

OCTOBER 1993 SAMPLING AND
RADIOLOGICAL ANALYSES
Mg-Th DISPOSAL AREA

PREPARED FOR:
Wyman-Gordon Company
North Grafton, Massachusetts

PREPARED BY:
GZA GeoEnvironmental, Inc.
Newton Upper Falls, Massachusetts

January 1994
File No. 3736.92

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PDR ADOCK 04001650
C PDR

January 7, 1994
File No. 3736.92-C
3736-C

Mr. Brian Postale
Wyman-Gordon Company
244 Worcester Street
North Grafton, Massachusetts 01536

Re: October 1993 Sampling and
Radiological Analyses
Mg-Th Disposal Area

Dear Mr. Postale:

In accordance with your Purchase Order No. 93353 and our proposal dated February 15, 1993 (File No. 3736.91), GZA GeoEnvironmental, Inc. (GZA) has completed the third of three proposed rounds of sampling of three monitoring wells located in the vicinity of the Magnesium-Thorium (Mg-Th) Disposal Area at your North Grafton plant. This sampling and subsequent analysis for gross alpha and beta activity was performed to further assess the potential impact of this disposal area on local groundwater quality and to verify prior findings. GZA's work is subject to the Limitations in Appendix A.

WELL SAMPLING

The three sampled wells, WGE-3, WGE-7, WGE-8, are situated within 100 feet of the former disposal trenches, as depicted on the attached plan. The wells consist of 1-1/2-inch PVC installations screened within the shallow aquifer soils at depths of 19 to 25 feet.

Well sampling was completed on October 19, 1993 using procedures similar to those developed and utilized during previous hydrogeologic studies in this area. Each well was evacuated of at least three well volumes, and then water samples were recovered using precleaned stainless steel bailers equipped with Teflon ball check valves. Duplicate samples from each well were transferred to precleaned acid-washed polyethylene containers, cooled, and delivered to GZA's Newton, Massachusetts Environmental Chemistry Laboratory (ECL).

One of the samples from each well was filtered on the day of collection using a 0.45 micron filter to remove sediment, and then acidified to a pH of less than 2 using nitric acid. The other sample from each well was acidified to a pH of less than 2 using nitric acid, but was not filtered. Both the filtered and nonfiltered samples were subsequently forwarded to Hazen Research, Inc. (Hazen) of Golden, Colorado for analysis of gross alpha and beta activity.



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Newton Upper Falls
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A Subsidiary of GZA
GeoEnvironmental
Technologies, Inc.



The samples were to be screened in the field for pH and conductivity, but these analyses were inadvertently not conducted. However, the wells had been sampled in September 1993 as part of another monitoring program, and pH and conductivity were measured at that time.

RESULTS OF ANALYSES

The results of the analyses for gross alpha and beta activity in the filtered and nonfiltered samples are contained in Appendix B. The October 1993 data are summarized in Table 1, and previous data for these wells are presented in Appendix C.

The results of analyses of the filtered samples collected in October 1993 were well within the EPA standards of 15 pCi/l and 50 pCi/l for gross alpha and beta activity, respectively. The significantly higher levels in the nonfiltered samples appear to be associated with the presence of fine soil particles in the groundwater samples. The pH and conductivity values were within the normal range for New England groundwater.

We trust that this information is sufficient for your current needs. Please call Sara Hanna at (617) 630-6157 if you have questions concerning GZA's radiological sampling and analysis program.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Sara R. Hanna
Senior Project Manager

Rick P. Harding, Ph.D.
Project Reviewer

Lawrence Feldman
Senior Principal

SRH/RPH/LF:ck

Attachments:

Tables
Figure
Appendix A - Limitations
Appendix B - October 1993 Radioanalytical Results
Appendix C - Summary of Previous Data

TABLES

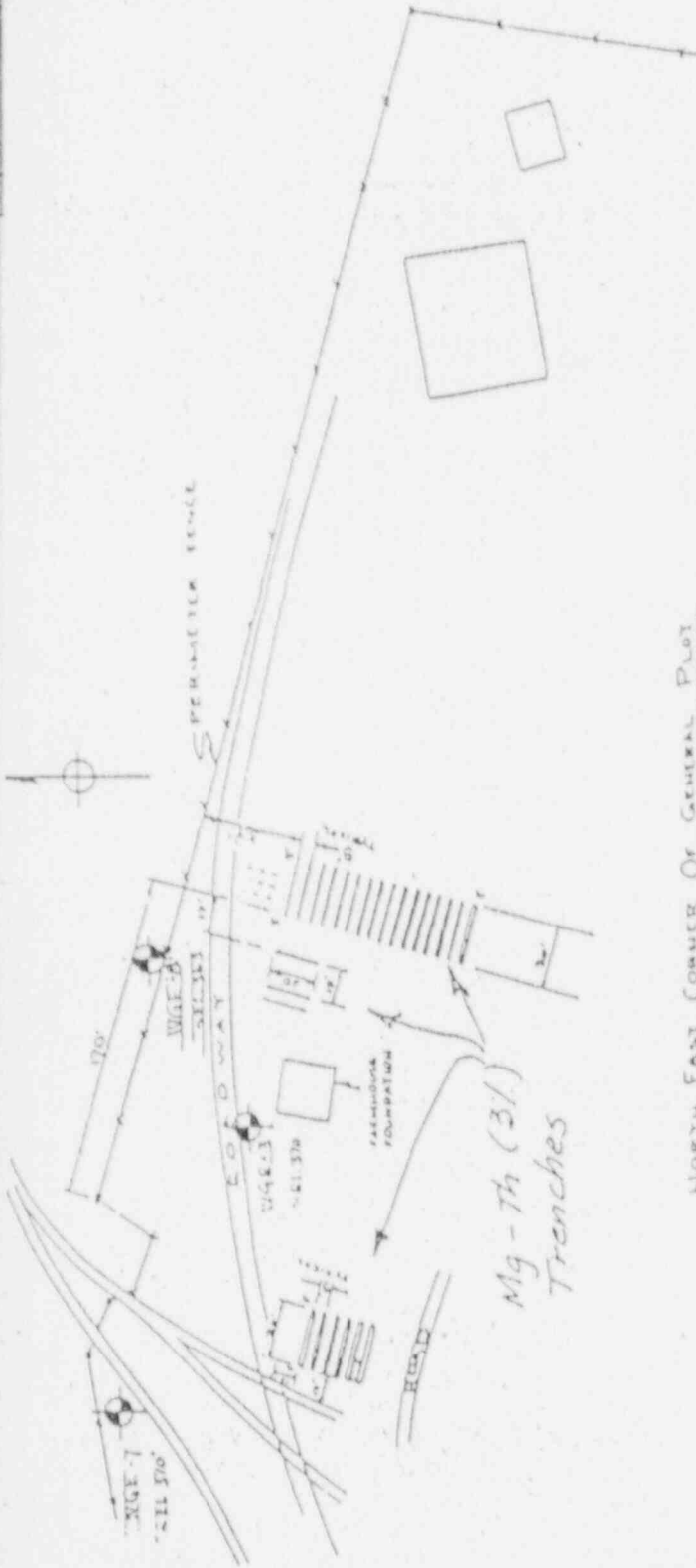
TABLE 1
RESULTS OF ANALYSIS OF GROUNDWATER SAMPLES
COLLECTED OCTOBER 19, 1993

Well No.	pH (Standard Units)	Conductivity (μ mhos/cm)	Gross Alpha Activity (pCi/l)		Gross Beta Activity (PCi/l)	
			Filtered	Unfiltered ^d	Filtered	Unfiltered
WGE-3	7.80	200	2.4 \pm 1.8	160 \pm 50	4.4 \pm 2.8	160 \pm 20
WGE-7	7.29	130	0.0 \pm 1.1	370 \pm 130	1.3 \pm 2.4	450 \pm 80
WGE-8	6.60	170	0.0 \pm 1.1	140 \pm 40	3.8 \pm 2.8	150 \pm 20

Notes:

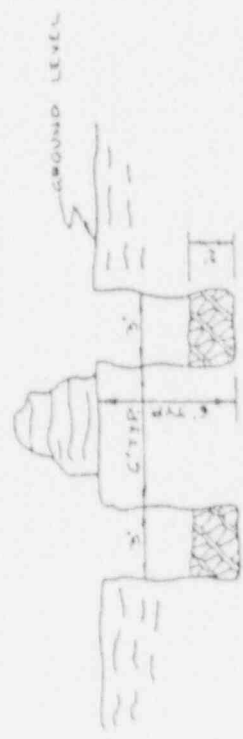
1. Samples for radiological analyses collected October 19, 1993 by GZA personnel and analyzed by Hazen Research, Inc. of Golden, Colorado.
2. pH and conductivity measured in the field by GZA on September 16, 1993.

FIGURES



NORTH EAST CORNER OF GENERAL PLOT

C-299



SECTION THROUGH TRENCHES
SCALE 1/4" = 1'-0"

GROUND WATER MONITORING WELL LOCATION

MAG THORIUM (31) TRENCHES FOR WASTE DISPOSAL
NORTH EAST CORNER OF GENERAL PLOT

WYMAN-GORDON CO.
WORCESTER, MASS.

DATE	1-21-58
BY	W. J. GORDON
CHECKED BY	W. J. GORDON
APPROVED BY	W. J. GORDON
SCALE	1" = 50'
PROJECT NO.	C-299

APPENDIX A
LIMITATIONS

LIMITATIONS

1. The conclusions and recommendations contained in this report are based in part upon various types of chemical and radioanalytical data and are contingent upon their validity. These data have been reviewed and interpretations made in the report. It should be noted that variations in the types and concentrations of contaminants and variations in their flow paths may occur due to seasonal water table fluctuations, past disposal practices, the passage of time, and other factors. Should additional chemical data become available in the future, these data should be reviewed by GZA, and the conclusions and recommendations presented therein modified accordingly.
2. Chemical and radioanalyses have been performed for specific parameters during the course of this study, as detailed in the text. It must be noted that additional constituents not searched for during the current study may be present in soil and groundwater at the site.

APPENDIX B

APRIL 1993 ANALYTICAL RESULTS



Hazen Research, Inc.

4801 Indiana St. • Golden, Colo. 80403
Tel: (303) 279-4501 • Telex 45-860
FAX: (303) 278-1528

DATE November 22, 1993
HRI PROJECT 002-47R
HRI SERIES NO. J397/93-A
DATE RECD. 10/22/93
CUST P.O.# 1 17039

GZA GeoEnvironmental, Inc.
Sara Hanna
320 Needham Street
Newton, MA 02164

REPORT OF ANALYSIS

SAMPLE NO. J397/93-1
SAMPLE IDENTIFICATION: WGE-3 (as received)

PARAMETER	RESULT	DETECTION LIMIT	METHOD	ANALYSIS DATE	ANALYST
Gross Alpha(±Precision*),pCi/l (T)	180(±50)	4	EPA 900.0	11/08/93	EdF
Gross Beta(±Precision*),pCi/l (T)	180(±20)	25	EPA 900.0	11/08/93	EdF

By: 

Robert Rostad
Laboratory Manager

CODES:

(T)=Total (D)=Dissolved
(S)=Suspended (R)=Recoverable
(PD)=Potentially Dissolved
<=Less Than

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96 x sigma.



Hazen Research, Inc.
4601 Indiana St. • Golden, Colo. 80403
Tel: (303) 279-4501 • Telex 45-860
FAX: (303) 278-1528

DATE November 22, 1993
HRI PROJECT 002-47R
HRI SERIES NO. J397/93-8
DATE RECD. 10/22/93
CUST P.O.# 1 17039

GZA GeoEnvironmental, Inc.
Sara Hanna
320 Needham Street
Newton, MA 02164

REPORT OF ANALYSIS

SAMPLE NO. J397/93-2
SAMPLE IDENTIFICATION: WGE-7 (as received)

PARAMETER	RESULT	DETECTION LIMIT	METHOD	ANALYSIS DATE	ANALYST
Gross Alpha(±Precision*),pCi/l (T)	370(±130)	16	EPA 900.0	11/08/93	EdF
Gross Beta(±Precision*),pCi/l (T)	450(±80)	100	EPA 900.0	11/08/93	EdF

By: 

Robert Rostad
Laboratory Manager

CODES:

(T)=Total (D)=Dissolved
(S)=Suspended (R)=Recoverable
(PD)=Potentially Dissolved
<=Less Than

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96 x sigma.



Hazen Research, Inc.

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Tel: (303) 279-4501 • Telex 45-860
FAX: (303) 278-1528

DATE November 22, 1993
HRI PROJECT 002-47R
HRI SERIES NO. J397/93-C
DATE RECD. 10/22/93
CUST P.O.# 1 17039

GZA GeoEnvironmental, Inc.
Sara Hanna
320 Needham Street
Newton, MA 02164

REPORT OF ANALYSIS

SAMPLE NO. J397/93-3
SAMPLE IDENTIFICATION: WGE-8 (as received)

PARAMETER	RESULT	DETECTION LIMIT	METHOD	ANALYSIS DATE	ANALYST
Gross Alpha(±Precision*),pCi/l (T)	140(±40)	4	EPA 900.0	11/08/93	EdF
Gross Beta(±Precision*),pCi/l (T)	150(±20)	25	EPA 900.0	11/08/93	EdF

By: 

Robert Rostad
Laboratory Manager

CODES:

(T)=Total (D)=Dissolved
(S)=Suspended (R)=Recoverable
(PD)=Potentially Dissolved
<=Less Than

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96 x sigma.



Hazen Research, Inc.
4601 Indiana St. • Golden, Colo. 80403
Tel: (303) 279-4501 • Telex 45-860
FAX: (303) 278-1528

DATE November 22, 1993
HRI PROJECT 002-47R
HRI SERIES NO. J397/93-D
DATE RECD. 10/22/93
CUST P.O.# 1 17039

GZA GeoEnvironmental, Inc.
Sara Hanna
320 Needham Street
Newton, MA 02164

REPORT OF ANALYSIS

SAMPLE NO. J397/93-4
SAMPLE IDENTIFICATION: WGE-3 (filtered)

PARAMETER	RESULT	DETECTION LIMIT	METHOD	ANALYSIS DATE	ANALYST
Gross Alpha(±Precision*),pCi/l (T)	2.4(±1.8)	0.8	EPA 900.0	11/17/93	EdF
Gross Beta(±Precision*),pCi/l (T)	4.4±2.8	5	EPA 900.0	11/17/93	EdF

By: 

Robert Rostad
Laboratory Manager

CODES:

(T)=Total (D)=Dissolved
(S)=Suspended (R)=Recoverable
(PD)=Potentially Dissolved
<=Less Than

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96 x sigma.



Hazen Research, Inc.

4801 Indiana St • Golden, Colo. 80403
Tel: (303) 279-4501 • Telex 45-860
FAX: (303) 278-1528

DATE November 22, 1993
HRI PROJECT 002-47R
HRI SERIES NO. J397/93-E
DATE RECD. 10/22/93
CUST P.O.# 1 17039

GZA GeoEnvironmental, Inc.
Sara Hanna
320 Needham Street
Newton, MA 02164

REPORT OF ANALYSIS

SAMPLE NO. J397/93-5
SAMPLE IDENTIFICATION: WGE-7 (filtered)

<u>PARAMETER</u>	<u>RESULT</u>	<u>DETECTION LIMIT</u>	<u>METHOD</u>	<u>ANALYSIS DATE</u>	<u>ANALYST</u>
Gross Alpha(±Precision*),pCi/l (T)	0.0(±1.1)	0.8	EPA 900.0	11/08/93	EdF
Gross Beta(±Precision*),pCi/l (T)	1.3(±2.4)	5	EPA 900.0	11/08/93	EdF

By: 

Robert Rostad
Laboratory Manager

CODES:

(T)=Total (D)=Dissolved
(S)=Suspended (R)=Recoverable
(PD)=Potentially Dissolved
<=Less Than

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96 x sigma.



Hazen Research, Inc.
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Tel: (303) 279-4501 • Telex 45-860
FAX: (303) 278-1528


DATE November 22, 1993
HRI PROJECT 002-47R
HRI SERIES NO. J397/93-F
DATE RECD. 10/22/93
CUST P.O.# 1 17039

GZA GeoEnvironmental, Inc.
Sara Hanna
320 Needham Street
Newton, MA 02164

REPORT OF ANALYSIS

SAMPLE NO. J397/93-6
SAMPLE IDENTIFICATION: WGE-8 (filtered)

<u>PARAMETER</u>	<u>RESULT</u>	<u>DETECTION LIMIT</u>	<u>METHOD</u>	<u>ANALYSIS DATE</u>	<u>ANALYST</u>
Gross Alpha(\pm Precision*),pCi/l (T)	0.0(\pm 1.1)	0.8	EPA 900.0	11/08/93	EdF
Gross Beta(\pm Precision*),pCi/l (T)	3.8(\pm 2.8)	5	EPA 900.0	11/08/93	EdF

By: 
Robert Rostad
Laboratory Manager

CODES:
(T)=Total (D)=Dissolved
(S)=Suspended (R)=Recoverable
(PD)=Potentially Dissolved
<=Less Than

*Variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96 x sigma.

CHAIN-OF-CUSTODY RECORD

Sample ID	Date/Time	Sample Type	ANALYSES REQUIRED																	Total # of Cont	Note #
			COBALT	CADMIUM	COPPER	CHLORIDE	IRON	LEAD	NICKEL	PHOSPHORUS	SILICA	SILVER	SODIUM	TOTAL SOLIDS	TURBIDITY	ZINC	AMMONIA	AMMONIUM	PHOSPHATE		
WGE-3 WGE-7 WGE-8		H ₂ O ↓																	4 4 4	1 1 1	

RELINQUISHED BY: (Signature) *Dean Gulley* DATE/TIME *10-19-93* RECEIVED BY: (Signature) *[Signature]*
 RELINQUISHED BY: (Signature) DATE/TIME *10-19-93* RECEIVED BY: (Signature) *[Signature]*
 RELINQUISHED BY: (Signature) DATE/TIME *10-19-93* RECEIVED BY: (Signature) *[Signature]*
 RELINQUISHED BY: (Signature) DATE/TIME *10-19-93* RECEIVED BY: (Signature) *[Signature]*

NOTES: Preservatives, etc.:
 Unless otherwise noted, all VOA vials have been preserved w/ 1:1 HCl in accordance with Mass-DEP Policy
 ① please filter 1 liter (2-500ml containers) for each sampling point and weigh the sediment on the filter paper
 ② 1 liter (filtered) and 1 liter (unfiltered) from each sampling point to be sent to Hazen Research for analysis

ANALYTICAL LABORATORIES: *GZA ECL*
 LABORATORY CONTACT: _____ PHONE: _____
 PROJECT MANAGER: *S. Hanna* EXT: *6157*
GZA GEOENVIRONMENTAL, INC.
 ENGINEERS AND SCIENTISTS
 320 Needham Street
 NEWTON UPPER FALLS, MA 02164
 (617) 969-0050
 FAX (617) 965-7769

GZA FILE NO: *3736-92* PO NO: *1-17039*
 PROJECT: *Wymen-Jordan*
 LOCATION: *Grafton, MA*
 COLLECTOR(S): *DSS*
 DATE(S) OF COLLECTION: *10-19-93* SHEET *1* of *1*

HAC 1 mg + CC 50

APPENDIX C
SUMMARY OF PREVIOUS DATA

RESULTS OF ANALYSES OF GROUNDWATER SAMPLES COLLECTED APRIL 26, 1993

Well Number	H (Standard Units)	Conductivity (umhos/cm)	Analytical Laboratory	Radiological Analyses			
				Gross Alpha Activity (pCi/l)		Gross Beta Activity (pCi/l)	
				Filtered	Nonfiltered	Filtered	Nonfiltered
WGE-3	6.6	114	Hazen	1.0±1.2	110±30	0.3±2.2	140±24
			CEP	<2	<2	<2	7±3
			TMA	0±2	31±8*	1±1	47±6*
WGE-7	6.0	73	Hazen	0.2±1.2	200±80	1.5±2.7	260±70
			CEP	<2	<2	<2	8±3
			TMA	0±2	17±7*	1±1	15±3*
WGE-8	6.4	93	Hazen	0.0±0.9	160±40	0.6±2.4	140±20
			CEP	<2	<2	<2	6±3
			TMA	0±2	22±7*	3±1	41±6*

Notes:

1. Samples collected April 26, 1993 by GZA personnel, pH and conductivity analyses by GZA using EPA Methods 150.1 and 120.1, respectively.
2. Radiological analyses by Hazen Research, Inc. (Hazen) of Golden, Colorado; Controls For Environmental Pollution, Inc. (CEP) of Santa Fe, New Mexico; and TMA Norcal, Inc. (TMA) of Richmond, California.
3. Asterisk (*) indicates results are in units of pCi/g.

RESULTS OF ANALYSIS OF SAMPLES COLLECTED IN FEBRUARY 1993

Well Number	pH (Standard Units)	Specific Conductance (umhos/cm)	Radiological Analyses				
			Laboratory	Gross Alpha Activity (pCi/l)		Gross Beta Activity (pCi/l)	
				Filtered	Non-filtered	Filtered	Non-filtered
WGE-3	6.3	100	Hazen A.A. TMA	0.0±2.1 1.5±0.97 0±2	97±29 20±3.8 --(4)	1.6±2.7 3.9±1.4 2±1	56±14 17±2.7 --(4)
WGE-7	5.8	87	Hazen A.A. TMA	0.5±1.67 ND 0±2	470±180 23±3.9 10±5*	2.4±2.5 2.3±1.2 0±1	320±90 22±2.9 17±3*
WGE-8	6.4	96	Hazen A.A. TMA	1.4±1.7 2.2±1.1 3±3	160±40 15±2.9 23±7*	4.1±2.7 5.8±1.5 0±1	100±20 15±2.2 30±4*

* Units are pCi/g; measurement made on residue after filtration.

Notes:

1. Samples collected February 15, 1993 by GZA personnel. Samples WGE-3 (unfiltered) and WGE-8 (filtered) for Alpha Analytical were spilled in transit; new samples were collected on February 19, 1993.
2. pH and conductivity were measured at GZA's Environmental Chemistry Laboratory in Newton, Massachusetts using EPA Methods 150.1 and 120.1, respectively.
3. Analyses for gross alpha and beta activity by Hazen Research, Inc. of Golden, Colorado (Hazen); Alpha Analytical, Inc. of Westborough, Massachusetts (A.A.); and TMA/Norcal, Inc. of Richmond, California (TMA).
4. Nonfiltered sample spilled in transit; filtered sample was analyzed twice. Results of second analysis were 0±2 pCi/l (gross alpha activity) and 1±1 (gross beta activity).

RESULTS OF OCTOBER 1992 SAMPLING AND ANALYSIS

Well Number	pH (Standard units) ²	Specific Conductance (umhos/cm) ²	Gross Alpha Activity (pCi/l) ¹		Gross Beta Activity (pCi/l) ¹	
			Filtered	Nonfiltered	Filtered	Nonfiltered
WGE-3	6.52	103	38+/-18, 96+/-19	350+/-100, 280+/-90	50+/-6, 83+/-9	330+/-60, 250+/-50
WGE-7	6.12	100	86+/-16, 14+/-1.9	530+/-150, 600+/-160	50+/-10, 6.9+/-3.7	500+/-90, 500+/-100
WGE-8	6.30	127	1.1+/-1.5, 10+/-4	300+/-90, 150+/-70	4.5+/-2.7, 15+/-5	230+/-40, 250+/-40

Notes:

1. Samples for radiological analysis were collected on October 20, 1992 and analyzed for gross alpha and beta activity by Hazen Research, Inc. of Golden, Colorado. First number reported is result of initial analysis, followed by the precision of analysis, or the variability of the radioactive disintegration process (counting error) at the 95% confidence level, 1.96 x sigma. Second number is result of re-analysis in December 1992, to confirm initial values (refer to text for additional details).
2. Samples taken during the October 1992 round were not screened in the field for pH or conductivity. Results reported above are from field screening for these parameters during sampling of wells WGE-3, WGE-7, and WGE-8 on September 22-23, 1992 as part of a separate monitoring program.

RESULTS OF APRIL 1992 SAMPLING AND ANALYSIS

Well Number	pH (Standard Units)	Specific Conductance ($\mu\text{S}/\text{cm}$)	Gross Alpha Activity (pCi/l)		Gross Beta Activity (pCi/l)	
			Filtered	Unfiltered	Filtered	Unfiltered
WGE-3	6.1	102	1.3 ± 0.7	47 ± 5	1.6 ± 0.5	43 ± 3
WGE-7	5.8	87	0.1 ± 0.3	68 ± 6	0.4 ± 0.4	53 ± 3
WGE-8	6.5	88	0.0 ± 0.4	33 ± 3	3.8 ± 0.6	34 ± 2

Notes:

1. Samples collected April 16, 1992. pH and specific conductance measured by GZA, gross alpha and gross beta analyses by Clean Harbors Analytical Services, Inc. of Braintree, Massachusetts.

SUMMARY OF RADIOLOGICAL ANALYSES
MG-TH DISPOSAL AREA WELLS

CONTACT LABORATORY:	DATE:	10/2/90	10/2/90	10/2/90	10/2/90	2/13/01	5/14/91	6/14/01
GROSS ALPHA ACTIVITY (pCi/l)	MIT	NRC	CHA	MIT	CHA	CHA	CHA	CHA
EPA MCL: 15 pCi/l								
WGE-3	46 +/- 60	2 +/- 6	1 +/- 6	23 +/- 57	8 +/- 5	1.1 +/- 5	1.2 +/- 8	
WGE-7	66 +/- 62	-2 +/- 7	8 +/- 5	12 +/- 53	0 +/- 3	-1 +/- 3	6 +/- 4	
WGE-8	23 +/- 39	-3 +/- 9	1 +/- 4	41 +/- 60	0 +/- 3	-1 +/- 3	7 +/- 8	
GROSS BETA ACTIVITY (pCi/l)								
EPA MCL: 50 pCi/l								
WGE-3	8.1 +/- 1.6	-2 +/- 4	2.2 +/- 6	----	2.6 +/- 6	2.0 +/- 6	2.0 +/- 7	
WGE-7	13.6 +/- 1.8	1 +/- 4	3.9 +/- 7	----	2 +/- 5	1.9 +/- 7	1.6 +/- 5	
WGE-8	14.2 +/- 1.8	6 +/- 5	10.4 +/- 1.3	----	5.6 +/- 8	3.6 +/- 8	6.9 +/- 1.0	
PH/SPECIFIC CONDUCTANCE (SU / Micromhos/cm)								
WGE-3	----	----		----	6.2/103	6.3/125		
WGE-7	----	----		----	5.6/82	5.8/70		
WGE-8	----	----		----	6.4/112	6.4/105		

NOTES:

- (1) All wells sampled by GZA personnel using procedure developed for Mg, Tn disposal area evaluation.
- (2) All results are for dissolved radiological constituents after filtration through 0.45 micron filter.
- (3) pH and specific conductance data corrected to 25°C and recorded by GZA GeoEnvironmental Chemistry Lab.
- (4) Labs noted are as follows:

MIT: Prof. Otto K. Harling MIT Nuclear Reactor Lab/Edward Karalan (Consultant), Weymouth, MA

NRC: Analysis performed for Nuclear Regulation Commission by Radiological and Environmental Services Laboratory (RESL), Idaho Falls, ID

CHA: Clean Harbors Analytical Services, Braintree, MA

- (5) EPA MCL indicates the safe drinking water maximum contaminant level.