2, if this initial Project XL proposal is approved and successfully implemented, IBM is considering undertaking additional waste minimization measures in order to facilitate the reuse of the sludge generated at its B/386 F/HM waste treatment facility as well.

2.3.2 Description of Manufacturing Operations

2.3.2.1 - Advanced Semiconductor Technology Center (ASTC)

The ASTC manufacturing area is located within B/650 on the west complex of the facility. The ASTC area manufactures memory and logic chips as part of IBM's ongoing research and development operations. In general, manufacturing process steps include sputtering, low pressure chemical vapor deposition, reactant gas phase etchant, chemical vapor deposition, photolithography and wet etch/clean. Fluoride wastewater generated in B/650 is conveyed to the on-site F/HM treatment plant located in Building 690. Sludge from the B/690 F/HM treatment plant is collected in roll-off containers, classified as an F006 hazardous waste, transported off-site, stabilized and disposed in a permitted landfill.

2.3.3 Wastewater Treatment Sludge Characterization

Waste code F006 is defined at 40 CFR 261.31 as follows:

> "Wastewater treatment sludges from electroplating operations except from the following processes: (1) Sulfuric acid anodizing of aluminum; (2) tin plating on carbon steel; (3) zinc plating (segregated basis) on carbon steel; (4) aluminum or zinc-aluminum plating on carbon steel; (5) cleaning/stripping associated with tin, zinc and aluminum plating on carbon steel; and (6) chemical etching and milling of aluminum."

40 CFR Part 261 Appendix VII identifies the hazardous constituents for which F006 waste is listed as including cadmium, hexavalent chromium, nickel and cyanide (complexed).

Since IBM conducts manufacturing operations that meet the definition of "electroplating operations," the wastewater treatment sludge is classified as a listed hazardous waste with the waste code F006.

2.3.4 Identification of Chemicals Utilized in Manufacturing and Wastewater Treatment Processes

In order to identify the constituents utilized in the manufacturing process that may be present in the wastewater treatment sludge, the IBM chemical management database was reviewed to identify 40 CFR Part 261 Appendix VIII compounds which are discharged to the F/HM and industrial waste treatment plants from various manufacturing operations as well as those chemicals that are utilized to enhance treatment operations at each of the facility's wastewater treatment facilities. Chemicals identified during the database search included:

Chemicals Utilized in Manufacturing Processes	
1,1,1-trichloroethane	Silver compounds
Saccharin	Formaldehyde
Chromium Compounds	Benzene
Nickel Compounds	Methyl Chloroform
Lead Compounds	Methyl Methacrylate
Mercury Compounds	Dibutyl Phthalate
Copper Compounds	

Chemicals Utilized in Wastewater Treatment Operations	
Calcium Hydroxide (Lime)	Drewplus ED-830, Foam Inhibitor
Concentrated Acid	(contains: Linear Primary Alcohols
Sodium Bisulfate	Proprietary Organic Acid
Dilute Acids and Caustics	Proprietary Surfactant
Sodium Sulfhydrate	Aluminum Sulfate
Betz Polymer 1123L	Triethanolamine
(contains: Sodium Acrylate Copolymer	Diethanolanine
Hydrotreated Light Distillate	Ethylene Oxide)
Proprietary Surfactant)	

2.3.5 Historical Wastewater Treatment Sludge Sampling and Analysis

IBM has historically conducted sampling and analysis of the wastewater treatment sludge generated at the facility in accordance with its waste analysis plan and quality assurance quality control plan contained in the Part 373 permit for the facility. Historical analytical data for the wastewater treatment sludge generated at the B/690 F/HM Waste Treatment Facility is presented on Table 1 and Table 2.

Table 1 provides analytical results obtained utilizing the Toxicity Characteristic Leaching Procedure (TCLP) method for sludge generated at the B/690 facility. Table 2

TABLE 1
INTERNATIONAL BUSINESS MACHINES CORPORATION - EAST FISHKILL FACILITY
HISTORIC F/HM SLUDGE SAMPLING TCLP ANALYTICAL RESULTS
BUILDING 690 TREATMENT FACILITY

Sample ID	**9401497**	**9402352**	**9403497**	**9404213**	**9405001**	**9405690**	**9407380**
Sample Type	**SLDG**	**SLDG**	**SLDG**	**SLDG**	**SLDG**	**SLDG**	**SLDG**
Sample Date	**02/03/94**	**03/09/94**	**04/15/94**	**05/10/94**	**06/07/94**	**07/05/94**	**08/11/94**
Units	**(mg/l)**	**(mg/l)**	**(mg/l)**	**(mg/l)**	**(mg/l)**	**(mg/l)**	**(mg/l)**
Chromium (Total)	0.011	U	0.115	0.113	0.032	0.037	0.015
Chromium (Hexavalent)	U	U	U	U	U	U	0.3
Nickel	0.01	U	0.02	0.01	0.01	0.01	0.01
Lead	U	U	0.01	U	0.02	U	U
pH (std. units)	12.1	11.7	11	11.2	11.2	11.5	11.4

Sample ID	**9408170**	**9409537**	**9410190**	**9410520**	**9507541**	**9507543**	**9509577**
Sample Type	**SLDG**	**SLDG**	**SLDG**	**SLDG**	**SLDG**	**SLDG**	**SLDG**
Sample Date	**09/16/94**	**10/24/94**	**11/29/94**	**12/20/94**	**07/11/95**	**08/14/95**	**09/29/95**
Units	**(mg/l)**	**(mg/l)**	**(mg/l)**	**(mg/l)**	**(mg/l)**	**(mg/l)**	**(mg/l)**
Chromium (Total)	0.016	0.015	0.009	U	0.113	0.269	0.274
Chromium (Hexavalent)	U	U	U	U	N/A	N/A	N/A
Nickel	0.01	0.01	U	0.01	U	0.01	0.12
Lead	U	U	U	0.02	0.02	0.01	U
pH (std. units)	11.3	11.4	11.8	11.6	11.3	9.5	10.3

Sample ID	**9705727**	**9709794**	**9802208**	**9805895**	**9807999**
Sample Type	**FS**	**SOLID**	**SOLID**	**SLDG**	**SLDG**
Sample Date	**07/11/97**	**12/09/97**	**02/27/98**	**06/15/98**	**08/28/98**
Units	**(mg/l)**	**(mg/l)**	**(mg/l)**	**(mg/l)**	**(mg/l)**
Nickel	0.09	U	0.05	7.073	U
Lead	U	U	U	U	0.02

Qualifiers:

U: Analyzed for but not detected
N/A: Compound not analzyed for

TABLE 2
INTERNATIONAL BUSINESS MACHINES CORPORATION - EAST FISHKILL FACILITY
HISTORIC F/HM SLUDGE SAMPLING TOTAL ANALYTICAL RESULTS
BUILDING 690 TREATMENT FACILITY

Sample ID	**9500614**	**9502448**	**9502689**	**9503856**	**9504492**	**9505402**
Sample Type	**SLDG**	**SLDG**	**SLDG**	**SLDG**	**SLDG**	**SLDG**
Sample Date	**01/12/95**	**02/27/95**	**03/20/95**	**04/11/95**	**05/08/95**	**06/09/95**
Units	**(mg/l)**	**(mg/l)**	**(mg/l)**	**(mg/l)**	**(mg/l)**	**(mg/l)**
Chromium (Total)	5.3	57	21.7	18	21.75	28.05
Nickel	4.8	76.25	3.4	2.8	1.85	2.6
Lead	4	95.2	1.2	16	13.35	1.2
pH (std. units)	11.7	11.3	11.6	11.7	11.512	11.7

Sample ID	**9705727**	**9709794**	**9802208**	**9805895**	**9807999**
Sample Type	**FS**	**SOLID**	**SOLID**	**SLDG**	**SLDG**
Sample Date	**07/11/97**	**12/09/97**	**02/27/98**	**06/15/98**	**08/28/98**
Units	**(mg/l)**	**(mg/l)**	**(mg/l)**	**(mg/l)**	**(mg/l)**
Cadmium	4.3	U	2.3	2	1.7
Chromium (Total)	33.6	21	21	24	25
Nickel (TCLP)	0.09	U	0.05	7.073	U
Lead (TCLP)	U	U	U	U	0.02
pH (std. units)	10.6	11.3	11.5	11.6	11.3
Cyanide (Total)	U	U	U	U	U
% Total Solids	62.4	39.49	41.5	39.1	35.53

Qualifiers:
U: Analyzed for but not detected

provides analytical results on a total concentration basis for sludge generated at the B/690 facility.

Tables 3 and 4 present a statistical summary of the analytical results presented on Tables 1 and 2. Standard statistical values presented for each compound include Number of Samples, Range (minimum and maximum), Mean, Standard Deviation and Upper and Lower bounds for the 95th Percentile Confidence Interval. The confidence interval is calculated as the mean plus the product of 't' times the standard deviation, where 't' is 1.96 for the 95th percentile confidence interval.

As part of a further evaluation of the suitability of utilizing the F006 sludge generated at the IBM East Fishkill facility in the manufacture of Portland cement, the historical laboratory results were compared to the appropriate land disposal restriction (LDR) treatment standards. After a careful review of this historic data in comparison to the LDR concentration, it is clearly evident that the sludge, *prior* to being recycled, inherently meets the land disposal restriction concentration thresholds. The comparison of the historic analytical results of the sludge versus the land disposal treatment standards for the constituents of concern is presented below.

Constituent of Concern	Historic Analytical Data Mean Concentration (mg/l TCLP)*	Land Disposal Restriction Treatment Standard (mg/l TCLP)
Cadmium	0.107**	0.11
Chromium (total)	0.07	0.60
Chromium (hexavalent)	0.178	–
Nickel	0.39	11

Constituent of Concern	Historic Analytical Data Mean Concentration (mg/l)	Land Disposal Restriction Treatment Standard (mg/kg)
Cyanide (complexed)	0.024	590

* TCLP except where noted

** On a total basis (results are divided by 20 for comparison to TCLP standards in accordance with EPA guidelines)

TABLE 3
INTERNATIONAL BUSINESS MACHINES CORPORATION - EAST FISHKILL FACILITY
HISTORIC F/HM SLUDGE SAMPLING TCLP ANALYSIS STATISTICAL SUMMARY
BUILDING 690 TREATMENT FACILITY

Analyte	Units	Number of Samples	MDL	Range		Mean	Std. Dev.	Lower 95th %	Upper 95th %
				Min	Max				
Chromium	mg/l	14	0.003	0.004	0.274	0.07	0.09	ND	0.25
Hexavalent Chromium	mg/l	11	0.005	ND	0.3	0.178	0.077	0.027	0.329
Lead	mg/l	19	0.01	ND	0.02	0.012	0.006	ND	0.024
Nickel	mg/l	19	0.01	ND	7.073	0.39	1.58	ND	3.48

Notes:
MDL = Method Detection Limit
ND = Not detected
Statistical summary assumes values less than MDL will average 1/2 the MDL. Therefore, 0.5 x MDL was substituted for all "U" values when calculating the Mean and the Standard Deviation.

TABLE 4
INTERNATIONAL BUSINESS MACHINES CORPORATION - EAST FISHKILL FACILITY
HISTORIC F/HM SLUDGE SAMPLING TOTAL ANALYSIS STATISTICAL SUMMARY
BUILDING 690 TREATMENT FACILITY

Analyte	Units	Number of Samples	MDL	Range		Mean	Std. Dev.	Lower 95th %	Upper 95th %
				Min	Max				
Cadmium	mg/l	5	0.3	0.4	4.3	2.14	1.26	ND	4.61
Chromium	mg/l	12	0.15	5.3	57	23.71	12.46	ND	48.13
Lead	mg/l	7	0.5	1.2	95.2	19.33	31.44	ND	80.95
Nickel	mg/l	7	0.15	1.85	76.25	13.61	25.59	ND	63.76
Total Cyanide	mg/l	5	0.003	ND	0.03	0.024	0.011	ND	0.046
pH	Std. Units	26	1	9.5	12.1	11.32	0.51	10.31	12.32
Total Percent Solids	Percent	5	0.05	35.53	62.4	43.60	9.59	24.80	62.41

Notes:
MDL = Method Detection Limit
ND = Not detected
Statistical summary assumes values less than MDL will average 1/2 the MDL. Therefore, 0.5 x MDL was substituted for all "U" values when calculating the Mean and the Standard Deviation.

2.3.6 Current Wastewater Treatment Sludge Sampling and Analysis

In response to preliminary discussions with the United States Environmental Protection Agency regarding the implementation of this F006 sludge recycling project, IBM collected samples of the sludge generated at the B/690 facility for analysis of appropriate Appendix VIII constituents. In order to develop a comprehensive list of applicable Appendix VIII constituents that would be analyzed as part of an evaluation of F006 sludge for recycling, the following was undertaken. First, all Appendix VIII chemical constituents were presented. From that list all chemical constituents for which the F006 sludge is listed were identified. Next, as discussed previously, a comprehensive review of chemicals used in the manufacturing area which generate wastewater that is conveyed to the F/HM Treatment Facilities was conducted. In addition, Appendix VIII constituents associated with wastewater treatment operations were identified. Lastly, specific constituents requested by the EPA were identified including dioxins, furans, high volatile metals, low volatile metals and semivolatile metals were added.

Accordingly, Table 5 presents a summary of the Appendix VIII constituents of concern along with the appropriate method of analysis. IBM collected samples of the sludge generated at the B/690 facility on February 8, 1999 and analyzed the samples for the constituents identified on Table 5. Tabulated analytical results are presented on Tables 6 through 9.

2.3.7 Typical Wastewater Treatment Sludge Composition

Sludge that is generated at the B/690 wastewater treatment facility is dry in appearance but typically contains approximately 50% water. The primary solid ingredient in the sludge is lime. Although the composition of the sludge will vary, typical sludge composition includes the following major constituents and approximate concentrations:

Major Constituent	Approximate Concentration
Water	50%
Calcium Hydroxide	15%
Calcium Carbonate	15%
Calcium Fluoride	8%
Various Sulfates	2% - 3%

TABLE 5
INTERNATIONAL BUSINESS MACHINES CORPORATION
EAST FISHKILL FACILITY
SUMMARY OF APPLICABLE AND
APPROPRIATE APPENDIX VIII CHEMICAL CONSTITUENTS OF CONCERN

Constituent	Rationale	Method of Analysis
Cadmium	Listed Constituent	ICP, Method 6010 or A.A.-Direct Aspiration Method 7130, SW-846
Hexavalent Chromium	Listed Constituent, utilized in manufacturing process	Colorimetric, Method 7196, SW-846
Nickel	Listed Constituent, utilized in manufacturing process	ICP, Method 6010 or A.A.-Direct Aspiration Method 7520, SW-846
Cyanide (complexed)	Listed Constituent	Total and Amendable Cyanide Method 9012, SW-846
Volatile Organic Compounds	Chemicals utilized in manufacturing process	Volatile Organic Compounds by GC/MS Method 8260, SW-846
Semivolatile Organic Compounds	Chemicals utilized in manufacturing process	Semivolatile Organic Compounds by GC/MS Method 8270, SW-846
Arsenic	Requested by USEPA	ICP, Method 6010 or A.A.-Furnace Technique, Method 7060, SW-846
Beryllium	Requested by USEPA	ICP, Method 6010 or A.A.-Direct Aspiration Method 7090, SW-846
Cadmium	Requested by USEPA	ICP, Method 6010 or A.A.-Direct Aspiration Method 7130, SW-846
Chromium	Utilized in manufacturing process, requested by USEPA	ICP, Method 6010 or A.A.-Direct Aspiration Method 7140, SW-846

TABLE 5 (continued)
INTERNATIONAL BUSINESS MACHINES CORPORATION
EAST FISHKILL FACILITY
SUMMARY OF APPLICABLE AND
APPROPRIATE APPENDIX VIII CHEMICAL CONSTITUENTS OF CONCERN

Constituent	Rationale	Method of Analysis
Lead	Utilized in manufacturing process, requested by USEPA	ICP, Method 6010 or A.A.-Direct Aspiration Method 7421, SW-846
Mercury	Utilized in manufacturing process, requested by USEPA	ICP, Method 6010 or A.A.-Direct Aspiration Method 7471, SW-846
Silver	Utilized in manufacturing process	ICP, Method 6010 or A.A.-Direct Aspiration Method 7760, SW-846
Formaldehyde	Utilized in manufacturing process	NYS ASP Method APC 44
Saccharin	Utilized in manufacturing process	Semivolatile Organic Compounds by GC/MS Method 8270, SW-846
Dioxins and Furans	Requested by USEPA	PCDDs and PCDFs by HRGC/LRMS, Method 8280, SW-846

*Holding times are based upon NYSDEC 10/95 ASP QA/QC requirements.

**VTSR = Validated Time of Sample Receipt.

TABLE 6
INTERNATIONAL BUSINESS MACHINES CORPORATION EAST FISHKILL FACILITY
F/HM SLUDGE SAMPLING TOTAL ANALYTICAL RESULTS
BUILDING 690 SLUDGE
VOLATILE ORGANIC COMPOUNDS

BUILDING	**B 690**	
SAMPLE IDENTIFICATION	**CA-F Grab**	
DATE OF COLLECTION	**02/08/99**	
DILUTION FACTOR	**1**	
PERCENT SOLIDS	**39.5**	
UNITS	**(ug/kg)**	
Chloromethane		U
Vinyl Chloride		U
Bromomethane		U
Chloroethane		U
Trichlorofluoromethane		U
1,1-Dichloroethene		U
Methylene Chloride	3.6	
trans-1,2-Dichloroethene		U
1,1-Dichloroethane		U
2,2-Dichloropropane		U
cis-1,2-Dichloroethene		U
Bromochloromethane		U
Chloroform		U
Carbon Tetrachloride		U
Benzene		U
1,2-Dichloroethane		U
1,1-Dichloropropene		U
Trichloroethene		U
1,2-Dichloropropane		U
Dibromomethane		U
Bromodichloromethane		U
cis-1,3-Dichloropropene		U
Toluene	1.6	J
trans-1,3-Dichloropropene		U
1,1,2-Trichloroethane		U
1,2-Dibromoethane		U
Tetrachloroethene		U
1,3-Dichloropropane		U
Dibromochloromethane		U
Chlorobenzene		U
1,1,1,2-Tetrachloroethane		U
Ethylbenzene		U
o-Xylene	2.1	J
m,p-Xylene	4.2	

TABLE 6 (continued)
INTERNATIONAL BUSINESS MACHINES CORPORATION EAST FISHKILL FACILITY
F/HM SLUDGE SAMPLING TOTAL ANALYTICAL RESULTS
BUILDING 690 SLUDGE
VOLATILE ORGANIC COMPOUNDS

BUILDING	**B 690**
SAMPLE IDENTIFICATION	**CA-F Grab**
DATE OF COLLECTION	**02/08/99**
DILUTION FACTOR	**1**
PERCENT SOLIDS	**39.5**
UNITS	**(ug/kg)**
Styrene	U
Bromoform	U
Isopropylbenzene	U
Bromobenzene	U
1,1,1-Trichloroethane	U
1,1,2,2-Tetrachloroethane	U
1,2,3-Trichloropropane	U
n-Propylbenzene	U
2-Chlorotoluene	U
4-Chlorotoluene	U
1,3,5-Trimethylbenzene	U
tert-Butylbenzene	U
1,2,4-Trimethylbenzene	2.7
sec-Butylbenzene	U
1,3-Dichlorobenzene	U
4-Isopropyltoluene	U
1,4-Dichlorobenzene	U
1,2-Dichlorobenzene	U
n-Butylbenzene	U
1.2-Dibromo-3-chloropropane	U
1,2,4-Trichlorobenzene	U
Hexachlorobutadiene	U
Naphthalene	U
1,2,3-Trichlorobenzene	U
Dichlorodifluoromethane	U
TOTAL VOCs	14.2

Qualifiers:
U: Compound analyzed for but not detected.
B: Compound found in the method blank as well as the sample.
J: Compound found at a concentration below the detection limit.

TABLE 7
INTERNATIONAL BUSINESS MACHINES CORPORATION EAST FISHKILL FACILITY
F/HM SLUDGE SAMPLING TOTAL ANALYTICAL RESULTS
BUILDING 690 SLUDGE
SEMIVOLATILE ORGANIC COMPOUNDS

BUILDING	**B690RR**
SAMPLE IDENTIFICATION	**CA-F Grab**
DATE OF COLLECTION	**02/08/99**
DILUTION FACTOR	**1**
PERCENT SOLIDS	**39**
UNITS	**(ug/kg)**
Phenol	U
bis(2-Chloroethyl)ether	U
2-Chlorophenol	U
1,3-Dichlorobenzene	U
1,4-Dichlorobenzene	U
1,2-Dichlorobenzene	U
2-Methylphenol	U
2,2'-oxybis(1-Chloropropane)	U
4-Methylphenol	U
N-Nitroso-di-n-propylamine	U
Hexachloroethane	U
Nitrobenzene	U
Isophorone	U
2-Nitrophenol	U
2,4-Dimethylphenol	U
bis(2-Chloroethoxy)methane	U
2,4-Dichlorophenol	U
1,2,4-Trichlorobenzene	U
Naphthalene	U
4-Chloroaniline	U
Hexachlorobutadiene	U
4-Chloro-3-methylphenol	U
2-Methylnaphthalene	U
Hexachlorocyclopentadiene	U
2,4,6-Trichlorophenol	U
2,4,5-Trichlorophenol	U
2-Chloronaphthalene	U
2-Nitroaniline	U
Dimethylphthalate	U
Acenaphthylene	U
2,6-Dinitrotoluene	U
3-Nitroaniline	U
Acenaphthene	U
2,4-Dinitrophenol	U
4-Nitrophenol	U

TABLE 7 (continued)
INTERNATIONAL BUSINESS MACHINES CORPORATION EAST FISHKILL FACILITY
F/HM SLUDGE SAMPLING TOTAL ANALYTICAL RESULTS
BUILDING 690 SLUDGE
SEMIVOLATILE ORGANIC COMPOUNDS

BUILDING	**B690RR**	
SAMPLE IDENTIFICATION	**CA-F Grab**	
DATE OF COLLECTION	**02/08/99**	
DILUTION FACTOR	**1**	
PERCENT SOLIDS	**39**	
UNITS	**(ug/kg)**	
Dibenzofuran		U
2,4-Dinitrotoluene		U
Diethylphthalate		U
4-Chlorophenyl-phenylether		U
Fluorene		U
4-Nitroaniline		U
4,6-Dinitro-2-methylphenol		U
N-Nitrosodiphenylamine		U
n-Nitrosodimethylamine		U
4-Bromophenyl-phenylether		U
Hexachlorobenzene		U
Pentachlorophenol		U
Phenanthrene		U
Anthracene		U
Di-n-butylphthalate		U
Fluoranthene		U
Pyrene		U
Butylbenzylphthalate		U
3,3'-Dichlorobenzidine		U
Benzo(a)anthracene		U
Chrysene		U
bis(2-Ethylhexyl)phthalate	140	J
Di-n-octylphthalate		U
Benzo(b)fluoranthene		U
Benzo(k)fluoranthene		U
Benzo(a)pyrene		U
Indeno(1,2,3-cd)pyrene		U
Dibenzo(a,h)anthracene		U
Benzo(g,h,i)perylene		U
Benzyl Alcohol		U
TOTAL PAHs	0	
TOTAL CaPAHs	0	
TOTAL SVOCs	140	

Qualifiers:
U: Compound analyzed for but not detected.
B: Compound found in the method blank as well as the sample.
J: Compound found at a concentration below the detection limit.

TABLE 8
INTERNATIONAL BUSINESS MACHINES CORPORATION EAST FISHKILL FACILITY
F/HM SLUDGE SAMPLING TOTAL ANALYTICAL RESULTS
BUILDING 690 SLUDGE
INORGANICS

BUILDING	**B690**		**B690**
SAMPLE IDENTIFICATION	**CA-F Comp.**		**CA-F Grab**
DATE OF COLLECTION	**02/08/99**		**02/08/99**
DILUTION FACTOR	**1**		**1**
PERCENT SOLIDS	**40.1**		**39.5**
UNITS	**(mg/kg)**		**(mg/kg)**
Arsenic	2.2	B	NA
Beryllium	0.21	B	NA
Cadmium	0.77	B	NA
Chromium (Total)	20.0		NA
Lead	16.8		NA
Mercury		U	NA
Nickel	8.0		NA
Silver	1.4	B	NA
Cyanide, Amenable		U	NA
Cyanide, Total		U	NA
Formaldehyde		NA	U

Qualifiers:
U: Compound analyzed for but not detected.
B: Compound concentration is less than the CRDL, but greater than the IDL.
NA: Not Analyzed for.

TABLE 9
INTERNATIONAL BUSINESS MACHINES CORPORATION EAST FISHKILL FACILITY
F/HM SLUDGE SAMPLING TOTAL ANALYTICAL RESULTS
BUILDING 690 SLUDGE
DIOXINS AND FURANS

BUILDING	**B 690**
SAMPLE IDENTIFICATION	**CA-F Grab**
DATE OF COLLECTION	**02/08/99**
DILUTION FACTOR	**1**
PERCENT SOLIDS	**39.1**
UNITS	**(ug/kg)**
2,3,7,8-TCDD	U
1,2,3,7,8-PeCDD	U
1,2,3,4,7,8-HxCDD	U
1,2,3,6,7,8-HxCDD	U
1,2,3,7,8,9-HxCDD	U
1,2,3,4,6,7,8-HpCDD	U
1,2,3,4,6,7,8,9-OCDD	U
2,3,7,8-TCDF	U
1,2,3,7,8-PeCDF	U
2,3,4,7,8-PeCDF	U
1,2,3,4,7,8-HxCDF	U
1,2,3,6,7,8-HxCDF	U
2,3,4,6,7,8-HxCDF	U
1,2,3,7,8,9-HxCDF	U
1,2,3,4,6,7,8-HpCDF	U
1,2,3,4,7,8,9-HpCDF	U
1,2,3,4,6,7,8,9-OCDF	U
Total TCDD	U
Total PeCDD	U
Total HxCDD	U
Total HpCDD	U
Total TCDF	U
Total PeCDF	U
Total HxCDF	U
Total HpCDF	U

Qualifiers:
U: Analyzed for but not detected

2.3.8 Comparison of Typical Cement Feedstock and F006 Sludge Composition

Portland cement is a combination of the oxides of calcium, silicon, aluminum, and iron with lime and silica comprising approximately 85% of its mass. Common materials that are utilized in the manufacture of cement are limestone, shells, and chalk or marl combined with shale, clay, slate, blast furnace slag, silica, sand and iron ore. Table 10 presents the typical raw mix analytical composition of Portland cement.

In addition, Table 10 provides a comparison of the typical raw mix analytical composition of Portland Cement with the analytical composition of the IBM F006 sludge derived from elemental analysis[2]. This comparison documents the fact that the composition of sludge is similar to the typical raw material utilized in the manufacture of cement.

2.3.9 Effect of Sludge on Cement Product

The addition of the wastewater treatment sludge generated at the B/690 wastewater treatment facility will have no measurable effect on the commercial properties or composition of the cement products. This conclusion is based on the fact that the composition of the sludge is similar to that of the naturally occurring or manmade materials typically utilized as a cement feed stock.

Prior to initiating the sludge recycling project in 1987, IBM conducted a detailed engineering evaluation of the recycling project[1]. In addition, in 1988 IBM conducted a trial run of recycling the sludge into cement and conducted chemical analysis of the Portland cement with and without IBM sludge as an ingredient[2]. These analytical results, which are presented on Table 11, indicate that the sludge has no measurable effect on the composition of the cement product.

2.3.10 Transport of Sludge to Cement Facility

IBM currently transports sludge off-site in lined 25 cubic yard roll-off containers to a permitted disposal facility, where it undergoes stabilization by mixing with cement prior to land disposal. Transportation to the cement manufacturing facility will be conducted in the same manner; however, we believe that the distance to the cement kiln will likely be less than the distance to the current permitted landfill.

TABLE 10
COMPARISON OF
TYPICAL RAW MIX ANALYSIS FOR PORTLAND CEMENT
AND IBM F006 SLUDGE

	Chalk	Clay	Limestone	Shale	Marl	Typical Raw Mix	IBM F006 Sludge
SiO_2	1.14	60.48	2.16	55.67	16.86	14.30	13.09
Al_2O_3	0.28	17.79	1.09	21.50	3.38	3.03	5.94
Fe_2O_3	0.14	6.77	0.54	9.00	1.11	1.11	0.36
CaO	54.68	1.61	52.72	0.89	42.68	44.38	41.33
MgO	0.48	3.10	0.68	2.81	0.62	0.59	0.89
S	0.01	n.d.	0.03	0.30	nil	nil	nil
SO_3	0.07	0.21	0.02	nil	0.08	0.07	8.45
Loss On Ignition	43.04	6.65	42.39	4.65	34.66	35.86	28.65
K_2O	0.04	2.61	0.26	4.56	0.66	0.52	0.04
Na_2O	0.09	0.74	0.11	0.82	0.12	0.13	0.08
	99.97	99.96	100.00	100.20	100.07	99.99	98.83

Note: Portland Cement Composition obtained from Lea's Chemistry of Cement and Concrete[4].
IBM F006 Sludge Composition Adapted from a Trial Run of Recycling Lime Sludge into Portland Cement, Brian W. Doyle Engineering, P.C.[2]
Reported Values for $A1_2O_3$ also includes P_2O_5, TiO_2, and Mn_2O_3.

TABLE 11
SLUDGE TO PORTLAND CEMENT
CHEMICAL ANALYSIS OF PORTLAND CEMENT
WITH AND WITHOUT IBM SLUDGE AS AN
INGREDIENT

Chemical Constituent	ICC Cement Product			
	4-18-88 w/o IBM Sludge (ppm)	6-2-88 w/IBM Sludge (ppm)	6-22-88 w/IBM Sludge (ppm)	7-4-88 w/o IBM Sludge (ppm)
Ca	458680	458880	463920	427540
Si	89950	94130	91650	82270
Fe	24160	24200	30460	25130
Al	18380	17960	18250	16800
Mg	6330	5580	4990	5780
Cr (total)	83	104	92	78
Ni	27	24	24	31
Cd	43	27	71	66
Pb	26	29	21	32
Ag	63	31	61	46

Source: A Trial Run of Recycling Lime Sludge into Portland Cement for IBM East Fishkill. Brian W. Doyle Engineering, P.C. February 1989

2.3.11 Processing of Sludge at Cement Facility

As part of the previous sludge recycling project, sludge was transported to the cement facility in 25 cubic yard dumpsters. The dumpsters were emptied in a segregated area at the cement plant and loaded into the cement kiln utilizing a bucket loader. Processing and handling of the sludge is proposed to be managed in a similar manner as part of the re-implementation of this recycling project.

3.0 PROJECT XL CRITERIA

3.1 Superior Environmental Performance

As is presented in previous sections, IBM East Fishkill currently generates approximately 825 tons of sludge annually and transports the material approximately 350 miles to Canada, to ultimately dispose of the material in a permitted landfill. The sludge is generated at two separate F/HM wastewater treatment facilities, one serving the West Complex located in Building 690 and one serving the East Complex at Building 386. After a careful evaluation of the chemical constituents of the sludge from the two segregated sources, we believe the sludge from the West Complex is eligible for the federal and New York State recycling exemption found at 40 CFR 261.2(e)(1)(i) and 6 NYCRR 371.1(c)(6)(i), respectively. The exemption allows for the use of "hazardous waste" as an ingredient in the manufacture of a commercially available product, in this case, Portland cement.

The F006 sludge generated at the IBM East Fishkill facility is basically a "lime" or "hydroxide sludge" with chemical constituents closely aligned to those inherent in natural aggregate materials typically used by cement kilns. By using the F006 sludge in the manufacture of cement, a number of environmental benefits can be realized. These include:

- Achieving a higher position on EPA's hierarchy of waste management options—that is, moving from ultimate disposal by landfilling to recycling the material as an ingredient in a commercially available product.
- While the volume of sludge generated at the IBM East Fishkill facility is a mere "drop in the bucket" as compared to the amount of aggregate that must be mined and often transported to a kiln to manufacture cement, it is a step in the right direction. Again, the reuse of waste material in lieu of continuing to consume a nonrenewable resource, not to mention the oftentimes irreparable harm to the landscape as a direct result of surface mining/quarrying techniques.
- It costs IBM approximately $120,000 to transport and dispose of the F006 sludge it generates in a typical year. While this project may not *generate* income, it surely will lend itself to reductions in the cost associated with disposal. Some portion of the transportation cost will likely remain as we believe most kilns will not pay to have the material transported to the site.
- F006 sludge generated at the IBM East Fishkill facility is transported by truck for disposal in landfills. As such, the material is utilizing expensive and valuable landfill capacity which in and of itself is a limited resource. It also represents a disposal option which is the least attractive and the lowest alternative on EPA's RCRA waste management hierarchy.

- The presence of metals within the F006 sludge have been shown to be comparable to elements found in naturally occurring quarried aggregate. As one might expect, this of course varies from location to location across the country.

3.2 Flexibility and Other Benefits

Flexibility

Federal [40 CFR 261.2(e)(1)(i)] and New York State [371.1(c)(6)(i)(a)] regulations affecting the definition of a solid waste indicate …

> *"… (e) Materials that are not solid waste when recycled.*
>
> *(1) Materials are not solid wastes when they can be shown to be recycled by being:*
>
> > *(i) Used or reused as ingredients in an industrial process to make a product, provided the materials are not being reclaimed, …"*

The regulation continues by placing some constraints on the above definition.

> *"…(2) The following materials are solid wastes, even if the recycling involves use, reuse, or return to the original process (described in paragraphs (e)(1)(i) through (iii) of this section):*
>
> > *(i) Materials used in a manner constituting disposal, or used to produce products that are applied to the land; …"*

The flexibility that we are seeking with regard to implementing this beneficial recycling project is associated with the second portion of the exemption; the potentially nullifying clause regarding use constituting disposal. It is here where we require a more enlightened definition of "use constituting disposal."

It should be noted that 40 CFR Part 266 provides additional insight into the definition of "use constituting disposal." Specifically, 40 CFR 266.20(b) indicates:

> *"(b) Products produced for the general public's use that are used in a manner that constitutes disposal and that contain recyclable materials are not presently subject to regulation if the recyclable materials have undergone a chemical reaction in the course of producing the products so as to become inseparable by physical means and if such products meet the applicable treatment standards in subpart D of part 268 (or applicable prohibition levels in Sec. 268.32 or RCRA section 3004(d), where no treatment standards have been established) for each recyclable material (i.e., hazardous waste) that they contain…."*

In the case in hand, F006 sludge will be commingled with naturally occurring aggregate at a ratio of approximately 200:1 (naturally occurring quarry material: sludge). The reason for the apparent low volume of sludge is simply that there is not sufficient sludge available from the IBM East Fishkill facility in a given period of time to increase the volume of sludge in the mixture. Next, the aggregate/sludge mixture will move through the kiln at a temperature of approximately 2700°F, where it undergoes complex chemical and physical changes. The kiln will be equipped with appropriate air pollution control equipment to capture any volatile metals and particulates. This air pollution control equipment would be a necessary part of the cement production process with or without the addition of the F006 sludge. The end result of the process is Portland cement.

Typically, the cement is utilized to make concrete. When the cement is mixed with water and sand or larger sized aggregate depending on its intended use, it undergoes a pozzolanic, exothermic reaction in which the crystalline structure of the final product undergoes a transformation. It may then be poured as a part of a structure, some portion of which could come into contact with the land. It is this contact with the land which could be considered a "use constituting disposal" and may require some degree of flexibility in terms of regulatory interpretation. The information enclosed in this Project XL Proposal will hopefully assist in supporting our rationale that the use of waste-derived products, particularly the use of concrete, made from cement, derived from a mixture of aggregate and F006 sludge could not logically be defined as a "use constituting disposal."

Benefits

There are actual benefits and potential benefits associated with this project. The potential benefits are far reaching and could have, we believe, significant positive environmental and economic impacts. If a project such as this were approved on a small scale and carefully monitored, it could easily be transferable across the country. Current EPA estimates of F006 sludge generation in the United States range from 360,000 tons to 500,000 tons on a dry weight basis[3]. As a result, its transferability is potentially geographically broad-based and could have applicability to numerous facilities throughout the United States.

If this project were to advance, then significant improvements could be made in achieving a more acceptable waste management practice for this waste stream rather than landfills.

Other benefits include:

- more acceptable waste management options in EPA's hierarchy
- cost savings due to lack of landfilling cost

- conservation of landfill capacity as a limited resource
- more efficient utilization of existing and future landfill capacity
- an additional 10 to 15 percent reduction in the generation of hazardous waste at the Building 386 F/HM wastewater treatment facility
- conservation of natural resources resulting from a reduction in the volume of mining naturally occurring aggregate

Cost Savings

As has been discussed earlier in this Project XL Proposal, a number of cost savings may be realized from the implementation of this F006 recycling project. In summary, these would include:

Disposal Costs – In calendar year 1998, the IBM East Fishkill facility disposed of over 800 tons of F006 sludge generated from its Building 690 and Building 386 operations via landfilling. Prior to landfilling, the sludge is stabilized as required by the Land Disposal Restrictions.

Assuming that IBM generates approximately 300 tons of F006 sludge at its Building 690 F/HM Wastewater Treatment Plant, and it costs approximately $90 per ton to dispose of the material, this project would realize a cost saving of approximately $27,000.

Transportation Costs - Basically, IBM spends approximately $55 per ton to transport its F006 sludge to a permitted landfill in Canada.

The specific transportation related costs are a function of the ultimate location of the kiln. While the kiln will likely accept the material at no cost, it is unlikely that the kiln will pay the transportation cost. Therefore, in reality the transportation component of the cost analysis may not realize any savings. However, as stated above, since the kiln utilized to recycle the F006 sludge will likely be located in closer proximity to the IBM East Fishkill facility relative to the existing landfill utilized for ultimate disposal, some transportation cost savings will likely be realized.

Avoided Costs

In the narrative below we present a discussion of the potential "avoided" costs associated with the recycling of F006 sludge as an ingredient in the manufacture of Portland cement. We have organized the discussion into "paperwork costs", "disposal costs" and "regulatory costs."

Paperwork - with regard to "avoided costs" in the category of "paperwork" we offer the following potential savings. As discussed earlier in this Project XL Proposal, the F006 sludge generated at the IBM East Fishkill facility is transported to Canada for ultimate disposal in a permitted landfill. Under this disposal scenario there are costs for IBM regarding "paperwork" requirements at the federal and New York State level of government. In addition, there are costs associated with government representatives at the federal and state level reviewing and monitoring that paperwork for accuracy, completeness and regulatory compliance. Specific examples of such avoided "paperwork costs" include the following:

- *Export Notification* - in accordance with the RCRA hazardous waste management regulations, hazardous waste generated in the United States and transported to Canada must comply with a sophisticated export notification procedure involving representatives of EPA - Headquarters and Region 2 as well as the New York State Department of Environmental Conservation. There is a significant amount of time involved for IBM representatives to properly implement the export notification procedures and paperwork as well as resources at both the federal and state levels of government to receive, check and manage the notification process.

- *Hazardous Waste Manifests (US and Canada)* - shipments of hazardous waste from the US to Canada require the execution of manifest/shipping documents for both the governments of the United States and Canada. Again, there is time involved for IBM personnel to properly prepare, review and manage the manifest systems for both countries, as well as federal and state regulations to review, process and track the manifests in both the US and Canada to assure compliance. In addition, time is required for the transporter to properly complete its responsibilities in tracking/managing paperwork under the manifest system.

- *Annual Generator Report* - Lastly, under the current land disposal scenario, resources are expended at both the federal and primarily state level to review and manage the annual generator reporting process. By implementing a sludge recycling program such as the one presented in this document, there will be avoided costs associated with completing reviewing and checking that portion of the annual generator report prepared for the facility addressing the generation of F006.

Disposal - as discussed in previous sections of this Project XL Proposal, the principal avoided cost associated with this recycling project is the disposal costs. Obviously, once this project is on-line, sludge that was previously destined for disposal in a permitted landfill at $90 per ton will now be transported to a kiln

which will recycle the sludge as an ingredient in the manufacture of Portland cement.

In addition to direct costs associated with the transportation and disposal of F006 sludge in a landfill, there are fees/assessments in New York State that will be avoided if the sludge is recycled. In New York State, a hazardous waste generator is assessed $27 for each ton of hazardous waste disposed in a permitted landfill. The fee structure in New York State is designed to "penalize" those generators selecting land disposal as the ultimate disposal management scenario, with lesser per ton assessments charged for management options higher on EPA hazardous waste management hierarchy.

Regulatory - at this point in the development of the project we do not foresee any significant "avoided costs" associated with regulatory issues relative to the F006 recycling project other than the disposal, regulatory fees and paperwork costs presented above.

3.3 Stakeholder Involvement

Prior to the submittal of this Project XL Proposal, IBM prepared a Preproposal Technical Information Document as a means of initiating stakeholder involvement. This Preproposal Document was submitted to the EPA-Region 2 and the Office of Solid Waste at EPA Headquarters in Washington, D.C. as well as the New York State Department of Environmental Conservation (NYSDEC). In addition, the Preproposal Document was also submitted to a major stakeholder involved in the Common Sense Initiative /Metal Finishing Subcommittee, the Atlantic States Legal Foundation.

Based on the review of the Preproposal Document, both the EPA-Region 2 and Headquarters as well as the NYSDEC expressed support for the project. As a result, IBM will contact the EPA Project XL Coordinator, Ms. Aleksandra Dobkowski, to develop a strategy for identifying and convening a stakeholder group on a broader base that would involve the local community, IBM internal staff/employees as well as other national environmental groups.

It should be noted that as was previously discussed and agreed to with EPA - Region 2 representatives prior to the submission of this Project XL Proposal, IBM has not been able to identify any cement kilns willing to participate as a cosponsor or stakeholder in the development of this project. While the kilns contacted were generally interested in accepting the sludge as an ingredient in the manufacture of cement, they are not inclined to become involved in the XL process. In addition, IBM will not conduct analytical testing of any cement product manufactured as part of this project.

3.4 Pollution Prevention

3.4.1 Pollution Prevention Activities Implemented at the IBM East Fishkill Facility

Pollution Prevention is the cornerstone of the IBM East Fishkill environmental philosophy. The East Fishkill Pollution Prevention Program has been ongoing for over 20 years and has been long recognized as an important factor in the planning and design of the plant's process operations. As mentioned in Section 1.1, this has been recognized by being the recipient of the New York State Governor's Award for Pollution Prevention in 1994 as well as USEPA's Region 2's 1996 Environmental Quality Award among numerous others.

As has been mentioned earlier in this Project XL Proposal, pollution prevention begins at the design of the tool. For example, in case of an emergency requiring that the plating baths be "dumped," new design features within the tool no longer allow the plating bath to be drained directly to the wastewater treatment plant. Instead, the baths are temporarily discharged to and stored in reservoirs located on a lower level of the building during such emergency episodes for subsequent re-use at the manufacturing tool. Secondly, the chemistry of both the baths and the reservoirs beneath the tools are continuously monitored in order to maintain the optimum chemical concentrations in solution. Therefore, when a bath is out of specification, the entire bath is not discharged to the wastewater treatment plant and replaced with a fresh batch of solution. Instead, a chemical analysis and mixing system introduce appropriate quantities of chemicals to the bath to compensate for the particular chemical not within specification. This means of maintaining the optimum stoichiometry is a significant component of the overall pollution prevention initiative. In addition, the amount of time necessary to achieve the optimum plating time, thereby extending bath life, as well as minimizing "dragout" is managed by a computer system integral to the tool.

One specific project recently completed at the IBM East Fishkill facility resulted in the elimination of two hazardous waste streams and a major reduction in air pollutant emissions. This reduction allowed the East Fishkill facility to modify its regulatory reclassification from a major to a minor source of Hazardous Air Pollutants (HAPs). The two principal actions contributing to this accomplishment included:

- Development and utilization of a replacement chemical for perchloroethylene (PCE) cleaning on the Multi Layer Ceramic (MLC) screening line resulting in a reduction, to date, of PCE potential to emit (PTE) emissions from 29 tons/year to less than 4 tons/year.
- Installation of Regenerative Thermal Oxidizer (RTO) emissions control technology resulting in a 43.3-ton/year reduction (PTE) in HAP and Toxic Release Inventory (TRI) emissions.
- Reduction in HAPs emissions from 91 tons/year to less than 22 tons/year.

Specific pollution prevention projects which have been incorporated into the manufacturing processes associated with the ASTC include:

BSG Etch by Hydrofluoric Acid Vapor - This pollution prevention project involved replacing liquid hydrofluoric acid (HF) with hydrofluoric acid vapor in the BSG etch process. This resulted in a reduction in the quantity of HF liquid and sulfuric acid treated at the Fluoride/Heavy Metal (F/HM) Treatment Plant. This project was implemented in November 1998 and reduced sulfuric acid waste by 780 gallons per year and hydrofluoric acid waste by 156 gallons per year.

Removal of SMS Tool – This pollution prevention project involved removing the SMS tool from the process and converting existing SCP tools to run acid processes utilizing a smaller bath size. This project was implemented in February 1998 and reduced chromic/phosphoric acid waste by 8 gallons per week, hydrofluoric acid waste by 8 gallons per week and DI water flow to the F/HM Treatment Plant by 7 gallons per minute.

FSI 100 Wafer Batching – This pollution prevention project involved modifying the batching requirements to allow the FSI 100 wafer tools to be run at or near capacity by combining compatible technologies. The process involved cleaning on one tool and cleaning and etching on the second tool. This project was implemented in April 1998 and reduced the quantity of waste 49% hydrofluoric acid by 4.8 gal/day and wastewater to the F/HM Treatment Plant by 1 gallon per minute.

FSI Tool Replacement - This pollution prevention project minimized chemical usage by utilizing a 50 wafer capacity tool in the Back End of Line (BEOL) process area. This allowed the tool to be run at or near capacity. This project was implemented in May 1998 and reduced the quantity of waste, dilute hydrofluoric acid by 900 gal/year and wastewater to the F/HM Treatment Plant by 1 gallon per minute.

Eliminate 7:1 Buffered Hydrofluoric Acid - This pollution prevention project involved replacing 7:1 buffered hydrofluoric acid (BHF) with an existing 40:1 BHF for the oxide etch process. This project was completed in May 1999 and reduced hydrofluoric acid waste by 2,351 gallons per year.

Shutdown of FSI Tool - This pollution prevention project involved shutting down an FSI tool that was utilized to strip films from monitor or test wafers by moving the process into another existing tool (SCP tank tool). This project was implemented in June 1998 and reduced hydrofluoric acid waste by 2,574 gallons per year and wastewater to the F/HM Treatment Plant by 8 gallons per minute.

Crack Stop Etch Process Elimination - This pollution prevention project involved the elimination of the crack stop etch process. The crack stop etch process was no longer required due to ongoing process improvements. This project was completed in May 1999 and eliminated 3600 gallons per year of hydrogen peroxide waste which was discharged to the F/HM treatment plant. In addition, wastewater flow to the F/HM treatment plant was reduced by 140 GPD.

Chromic/Phosphoric Acid Elimination - This pollution prevention project involved replacing chromic/phosphoric acid in a metal cleaning process with a very dilute mixture of sulfuric acid and hydrogen peroxide. This project was completed in May 1999 and reduced the use of chromic/phosphoric acid by approximately 2400 gallons per year. In fact, implementation of this project has eliminated chromic/phosphoric acid from the ASTC. In addition, wastewater flow to the F/HM treatment plant was reduced by 140 GPD.

Backside Etch Elimination - This pollution prevention project involved the elimination of a backside etch step in the semiconductor process. In this process, 49% hydrofluoric acid was utilized to strip unwanted oxide and nitride films from the back of wafers. The mixture of 49% hydrofluoric acid and nitric acid which was utilized for other applications was also eliminated. This project was implemented in May 1999. This project reduced the quantity of 49% hydrofluoric acid waste by 700 gallons per year. In addition, wastewater flow to the F/HM treatment plant was reduced by 15 GPD.

In and of itself we believe that this project is consistent with EPA's Project XL guidance document entitled, "Project XL: Best Practices for Proposal Development." On page 13 of that document Section D, Innovation or Pollution Prevention states the following …

> "… EPA strongly encourages proposals which indicate strategies promoting pollution prevention and new technologies that improve environmental protection. Project themes EPA is particularly interested in include:
>
> - *approaches that encourage source reduction and recycling of hazardous waste or materials produced or used during manufacturing or commercial operations [emphasis added]."*

We believe that the essence of this proposed F006 recycling project speaks for itself in this regard as it proposes to utilize a hazardous waste as an ingredient in the manufacture of Portland cement.

3.4.2 New Pollution Prevention Initiatives Related to Current Project XL Proposal

In the introductory portion of this document, we indicated that IBM, on an annual basis, generates a total of approximately 825 tons of F006 sludge from a combination of two separate F/HM waste treatment operations. As discussed, we are proposing to utilize the sludge from the Building 690 F/HM waste treatment process serving the west complex, which generates approximately 300 tons annually, to initiate this F006 recycling process.

If this initial Project XL Proposal is approved and successfully implemented, IBM will consider undertaking additional waste minimization measures in order to facilitate the reuse of the sludge generated at its B/386 F/HM waste treatment facility as well. Among other elements, these waste minimization measures could include evaluating, designing and installing pretreatment equipment on specific manufacturing processes in order to allow the approximately 500 tons of sludge generated annually at the B/386 F/HM waste treatment facility to be amenable for the recycling project.

3.5 Transferability

The Metal Finishing F006 Bench Marking Study prepared by the United States Environmental Protection Agency (USEPA), Office of Solid Waste and Emergency Response and dated October 7, 1998, indicates that F006 generation in the US range from 360,000 to 500,000 tons dry weight equivalent (F006 Industry Estimate)[3].

We believe that if this proposed XL project is found to be acceptable as a pilot project, and through continuous monitoring over a specified period of time gains increasing support, its potential to be transferred to other facilities throughout the United States is significant.

3.6 Feasibility

The International Business Machines Corporation has in the past and continues to demonstrate a long-standing commitment to pollution prevention, waste minimization and recycling. This is very clearly demonstrated by the fact that IBM East Fishkill had designed and implemented an F006 sludge recycling project from 1988 to 1991. During that timeframe, IBM recognized the value of its F006 sludge and pursued a recycling project using the material as an ingredient in the manufacture of Portland cement. As part of the project development undertaken to support the initiation of that recycling program, IBM undertook a pilot study to successfully demonstrate the technical feasibility of the project. After demonstrating its technical feasibility, IBM implemented the project on a full-scale basis. In short, the technical feasibility of a recycling program such as this is not based on simply an engineering evaluation and analysis on paper, but

proven, demonstrated long-term operation as both a pilot project and full-scale program for an approximate 3 year time-frame.

Currently, IBM continues to believe in the merits of the project and as a result has developed this Project XL Proposal to support the continued development and reimplementation of the program.

3.7 Evaluation, Monitoring and Accountability

Accountability

As has been restated a number of times throughout this document, IBM is not requesting any redefinition of compliance as part of this project. As a result, we believe that the issue of "accountability" is minimal. The reason for this rationale is that we believe we are pursuing an available exemption found at 40 CFR 261.2(e)(1)(i). The exemption defines as nonhazardous, a hazardous waste (F006 sludge) that is utilized as an ingredient in the manufacture of a commercial product (Portland cement). However, as articulated clearly in the regulations, this exemption is not applicable to those recycling applications fitting a "use constituting disposal" scenario. With regard to any concern regarding a "use constituting disposal" scenario, we offer the following. 40 CFR 266.20(b) specifically states that if during the manufacturing process, the recyclable materials undergo a chemical reaction so as to be inseparable from the product, the product is not subject to regulation and, as a result, would be eligible for the exemption. In this case, the sludge is being commingled with naturally occurring aggregate at a 1 to 200 ratio, is being fed through the kiln at a temperature of approximately 2700 °F to manufacture cement. At this stage, the sludge has undergone a chemical transformation to Portland cement; a commercial product with pozzolanic properties. We believe that the sludge utilized as an ingredient in this case is not simply stabilized or a mixture of naturally occurring aggregate, but once it passes through the kiln actually undergoes a chemical transformation and chemical bonding. The preamble to Federal Register Vol. 50, No. 3/Friday, January 4, 1985, discusses the Agency's thinking regarding exemptions for hazardous waste-derived products (see Exhibit J). Excerpting from the preamble, the Agency stated …

> *Examples of hazardous waste-derived products in which contained wastes have undergone chemical bonding … are waste-derived cement and asphalt. In these processes, the constituents polymerize and are essentially inseparable by physical means.*

Basically, therefore, we do not believe that this requires regulatory flexibility based on our review of the applicable federal and New York State regulations. However, we recognize that accountability must be instituted and maintained.

With regard to the issue of "accountability", the IBM East Fishkill facility is a hazardous waste generator and a permitted storage facility. As such it is required to maintain

records of all waste generation and disposal operations, conduct inspections and otherwise comply with all applicable paperwork and reporting in accordance with numerous federal, state and local regulatory requirements. As such, IBM will extend its "accountability" to this project and implement the voluntary commitments discussed below.

Enforceable Commitments

As is currently the case, IBM agrees to undertake and complete laboratory analysis of the F006 sludge designated for recycling and continue to comply with all other regulatory obligations.

Voluntary Commitments

As part of this project, IBM understands that monitoring the chemical quality of the F006 sludge being transported to the kiln for recycling is an important component of managing this recycling project as a successful aspect of the facility's overall pollution prevention/waste minimization program. As such, it will commit to undertaking a sludge sampling and laboratory analysis program for appropriate chemical constituents. We believe the program should be designed around specific land disposal restriction rule constituents and should at least initially be sampled and analyzed at an Environmental Laboratory Approval Program (ELAP) laboratory on a quarterly basis. Subsequent to this initial implementation period, say six (6) months, the program should require sludge sampling on a biannual basis or sooner if significant changes to manufacturing process operations affecting the chemical makeup of the sludge are implemented at the facility.

Tracking, Reporting and Evaluation

As part of this Project XL Proposal, IBM will commit to continue to track and make available to federal and state stakeholders analytical data regarding the quality of sludge earmarked for recycling on a quarterly basis.

3.8 Shifting of Risk Burden

At this point in time, we do not believe this aspect of the XL Program to be problematic relative to whether the F006 sludge goes to a landfill or a cement kiln. The reason for this is that in either scenario, the facilities are already in existence, are currently properly permitted and are in compliance with such permits, and are located in either industrial or a heavy commercially zoned area. As a result, we do not foresee any unjust or disproportionate environmental impacts.

4.0 REQUESTED FLEXIBILITY

As has been stated on a number of occasions throughout this Project XL Proposal, the IBM East Fishkill facility is proposing to implement a recycling project which it had successfully designed and implemented during the time period of 1988 through 1991. The hazardous waste management regulations found at 40 CFR 261.2(e)(1)(i) [federal regulations] and 6 NYCRR 371.1(c)(6)(i) [New York State regulations], provide for hazardous waste utilized as an ingredient in the manufacture of a commercially available product to be exempt from being classified as a solid waste. An important proviso of this exemption is that the ultimate use of the product cannot be categorized as a "use constituting disposal."

In the recent past, after very detailed and thorough review, EPA-Region 2 had determined that the recycling component of the overall project is in fact legitimate and is not "sham recycling." The bigger issue has been the "use constituting disposal" issue. This is where flexibility is requested. While we are not suggesting that flexibility or interpretation is even required in this case, we are simply requesting that the Agency compare the two scenarios of "disposal" versus "recycling" prior to making its decision.

Existing Sludge Disposal Alternative	Sludge Recycling
➢ Transport F006 sludge via truck to Stablex facility in Canada ➢ Stabilize F006 sludge ➢ Dispose of sludge in "minimum technology cell"	➢ Commingle F006 and natural quarry material at a ratio of approximately 1 to 200* ➢ Convey commingled aggregate material through cement kiln at approximately 2,700°F ➢ Produce Portland cement

*The ratio is dictated because IBM is limited in the amount of sludge generation.

In addition to recognizing that the sludge would be commingled with natural aggregate, would be subjected to high temperatures within the kiln, and undergo chemical transformation in the process of manufacturing Portland cement as well as being further mixed and undergoing a pozzolanic reaction in the formation of concrete as part of the proposed sludge recycling project, an additional consideration warrants discussion. As part of a further evaluation of the suitability of utilizing the F006 sludge generated at the IBM East Fishkill facility in the manufacture of Portland cement, the following was undertaken. Historic laboratory analytical results of the sludge were obtained and summarized in Tables 1 and 2. The historic laboratory results were then compared to the appropriate land disposal restriction (LDR) treatment standards. After

a careful review of this historic data in comparison to the LDR concentration, it is clearly evident that the sludge, *prior* to being recycled, inherently meets the land disposal restriction concentration thresholds. The comparison of the historic analytical results of the sludge versus the land disposal treatment standards for the constituents of concern is presented below.

Constituent of Concern	Historic Analytical Data Mean Concentration (mg/l TCLP)*	Land Disposal Restriction Treatment Standard (mg/l TCLP)
Cadmium	0.107**	0.11
Chromium (total)	0.07	0.60
Chromium (hexavalent)	0.178	–
Nickel	0.39	11

Constituent of Concern	Historic Analytical Data Mean Concentration (mg/l)	Land Disposal Restriction Treatment Standard (mg/kg)
Cyanide (complexed)	0.024	590

* TCLP except where noted

** On a total basis (results are divided by 20 for comparison to TCLP standards in accordance with EPA guidelines)

We believe the above data offers a compelling reason for both the EPA and NYSDEC to lend support to this project and advance it as a XL project in Region 2.

5.0 COMPLIANCE AND ENFORCEMENT PROFILE

Violations of Environmental Regulations/Permits

Within the last five years there have not been violations of environmental regulations or permits at the IBM East Fishkill facility.

Ongoing Enforcement Actions/Outstanding Compliance Issues

There are no ongoing enforcement actions or outstanding compliance issues at the IBM East Fishkill facility.

Administrative Orders/Judicial Decrees

There are no obligations under an administrative order or judicial decree at the IBM East Fishkill facility.

EPA/State Litigation

There is no EPA / State litigation with respect to the IBM East Fishkill facility.

Relevant Civil Lawsuits

There are no relevant civil lawsuits pending against the IBM Corporation with respect to its East Fishkill facility's environmental compliance.

6.0 SCHEDULE

The project schedule for this F006 sludge recycling proposal is deferred pending additional discussion of the merits of the proposal with major stakeholders.

7.0 BIBLIOGRAPHY

1. Initial Evaluation of the Conversion of Fluoride Sludge to Portland Cement August 1986, Brian W. Doyle Engineering, P.C.

2. A Trial Run of Recycling Lime Sludge into Portland Cement for IBM East Fishkill February 1989, Brian W. Doyle Engineering, P.C.

3. Metal Finishing F006 Benchmarking Study, United States Environmental Protection Agency, October 1998.

4. Lea's Chemistry of Cement and Concrete, Peter C. Hewlett, 4th edition (December 1997).

EXHIBIT A

CORRESPONDENCE FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY TO THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC), DATED APRIL 23, 1987

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION II
26 FEDERAL PLAZA
NEW YORK, NEW YORK 10278

APR 23 1987

David Manfrici, P.E.
Chief, Bureau of Hazardous Waste Operations
Division of Solid and Hazardous Wastes
New York State Department of Environmental Conservation
50 Wolf Road
Albany, New York 12233

Dear Mr. Manfrici:

EPA recently received an inquiry from Harold Snow of the New York State Environmental Facilities Corporation regarding a classification problem posed by IBM Corporation's East Fishkill Facility.

My staff has reviewed the information forwarded to us which originated with IBM, and after consulting EPA Headquarters have come to the conclusion that the proposed process for "Conversion of Fluoride Sludge to Portland Cement" is excluded from regulation under Federal Regulations. Specifically 40 CFR 261.2(e)(1)(i), and the equivalent 6NYCRR Part 371.1(c)(6)(i)(a), state that materials are not solid waste when used as ingredients in an industrial process. The question of sham recycling which was raised in the September 29, 1986 letter from NYSDEC to IBM was investigated. It is clear that the waste is not encapsulated in concrete as contemplated in the cited discussion in the Federal Register (FR January 4, 1985 page 638.) In the present case the waste is used as a raw material instead of limestone in the manufacture of Portland Cement, made by high temperature transformation in a cement kiln.

We note that 40 CFR 261.2(f) and 6 NYCRR Part 371.1(c)(7) require documentation of claims for the conditional exemption when the material is recycled. Since the material would not be a solid waste as long as it is recycled, manifests and storage permits would not be required.

If you decide to exempt the process of recycling the sludge to manufacture cement from regulations, EPA does not anticipate raising any objections.

If you wish to discuss the subject further, please call Dr. Leonard M. Naphtali of my staff, on (212) 264-2377.

Yours truly,

Richard Salkie
Chief
Hazardous Waste Programs Branch

cc: Harold Snow

EXHIBIT B

CORRESPONDENCE FROM NYSDEC TO INTERNATIONAL BUSINESS MACHINES CORPORATION (IBM), DATED APRIL 16, 1987

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233-

Henry G. Williams
Commissioner

APR 16 1987

Mr. J. J. Mullens
IBM
Eastkill Facility Route 52
Hopewell Junction, New York 12533-0999

Dear Mr. Mullen:

We have evaluated your request concerning an exemption provided by 6 NYCRR Part 371.1 (c)(6)(i)(a). After discussions with USEPA Region II, we have concluded that the heavy metal sludge used as a raw material in the production of Portland Cement would not be a solid waste and, therefore, not a hazardous waste. This conclusion is based upon the report entitled, "Initial Evaluation of the Conversion of Fluoride Sludge to Portland Cement."

Please be advised that disposal or use of this sludge in any other manner may negate this exemption.

Sincerely,

James Sibbald Moran

James Sibbald Moran, P.E.
Supervisor
Manifest Section
Bureau of Hazardous Waste Operations
Division of Solid and Hazardous Waste

EXHIBIT C

CORRESPONDENCE FROM NYSDEC TO IBM
DATED MARCH 22, 1991

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233

Thomas C. Jorling
Commissioner

CERTIFIED MAIL RETURN RECEIPT REQUESTED

MAR 2 2 1991

Mr. Richard A. Hay
Manager
Site Environmental Engineering
IBM Corporation
Route 52 B/511-9A1
Hopewell Junction, NY 12533

Dear Mr. Hay:

This will summarize the results of our March 21, 1991 meeting.

For approximately three years, IBM - East Fishkill has been shipping electroplating/metal finishing sludge to Independent Cement Corporation, in Catskill, New York, for use in making portland cement. IBM requested and received prior concurrence from both this Department and EPA that the sludge, when used in this manner, qualified for the "use/reuse" exemption contained in 40 CFR 261.2 (e)(1)(i) and 6 NYCRR 371.1 (c)(6)(i)(a). At the time, federal and state concurrence was given, based on a demonstration that the chromium from the sludge would have a beneficial effect on the properties of concrete, made from the cement product.

Both IBM and Independent Cement wish to know if the "use/reuse" exemption still applies, given the most recent changes to New York State's solid and hazardous waste regulations and the new federal regulations, regarding boilers, industrial furnaces, and cement and aggregate kilns, published in the Federal Register on February 21, 1991.

Insofar as New York State's hazardous waste regulations are concerned, there have been no recent changes that would materially affect our prior concurrence with the "use/reuse" exemption for this material. Therefore, this sludge, when sent to Independent Cement for use in making portland cement, is not a solid or hazardous waste under New York State's hazardous waste program, but:

1. EPA must also be requested to renew its concurrence that this material qualifies for the "use/reuse" exemption. This is because the February 21, 1991 Federal Register contains new federal regulations that may affect the applicability of the "use/reuse" exemption to secondary materials, used to make cement. Since New York State has not yet adopted these, we

cannot presume to represent EPA in this regard, even though New York State generally has been delegated the RCRA program.

If EPA also renews its concurrence that this material qualifies for the "use/reuse" exemption, the sludge will not be regulated under either the federal or state hazardous waste regulatory programs, and the regulations, promulgated in the February 21, 1991 Federal Register, will not apply to Independent Cement, unless it co-processes regulated hazardous waste from other sources.

EPA commented at some length in the February 21, 1991 Federal Register (see especially page 7185), regarding the use of secondary materials as ingredients in making cement. In so doing, EPA indicated that a secondary material could qualify for the "use/reuse" exemption if can be shown that the material contributes to the quality of the product, and that the material is not being burned, at least in part, for energy recovery or for destruction. Therefore, prior to meeting with or applying to EPA for renewed concurrence, it will be necessary for IBM to test samples of its sludge for both heating value, in terms of BTU per pound, and for levels of non-metal hazardous constituents, contained in Appendix VIII of 40 CFR 261.

2. Because of the most recent changes in New York State's Part 360 regulations (December 31, 1988), however, a separate determination must be made by this Department's Division of Solid Waste as to whether or not this sludge is regulated as non-hazardous solid waste, and whether Independent Cement would require a Part 360 permit to accept and process this material. To request an exemption from Part 360 regulation, IBM and Independent Cement must submit a petition for a beneficial use determination, in accordance with 6 NYCRR 360-1.2 (a)(4)(vii)(a) and 360-1.2 (a)(5). This should be submitted to Mr. William Colden, Chief, Bureau of Waste Reduction and Recycling, at the Department's Central Office location. A copy should also be sent to our Region 4 Office to the attention of Mr. Eldred Rich.

If the Division of Solid Waste approves the petition for beneficial use, then IBM sludge, when used in this manner, would not be a regulated solid waste, and Independent Cement would not be required to obtain a Part 360 permit as a solid waste management facility.

3. Of course, any regulatory exemptions would apply only

to sludge that IBM sends to Independent Cement to be processed in the manner described. Any excess sludge that IBM disposes of elsewhere would continue to be regulated as a hazardous waste.

4. As a correction on one issue, discussed at our meeting, it appears that, under the current Part 364 regulations, a licensed, non-hazardous waste hauler will still be required, even if the aforementioned regulatory exemptions are granted.

If there are any questions, please contact this office at (518) 457-6858.

Sincerely,

Lawrence J. Nadler

Lawrence J. Nadler, P.E.
Chief
Determination and Compliance Section
Bureau of Hazardous Waste Facility Compliance
Division of Hazardous Substances Regulation

cc: B. Stull, Independent Cement Corp.
J. Heintz, Devorsetz Stinziano & Smith, PC
G. Meyer, EPA-Region II

EXHIBIT D

CORRESPONDENCE FROM EPA TO IBM, DATED JUNE 10, 1991

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, NEW YORK 10278

JUN 10 1991

Mr. Richard Hay
Manager
Site Environmental Engineering
IBM Corporation
Route 52 B/511-9A1
Hopewell Junction, NY 12533

Re: Request for Regulatory Interpretation of the Boilers and Furnaces Regulations as it Pertains to F006 Electroplating Sludge.
IBM Corporation
EPA I.D. Number: NYD000707901

Dear Mr. Hay:

I am in receipt of your letter dated April 24, 1991 requesting our regulatory interpretation of the new Boilers and Furnaces Regulations (BIF rule) as they would pertain to the F006 electroplating sludge on which you were granted an exemption. In April 1987, IBM requested an exemption for F006 electroplating sludge when used in the manufacture of Portland Cement. IBM argued that the F006 sludge qualified for the "use/reuse" exemption as found at 40 C.F.R. § 261.2(e)(1)(i) and 6 NYCRR 371.1(c)(6)(i)(a) and demonstrated that the use of the sludge in the manufacture of Portland Cement has a beneficial use on the properties of concrete made from such cement. After review and consultation with EPA Headquarters, the United States Environmental Protection Agency (USEPA)-Region II advised The New York State Department of Environmental Conservation (NYSDEC) that the BIF Rule was inapplicable to your situation since you had previously been granted an exemption from the definition of solid waste.

Mr. Larry Nadler, in his letter of March 22, 1991, to IBM, stated that as far as New York State hazardous waste regulations are concerned, the use/reuse exemption is still valid, therefore the F006 sludge is not a solid waste nor is it a hazardous waste. The new Boilers and Industrial Furnaces Regulations define cement kilns as Industrials Furnaces and states that a secondary material which is a hazardous waste could qualify for the use/reuse exemption if it can be shown that the material contributes to the quality of the product and is used as a bonafide ingredient if it contains less than 500 ppm of non

metallic toxic organics and has a heating value of less than 5000 BTU/LB. The use/reuse exemption under the BIF Rules applies to the use/reuse of materials that are still hazardous wastes; not to materials that are exempt from the definition of solid wastes.

With the exemption granted by NYSDEC, the F006 sludge is not a solid waste and as a result is not a hazardous waste, therefore the Boilers and Industrial Furnaces Rule would not apply. There are no provisions in the new rules which would alter the applicability of the exemption granted by NYSDEC.

If you have any questions regarding this determination, please contact Abdool Jabar of my staff at (212) 264-0683.

Sincerely yours,

George Meyer, P.E., Chief
Hazardous Waste Compliance Branch

EXHIBIT E

CORRESPONDENCE FROM NYSDEC TO EPA DATED JANUARY 10, 1992

New York State Department of Environmental Conservation
50 West Rose, Albany, New York 12233

JAN 10 1992

Thomas C. Jorling
Commissioner

Mr. George Meyer
Chief, Hazardous Waste Compliance Branch
U.S. Environmental Protection Agency
Region II
Jacob K. Javits Federal Building
26 Federal Plaza
New York, NY 10278

Dear George:

RE: IBM - East Fishkill Facility, Status of F006 Sludge Exemption for the Manufacturing of Portland Cement

Both this Department and Region II of EPA recently concurred that the F006 sludge, generated by IBM's East Fishkill facility, was eligible for the use/reuse exemption (40 CFR 261.2 (e)(1)(i)), when utilized by Independent Cement, of Catskill, New York, to make portland cement (see enclosed correspondence). This was, in fact, a renewal of earlier concurrence, the matter of which had to be reexamined to see if the new Boiler and Industrial Furnace (BIF) rules still permitted this exclusion or imposed constraints. EPA determined that the BIF rules would not apply to Independent Cement, as long as the sludge continued to qualify for the use/reuse exemption.

It is necessary to reexamine this exclusion once again because of new input, provided by Independent Cement in its letter of December 3, 1991, (enclosed). The letter, in fact, summarizes what was told to Mr. Nadler in a telephone conversation on October 28, 1991 by Mr. Turner and Mr. Stull, of Independent Cement. The gist of the letter is that, while chromium may have a beneficial effect on concrete made from Portland Cement, IBM's sludge did not contain enough chromium to produce any measurable benefit, and that Independent Cement was not interested in seeking any supplementary sources of chromium in order to intentionally try to produce the indicated beneficial effect.

As indicated in Mr. Nadler's letter of March 22, 1991, the basis for this Department's concurrence with the exclusion was that the hazardous constituent in the F006 sludge, namely chromium, would produce a beneficial effect on Independent Cement's product. We considered this to be crucial in use/reuse situations, in accordance with our understanding of EPA's indices of legitimate recycling and reuse (see enclosed October 11, 1991 letter to N.G. Kaul from Sylvia Lowrance and enclosed guidance from Sylvia Lowrance to the EPA regions, dated April 26, 1989).

Although the indicated guidance to the EPA regions outlines a number of indices of legitimate recycling and reuse, it does not indicate whether they are all weighted equally, or some should be given higher priority than others. In our case, this Department has always placed great stress on the need to have the hazardous constituent contribute to product quality, besides posing no increased environmental or public health risk from being incorporated into the product. If the hazardous constituent does not contribute to product quality, but is merely "along for the ride," even though posing no threat, we have tended not to regard this as legitimate use/reuse, eligible for a regulatory exemption, even though non-hazardous constituents may be used beneficially.

In the case at hand, the chromium in IBM's sludge does react in the cement kiln and becomes part of the cement matrix, as does the lime residual, which is clearly used beneficially. However, if there is insufficient chromium to produce any measurable benefit, we would normally not view this as exempt use/reuse.

This matter was brought to our attention by Independent Cement because of their realization that the beneficial effect of the chromium had been central to our concurrence with the exemption, and because of their concern that some third party might challenge the legality of their use of IBM's sludge.

After reviewing Independent Cement's December 3, 1991 letter our initial determination was that we should withdraw our concurrence with the use/reuse exemption, and a meeting was held with IBM and Independent Cement on December 20, 1991 to discuss this matter with them. Before taking final action, we decided to consult with EPA to see if EPA would view the exemption as still being applicable.

Thus, we need EPA's views on this matter. Are we correct in believing that, based on Independent Cement's letter, we can no longer consider IBM's sludge to be eligible for the use/reuse exemption, unless Independent Cement is willing to supplement IBM's sludge with chromium from other sources (even other plating/metal finishing sludges containing chromium) sufficient to produce a measurable beneficial effect. Based on EPA's understanding of its own April 26, 1989 guidance on the indices of legitimate recycling and reuse, is it essential that the hazardous constituent or constituents in a secondary material contribute to product quality in use/reuse situations, or is this Department placing too much stress on this one consideration? Does the term "of sufficient use," as stated in Ms. Lawrence's letter, apply to the chromium in this instance?

If there are any questions, please contact Mr. Lawrence J. Nadler, of my staff, at (518) 457-6858.

Sincerely,

John L. Middelkoop, P.E.
Director
Bureau of Hazardous Waste Facility Compliance
Division of Hazardous Substances Regulation

Enclosures
cc: w/encl D. Turner, Independent Cement
R. May, IBM - East Fishkill

EXHIBIT F

CORRESPONDENCE FROM EPA TO NYSDEC DATED AUGUST 18, 1992

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, NEW YORK 10278

18 AUG 1992

Mr. John Middelkoop, P.E.
Director
Bureau of Hazardous Waste Facility Compliance
Division of Hazardous Substances Regulation
New York State Department Of
Environmental Conservation
50 Wolf Road
Albany, New York, 12233

RE: IBM - East Fishkill Facility, Status of F006 Sludge Exemption for the manufacturing of Portland Cement.

Dear Mr. Middelkoop:

I am in receipt of your letter dated January 10, 1992, requesting the U.S. Environmental Protection Agency's (EPA) views on the status of the F006 sludge generated by the IBM - East Fishkill Facility and utilized by Independent Cement in the manufacture of Portland Cement. About four years ago, IBM requested and received concurrence from the New York State Department of Environmental Conservation (NYSDEC) and the EPA that the sludge, when used for the manufacture of Portland Cement, qualified for the 'use/reuse' exemption contained in 40 CFR § 261.2(e)(1)(i) and 6 NYCRR § 371.1(c)(i)(a). At that time, the concurrence was based on a demonstration that the chromium would have beneficial effect on the properties of concrete, made from the cement product.

As you indicated in your letter, Independent Cement's letter of December 3, 1991, stated that the chromium present in IBM's sludge is not of sufficient concentration to have a beneficial effect on the properties of concrete made from cement.

Sylvia Lowrance, on page four of her letter of October 11, 1991 to N.G. Kaul, stated that the criteria for evaluating the legitimacy of recycling include the following:

- Does the waste contain Appendix VIII constituents not found in the analogous raw material/product(or at higher levels)?
- Does the waste exhibit hazardous characteristics that the analogous raw materials/product would not?

- o Are the toxic constituents actually necessary (or of sufficient use) to the product or are they not necessary for the product?

Based upon the information provided thus far, the basic eligibility of IBM's F006 sludge in terms of meeting the three criteria described above cannot be answered. A comparative analysis on the analogous feedstock and the F006 sludge must be performed so that a determination can be made regarding this sludge's eligibility for the use/reuse exemption. This has been conveyed to the facility at meetings between representatives of IBM and EPA-Region II.

Should IBM's F006 sludge meet the basic eligibility criteria as defined above, then we believe that regulation 40 CFR § 261.2(e)(2)(i) applies to that F006 sludge. EPA makes it clear at 40 CFR § 266.20(b) that hazardous secondary materials (e.g., spent materials, sludges, by-products, and scrap metal) used as ingredients in waste-derived products that will be placed on the land in a manner constituting disposal, pursuant to 40 CFR § 261.2 (e)(2)(i) must meet applicable treatment standards in Subpart D of Part 268. It is conceivable that Portland Cement might be used in situations where it is applied directly to the land (e.g., building foundation materials).

The EPA has decided not to regulate products manufactured, using recycled materials which are used in a manner constituting disposal, at this time, provided that the initial wastes have undergone a chemical reaction so as to become inseparable by physical means, and that the waste-derived aggregate meets the Part 268 treatment standard for every hazardous waste and/or hazardous constituent used to make the product. Whenever a product derived from hazardous wastes is placed in or on the ground or otherwise used in a manner constituting disposal, a representative sample should be obtained and analyzed to assure that it meets the treatment standards for F006 waste found in 40 CFR § 268.41 and 40 CFR § 268.43. The 40 CFR § 268.41 analysis requires the use of the toxicity characteristic leaching procedure (TCLP) as described in Appendix I to 40 CFR § 268.41 for parameters described in Federal Register, Vol. 53, No. 95 (Wednesday, August 17, 1988, pp. 17588-89). The 40 CFR § 268.43 analysis has to be conducted on samples for Total Constituent Concentration in Wastes. The EPA's protocol for obtaining representative samples for testing, as described in SW-846, must be followed. In order to get an accurate representation of the waste, it is recommended that, at a minimum, one composite sample shall be tested for 40 CFR § 268.41 and 40 CFR § 268.43 parameters. These tests must be representative of each batch sale, and the test results must be obtained and recorded prior to sale. If after six months the composite samples are consistent, then samples can be done once per quarter.

Furthermore, when the product is stored prior to sale, until it has been shown to meet the 40 CFR § 268.41 and 40 CFR § 268.43 criteria for F006, it must be managed as a hazardous waste. However, once it can be demonstrated that the end products meets treatment standards, the storage provisions of Subtitle C, would not apply since the material would be exempt from Subtitle C regulation. It is important that a recordkeeping system be implemented by the company to track the results of chemical analyses conducted on samples representative of the end product designed for land use to verify compliance with all 40 CFR § 268.41 and 40 CFR § 268.43 treatment standards. Failure to conduct these tests stated above would immediately cause the use of IBM's F006 sludge to manufacture Portland Cement by Independent Cement Company to be discontinued.

Should you have any questions regarding this matter, please contact Abdool Jabar of my staff at (212) 264-0683.

Sincerely yours,

George C. Meyer, P.E., Chief
Hazardous Waste Compliance Branch

cc: Peter J. Darcy, Manager
Environmental/Regulatory Engineering

EXHIBIT G

INTERNAL MEMORANDUM FROM USEPA - REGION 2 TO USEPA - HEADQUARTERS, DATED JANUARY 15, 1993

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II

DATE: JA[illegible]

UBJECT: Use of IBM F006 Sludge as an Ingredient in the Manufacture of Portland Cement

FROM: George C. Meyer, P.E., Chief
Hazardous Waste Compliance Branch (2AWM-HWC)

TO: Michael Petruska, Chief
Waste Characterization Branch (OS-332)

This is a follow up to our telephone conversation in late December, 1992. At the request of the New York State Department of Environmental Conservation (NYSDEC), we are presently involved in discussions with the International Business Machines Corporation (IBM), East Fishkill, N.Y. concerning their request to use F006 sludge, generated by the electroplating of electronic components, as an ingredient in the manufacture of Portland Cement. We have been involved in numerous meetings and teleconferences with representatives of NYSDEC and IBM regarding this issue and have reviewed information supplied to us by IBM. NYCDEC and IBM have requested that EPA made a decision on IBM's request.

As a result of these meetings, teleconferences, and our review of the information, we believe that the addition of the F006 sludge generated by IBM to the manufacture of Portland Cement constitutes a legitimate, beneficial reuse of a waste material. This reuse, under the conditions specified, will add value to the cement-making process through reuse of a feedstock-equivalent material, prevent the IBM facility from incurring unnecessary disposal costs, beneficially impact the nations hazardous waste management disposal capacity, and will not cause harm to human health and/or the environment. The following defines the basis for our proposed decision to concur with the IBM request.

1. We have evaluated the addition of the F006 sludge to the manufacture of Portland Cement in terms of whether or not this activity would constitute legitimate recycling or is actually a form of treatment intended to avoid regulation (sham recycling). This evaluation was conducted using the criteria defined by Sylvia Lowerance in her memorandum to the Regions dated April 26, 1989, which dealt specifically with the recycling of F006 waste.

   Our evaluation, using the above-mentioned criteria, indicates that the proposal would constitute legitimate recycling. We determined that the sludge is "commodity-like", has value as a raw material and that the recycling process, as specified in this memorandum, will not release hazardous constituents that are significantly different from or greater then those from the processing of virgin feedstock. Information received from the Environmental Manager of Independent

Cement Company (ICC), Catskill, New York states that ICC's "interest in the IBM material is for the major constituents, namely lime, silica, alumina, and iron, which are the normal constituents in the cement manufacturing process".

2. The IBM F006 sludge is and will be regulated as a solid waste pursuant to 40 C.F.R. Section 261.3(e)(2)(i) which states that materials are solid wastes even if the recycling involves use, reuse, or return to the original process if these materials will be used in a manner constituting disposal or will be used to manufacture products which are applied to the land. The IBM F006 sludge will be mixed with quarry rock (in a ratio of 1/200) to produce Portland Cement. The cement will be used to make concrete which may be applied directly to the land (as in the case of building foundations, etc.) and therefore remains a solid waste, and by virtue of its listing, a RCRA hazardous waste.

3. Pursuant to 40 C.F.R. Section 266.20(b), products manufactured using recyclable materials are not subject to regulation provided that the recyclable materials have undergone a chemical reaction in the course of production which renders them inseparable by physical means and the product meets the applicable treatment standards in Subpart D of Part 268 for each recyclable material that they contain. We have determined that the cement manufacturing process is such that the recyclable material (F006 sludge) undergoes a pozzuolanic reaction and physically becomes inseparable from the product. In addition, IBM has agreed to demonstrate through testing of each batch of F006 sludge, that all applicable Land Disposal Restriction (LDR) standards are met prior to introduction of the sludge into the cement-making process. Should any F006 constituent exceed the relevant LDR treatment standard, that batch of F006 would not be available for use in the cement-making process unless it underwent treatment to bring the constituent(s) level below the concentration of the regulatory treatment standard.

4. Prior to introduction into the cement-making process, the IBM F006 sludge will be managed as a RCRA hazardous waste in accordance with all applicable provisions of 40 C.F.R. Parts 261 through 270.

5. The use of IBM F006 sludge in the cement-making process will be conducted only at facilities which are authorized to handle such material pursuant to the Boiler and Industrial Furnace (BIF) Rule (40 CFR Part 266, Subpart H) and meet these requirements, including

those of Section 266.112 regulating cement kiln residue (dust).

To summarize, when conducted consistent with the above conditions, the use of IBM's F006 sludge in the manufacture of Portland Cement will be protective of health and the environment as well as contribute substances needed in the manufacture of Portland Cement. This activity will also be consistent with the Agency goal of waste minimization and will conserve scarce hazardous waste disposal capacity.

In addition, as a condition of concurrence, we will require that IBM demonstrate that all practicable and economically feasible steps have been taken to minimize the generation of hazardous waste constitutients in the F006 sludge.

We are proposing to issue concurrence, in writing, for the use of IBM's F006 sludge in the manufacture of Portland Cement, pursuant to the provisions described above, within three weeks of the date of this memorandum unless you indicate non-concurrence and the basis for it. In view of our earlier conversation, I am anticipating your continued support for this proposal.

Mike, thanks, in advance, for your help in moving Agency action on this proposal forward.

If you have any questions, please call me at (212) 264-8356 or have your staff call Phil Flax or Abdool Jabar, at (212) 264-0683.

cc: Larry Nadler, NYSDEC
John Middlekoop, NYSDEC

bcc: Conrad Simon, AWM
Philip Flax, 2AWM-HWC
John Gorman, 2AWM-HWC
Abdool Jabar, 2AWM-HWC

EXHIBIT H

CORRESPONDENCE FROM IBM TO USEPA - REGION 2
DATED FEBRUARY 19, 1993

IBM

International Business Machines Corporation

East Fishkill Facility, Route 52
Hopewell Junction, New York 12533-0999
914/894-2121

February 19, 1993

George C. Meyer, P.E., Chief
Hazardous Waste Compliance Branch
U.S. Environmental Protection Agency, Region II
Jacob K. Javits Building
New York, New York 10278

Re: IBM East Fishkill Facility
EPA ID No. NYD000707901
Utilization of IBM Sludge in the
Manufacture of Portland Cement

Dear Mr. Meyer:

This letter is a follow-up to your most recent telephone conversation of February 12, 1992 with Richard Walka of William F. Cosulich Associates, P.C. regarding the recycling of IBM sludge as an ingredient in the manufacture of Portland Cement. As discussed, in reviewing your January 15, 1993 memorandum to Mr. Michael Petruska of EPA Headquarters regarding this matter (attached), we remain concerned about the Agency's most recent interpretation regarding the "use constituting disposal" issue. Towards that end, we would like to take this opportunity to review with you a few technical points regarding the matter.

In a letter dated August 18, 1992 (attached) addressed to Mr. John Middelkoop of the New York State Department of Environmental Conservation (NYSDEC) (pages 2 and 3, last two paragraphs), the Agency provides considerable detail regarding its practical interpretation and requirements regarding the definition of use constituting disposal. In part, the letter indicates that... "The EPA has decided <u>not</u> (emphasis added) to regulate products manufactured using recycled materials which are used in a manner constituting disposal at this time, provided that the initial waste has undergone a chemical reaction so as to become inseparable by physical means and that the waste derived aggregate meets the Part 268 treatment standards...." With regard to this later point, the letter continues to point out that whenever a commercial product derived from hazardous waste is used in a manner constituting disposal, a representative sample should be obtained and analyzed to assure that it meets the appropriate treatment standards found at 268.41 and 268.43. In closing, the correspondence states... "However, once it can be demonstrated that the end product meets treatment standards, the storage provisions of Subtitle C would <u>not apply since the material would be exempt from Subtitle C regulation</u> (emphasis added)."

During the course of developing this project, we identified a number of implementation, and marketing issues associated with the requirement to sample and analyze Portland Cement. Basically, we were concerned that the requirement to analyze a commercially available product such as Portland Cement for Toxicity Characteristic Leaching Procedure (TCLP) hazardous constituents in accordance with Part 268.41 and .43 would not be acceptable to the cement manufacturing industry and therefore seriously jeopardize an otherwise environmentally sound recycling project. In pursuing an alternative product monitoring methodology, IBM submitted to your office the analytical results of over 100 samples of typical IBM sludge analyzed for the required TCLP constituents collected over the course of a year that could have been utilized in the manufacture of Portland Cement. The purpose of this data was to demonstrate that the sludge, which is the ingredient in question, already met the Land Disposal Restriction Rule (LDR) treatment standards prior to entering the kiln. In doing so, it was our goal to assure the Agency that if the ingredient (sludge) already met the LDR standards, the product (Portland Cement) would not require testing. In addition, as a further safeguard, IBM agreed to sample and analyze each batch of sludge prior to shipment to a cement kiln to demonstrate compliance with the applicable 268 treatment standards. In the unlikely event that the sludge does not comply, that batch will not be utilized in the manufacture of Portland Cement.

At this time, our concerns basically arise from item numbers 2 and 5 of your January 15, 1993 memorandum to Mr. Petruska and center around what we believe is IBM's compliance with the two basic technical criteria required to maintain the exempt status of the sludge utilized in the manufacture of Portland Cement (i.e. the subject to chemical reaction provision and adherence to 268 treatment standards).

First, in the January 15th memorandum to Headquarters, Region II agreed that the recycling of IBM sludge in the manufacture of cement "...[has] undergone a chemical reaction in the course of production which renders them inseparable by physical means...." (See item number 3, line 8.) With regard to the second criteria, that is, not representing a use constituting disposal, as stated above in the second paragraph, as an excerpt from Region II's August 18, 1992 correspondence, the Agency stated that it has chosen not to regulate products manufactured using recycled materials provided it has undergone chemical reaction and meets the 268 treatment standards.

Since we believe that both of these criteria have been addressed to the satisfaction of EPA, we are not clear as to why the Agency continues to require regulation of the material as both a hazardous and solid waste under 261.2(e)(2)(i) and 261.2(e)(1)(i).

Based on the information provided to the Agency to date and the agreement by IBM to sample and analyze its sludge prior to recycling in the manufacture of Portland Cement, we believe that the sludge continues to be eligible for the exemption as a solid waste found at 261.2(e)(1)(i) and would therefore not be regulated as a hazardous waste as identified in item number 2 of the January 15th memorandum. Additionally, we question the relevance of item number 5 of the memorandum with regard to the compliance of any kiln with the Boiler and Industrial Furnace requirements.

We greatly appreciate the time Region 2 has dedicated to the technical evaluation of this important environmental project and look forward to its successful implementation. If you have any questions regarding this matter, please do not hesitate to contact Dr. Narayan Ayengar or me at (914) 892-1560.

Very truly yours,

INTERNATIONAL BUSINESS MACHINES CORPORATION

_____

Peter J. Darcy
Manager, Environmental Regulatory Engineering

PJD/mbf
Enclosure
cc/encl.:
L. Nadler (NYSDEC)
J. Middelkoop (NYSDEC)
0503a/87
1116

EXHIBIT I

INTERNAL MEMORANDUM FROM EPA - REGION II TO EPA - HEADQUARTERS, DATED MAY 27, 1993

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II

DATE: 27 MAY 1993

SUBJECT: Use of IBM F006 Sludge as an Ingredient in the Manufacture of Portland Cement

Original Signed By

FROM: George C. Meyer, P.E., Chief,
Hazardous Waste Compliance Branch (2AWM-HWC)

TO: Mike Petrunka, Chief,
Waste Characterization Branch (OS-332)

As I mentioned to you at the recent Public Forum on the Definition of Solid Waste, please consider this memorandum to be the Region's primary position on this matter. My earlier memorandum of January 15, 1993 to you represented an alternate but secondary position.

A February 13, 1990 memorandum from Sylvia Lowrance to Robert Duprey stated "Cement is considered to be a product that is typically applied to the land (although this is a rebuttable presumption), and therefore the EAF dust is a solid waste (and a hazardous waste--K061) under 40 CFR 261.2 (e)(2)(i)."

A March 11, 1992 memorandum from Jeff Denit to Donald Guinyard stated "generally, when listed hazardous waste is burned in a cement kiln for any purpose other than solely for energy recovery (i.e. as an ingredient or for destruction) and the product is placed on the land, under 261.2(c)(1)(i)(B) and the derived-from rule (261.3(i)(2)(i)), the cement product is a solid and hazardous waste and is subject to 266.20."

The April 1, 1985 Federal Register (Pg. 623) states that " We read our jurisdiction as applying to waste-derived products whose recycling is similar to the normal form of waste management-in this case land disposal." It also states "The agency is thus asserting jurisdiction over all hazardous secondary materials, and over products that contain these wastes when they are applied to the land. Thus fertilizers, asphalt, and building foundation materials that use hazardous waste as ingredients and are applied to the land are subject to RCRA jurisdiction."

Unlike fertilizers and even asphalt, concrete is not "applied to the land" and concrete cannot typically be considered as coming in contact with the land when it is used as a product. Concrete is used in many applications other than as a building foundation material in contact with the land. Concrete, made with cement produced using a hazardous secondary material as beneficial ingredient, should not be included in the category of "waste derived products whose recycling is similar to the normal form of waste management in this case land disposal."

It is therefore inappropriate to include cement in the same category as products that are typically placed on the land and generally cannot be used in any other manner. Since Sylvia Lowrance indicated this is a rebuttable presumption and Jeff Denit said that "generally" cement would be subject to RCRA, it appears that reconsideration is an option.

Therefore, please reconsider the previous Headquarters interpretations cited above so that beneficial recycling, which is protective of the environment, may proceed. IBM is currently transporting 2500 tons of F006 sludge per year out of the country for disposal into a Canadian landfill. This material is primarily lime, silica, etc. which could be beneficially used as an ingredient in the manufacture of cement. As we clearly heard at the recent public forum on the Definition of Solid Waste, the participants strongly desire regulations and policy that promote legitimate and protective recycling. The IBM recycling proposal is one which can be addressed now without waiting for regulatory changes. Please let me know your position on this matter.

As discussed, I am attaching the most recent IBM data received. This data addresses all BDAT parameters specified for F006.

If you have any further questions, please call me at 212-264-8356.

Attachment

cc: Larry Nadler, NYSDEC
John Middelkoop, NYSDEC

EXHIBIT J

EXCERPT FROM JANUARY 4, 1985 FEDERAL REGISTER REGARDING WASTE DERIVED PRODUCTS UNDERGOING CHEMICAL REACTION

[illegible] dilution or toxic [illegible] that can occur in the course of [illegible] use of hazardous waste-derived commercial products on the land also is more clearly a recycling activity than direct waste application, and this use thus is a better candidate for separate regulatory standards. In any case, the Agency wishes to obtain public comments on this issue in the context of a specific proposal.[*]

The regulation thus states that products that contain hazardous wastes would wastes have undergone a chemical reaction so as to become inseparable by physical means are not presently subject to Subtitle C regulation when they are used in a manner constituting disposal. We think the phrase have undergone a chemical reaction so as to become inseparable by physical means expresses our intention better than the language used at proposal, namely "without essential change to their identity or after simple mixing." The waste-derived products for which we are deferring regulation are those where the hazardous wastes have undergone chemical bonding, so that they are chemically transformed. The waste-derived products for which we are *not* deferring regulation are those where the waste is mixed but not chemically reacted. (An exception is for commercial hazardous waste-derived fertilizers which would not have to undergo chemical bonding to be exempt.) The language used in the final regulation is drawn from 40 CFR § 116.3 (definition of "mixture") but expresses a familiar physical concept. See *Condensed Chemical Dictionary*, 10th ed., Van Nostrand Reinhold Co. (1981).

Examples of hazardous waste-derived products in which contained wastes have undergone chemical bonding, and so are deferred from regulation, are waste-derived cement and asphalt. In these processes, the constituents polymerize and so are essentially inseparable by physical means.[**] They

[*] The Agency was not considering waste-derived products in the 1980 preamble statement quoted earlier.

[**] We note, however, that the wastes must contribute to the effectiveness of the waste-derived product for the Agency to regard the waste as being recycled. For example, a waste used in a fertilizer would have to contain nutrients or micronutrients; a waste used in cement would have to have pozzolanic properties. If a waste does not contribute to the product, we consider the waste to be disposed of.

[†] Technically, not every constituent introduced in cement or asphalt becomes chemically bonded in the polymer. Some constituents become trapped in the polymer rather than chemically bound. Because cement and asphalt are not viewed as chemical mixtures and are commercial products, the Agency intends to defer regulation of hazardous wastes-derived cement and asphalt at this time.

3. *Exemption For Hazardous Waste-Derived Products.* As we indicated in Part II of the preamble, we are deferring regulation of hazardous waste-derived products that are placed on the land. We are deferring action because waste-derived products may present less potential risk than wastes placed directly on the land without significant chemical change, due to the chemical

[**] Delistings do not apply on a site-specific basis, however. The petitioner must demonstrate that the waste will not cause substantial harm to human health and the environment if left unregulated in any reasonably-occurring management setting.