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The Administrative Record Staff

57260

03-95-06/P

TREATABILITY STUDY REPORT AND PROCESS FORMULATION REPORT

FOR

POND SLUDGE AND CLARIFIER

APPENDIX C
VOLUME 2 OF 3

REVISION 0

HALLIBURTON NUS CORPORATION

JUNE, 1995

DOCUMENT CLASSIFICATION REVIEW WAIVER PER CLASSIFICATION OFFICE

Halliburton NUS CORPORATION

A-0004-000907

APPENDIX C

TREATABILITY STUDY LOGBOOKS

APPENDIX C

LABORATORY LOG BOOK

LABORATORY LOG BOOK

P001-95

ROCKY FLATS

- INITIAL PREP.
- LIME STUDY
- CRYSTAL HABIT MOD.
- PRE WAC MIXES
  - 207 A/B
  - 207C
  - CLARIFIER

12/9/94 Thru 2/3/95
NUS

2001-95

Rocky Flats

Rocky Flats

Shippment Arrived 12/8/94

- 55 gal metal Drum
  - Contained packing material and a 30 gal poly Drum
    - Labled Clarifier Sludge
    - Texture Like pudding or brown mud
    - Percent solids Preformed: 32% Solids (12/9)

- 30 gal metal Drum, lined with plastic bags
  - Labled A/B Pond Sludge
  - Brownish gray
  - Very strong Sewage Smell
  - Soil like material or wet sand.
  - Percent solids Performed: 58.8 % Solids (12/12)

- 30 gal metal Drum, lined with plastic
  - Labled C pond Sludge
  - Greenish in color
  - no odor
  - 1 Inch water on top rest all crystals
  - Unable to get an accurate % solids due to crust forming in oven.

Ran a Mud Balance on 207C pond and got a reading of 2.02 S.G.

Prefered a volume & weight test to determine the specific gravity and got a reading of 2.015 S.G.

Continued to Page

Ruff Smith — DATE 12/9/94

DATE

Rocky Flats

- Pondcrete Metals submitted for BASELINE on 12/29/94.
- Pondcrete Triwalls submitted for Baseline on 12/29/94.
- CLARIFIER Sludge submitted for Baseline Analysis on 1/3/95 morning.

Goal

- Prepare A/B Pond Sludge to 20% Solids and submit for Baseline analysis, Lime study, etc.
- Prepare C Pond Sludge to 1.7 S.G. and submit for baseline analysis, Lime study, etc. and Crystal Habit. Modifier Study.

Prep. of 207 C Pond. Will preform trial mixes using THU-CUP MUD BALANCE. Will start at the estimated point.

207 C "as delivered" = 2.01

$$\frac{X+Y}{(X/2.01)+Y} = 1.7$$

$$X+Y = \frac{1.7X}{2.01} + 1.7Y$$

$$0.15X = 0.7Y$$

$$X = 4.539Y$$

X = 207 C Pond "As delivered"
Y = mass of A/B water (assume S.G = 1.

Will add 207 A/B water to convert S.G 2.01 to 1.7.

[signature] 1/3/95

Goal: 1.7 S.G. for 207 C & A/B Water

Assume 207 A/B S.G 1.0

207 C S.G 2.01

$X = 4.539y$ X = grams or ml of 207 A/B water

X = grams of 207 C "As Delivered"

$\frac{X}{2.01} + y = 250$

$\frac{4.539y}{201} + y = 250$

y = 76.7 ml A/B water

X = 348.3g C at 2.01 S.G.

- Ran Mud Balance

Read Specific Gravity Scale directly:

1.71

GOOD!

Will mix a large batch using this formula using Volume.

STAFF: Clyde 8.0
Tom M 8.0
Rob S. 8.0

Sample submitted for Lab result = 1.85 S.G.
ID# 297356

Work continued to Page

DATE 1/3/14

DATE

Rocky Flats

Prep. of large batch of 207C; Make 25 gallons

Conversion factor for 2.01 S.G. to 1.7 S.G.

$X = 4.539y$

Y = grams of 207 A/B water @ 1.0 S.G.
X = grams of 207 C sludge @ 2.01 S.G.

$\frac{X}{2.01} + y = 25\ gal$

$\frac{4.539y}{2.01} + y = 25\ gal$

$2.26y + y = 25\ gal$

$y = \frac{25\ gal}{3.26} = 7.67\ gal \times 3.8\ L/gal = 29.15\ liters$

$X = 25\ gal - 7.67\ gal = 17.33\ gal$ or $291.5\ lbs$

Mixed in a 55 gallon drum. Tried using drum mixer but crystals packed to dense to mix with blender. Tried to mix by hand, but found couldn't keep crystals in suspension. Decided to determine S.G. of resultant crystals and liquid. With this will combine individual mixes at a S.G. of 1.7.

Crystals $X \sim \frac{442.7\ g}{228\ ml} > 1.94$

Liquid $Y \sim \frac{289.6\ g}{220\ ml} > 1.32$

DATE 1/4/95

NOTE: When pulled cup cap down no liquid was released from top so actual reading may be close to the goal of 1.7.

good

Conversion to determine amount of each to prepare a solution which is 1.7 S.G.

$$\frac{X+Y}{\frac{X}{1.94}+\frac{Y}{1.32}} = 1.7$$

$$X+Y = 1.7\left(\frac{X}{1.94}\right) + 1.7\left(\frac{Y}{1.32}\right)$$

$$X+Y = 0.876x + 1.288y$$

$$0.124x = 0.288y$$

$$X = 2.323y \qquad \text{(By mass)}$$

(By volume)

$$\frac{X}{1.94} = 2.323\left(\frac{Y}{1.32}\right)$$

$$X = 3.414y \qquad \text{(by volume)} \qquad \text{or } 29.3\% \text{ liquid}$$

Will Run a MUD BALANCE to check calcs. Note MUD Balance Thru-cup volume is 210 ml so volume of each component.

$$\frac{X}{1.94} + \frac{Y}{1.32} = 210$$

$$\frac{2.323Y}{1.94} + \frac{Y}{1.32} = 210$$

$Y = 107.4$ g liquid

$X = 249.5$ g Crystals

S.G. = 1.66

Work continued to Page good

SIGNATURE [signature] DATE 1/4/94

DISCLOSURE AND ANALYSIS MODELS DATE WITNESS DATE

$\%$ = Desired percent solids of material
X = mass of material
Y = mass of A/B water = Volume of A/B water

$X(\%)$ = Solid content
$X+Y$ = Total mass
0.2 = desired percent solids

$$\frac{(X)(\%\ \text{solids})}{X+Y} = 0.20$$

$$X(\%) = 0.20X + 0.20Y$$

$$X(\% - 0.20) = 0.20Y$$

$$X = \left(\frac{0.2}{\% - 0.2}\right) Y$$

- Submitted 207 C @ ~1.7 S.G for Baseline Analysis
  PZ97356 as received
  PZ97357 TCLP
  Will prepare ~5 gallons of 207 A/B @ 20% solids
  Put in oven for % solids

- Submitted 207 A/B Sludge "as received" (58.8% solids) for Baseline Analysis
  PZ97358 as received
  PZ97359 TCLP

$3_{gal} \rightarrow 11400\,ml$

$$\frac{X(0.588)}{11400\,ml + (X \cdot 0.412)} = 0.2$$

$$X(0.588) = 0.2(11400) + X(0.412)(.2)$$

$$X(0.588) = 2280 + X(0.0824)$$

$$X(0.5056) = 2280$$

$$X = 4509.5_g$$

$$X = 0.396y \qquad (X = 0.3955y)$$

X = A/B sludge @ 58%
Y = A/B water

Placed a split from the bucket of A/B prepared and a sample with exactly enough for a % solids in oven for % solids
Grab Sample = 13.1 % Solids (1/5)
Measured Sample = 19.1 % Solids (1/5)

DATE 1/24/95

DATE

207 A/B Lime Mixes

Mixes will be prepared using 100 g of as received A/B sludge and 253 ml A/B water and mixed in Hobart. Submitted Raw Sample (sample #1) at 20% Solids for Plate Count and pH

Mix #1

100 g Sludge
253 ml Water

Initial pH = 9.4 Initial Temp. = 59.6°F

	$Ca(OH)_2$ Lime addition		
5 min	5 g	pH = 10.7	Temp 56.9°F mixing
10 min	—	pH = 12.0	55.2°F

See page 17

Mix #2 100 g Sludge
253 ml water

$Ca(OH)_2$ Lime addition	pH	Temp	mix time
0	9.6	57.3	5 min No Lime
10 g	12.5	56.8	10 min
same	12.6	55.3	20 min

Work continued to Page

DATE 1/5/88

WITNESS DATE

Summary Table for 207 A/B Lime Mixes

Sample Number	$Ca(OH)_2$ Lime Addition	Description / Observations	PLATE Count	LAB pH
#1	0	Raw Sample @ 20%	< 10,000	9.5
#2	5 g	mix #1	< 10,000	12.7
#3	10 g	mix #2	< 10,000	12.7
#4	2.5 25 g	mix #3	< 10,000	10.8
#5	20 20 g	mix #4	< 10,000	13.1
#6	1.0 g	mix #5	< 10,000	9.9

Sample #	CaO Lime Addition	Label	PLATE Count	LAB pH
#7	1.0 g	mix #1A	55,000	9.7
#8	2.5 g	mix #2A	< 10,000	10.4
#9	5.0 g	mix #3A	< 10,000	11.6
#10	10 g	mix #4A	30,000	12.6
#11	20 g	mix #5A	< 10,000	12.9
#12	50 g	mix #6A	< 10,000	13.0

207 A/B : X = mass of as received material, in grams
y = mass (or volume) of A/B water, in milliliters

To find proportions of material to water (for 20% solids):

$$X = 0.3955y$$

To find material / water (for 20% solids) for some total mass, M:

$$X = 0.2834\,M$$
$$y = 0.7166\,M$$

DATE 4/5/95

Note!

$$\frac{100g\ (.588)}{100g + 253g} = 0.1665$$

or

16.7%

Mixes:

Mix #1 100g Sludge A/B @ 58.82 Solids
253 ml A/B water to make A/B sludge at ~~2~~ 16.7% Solids
5 g Hydrated Lime $Ca(OH)_2$

Time Mixing	pH	Temp.	Amount lime
0 min	9.4	59.6 °F	0 (before lime added)
5 min	10.7	56.9 °F	5g
10 min	12.0	55.2 °F	Same
15 min	NONReam	No Reader	
20 min	12.3	54.9 °F	

Submitted Sample for plate count & pH Labled sample #2

Mix #2 100g Sludge A/B
253 ml A/B water
10 g Hydrated lime
> Initial pH = 9.6
> Initial Temp = 57.3 °F

Mixing Time	pH	Temp
5 min	12.5	56.8 °F
10 min	12.5	54.6 °F
20 min	12.6	55.3 °F

Submitted Sample for plate Count & pH Labled sample #3

Scott Smith 1/5/94

Mix #3 — 100g Sludge; 253 ml Water; 2.5g $Ca(OH)_2$ → Initial pH = 9.6; Initial Temp. = 57.7 °F

Mixing Time	pH	Temp.
5 min	11.3	57.0 °F
10 min	11.20	57.1 °F
30 min	11.6	59.1 °F

Submitted Sample for plate Count & pH and Labled Sample 4

Mix # 4 — 100g Sludge A/B; 253 ml A/B water; 20g Lime Hydrated → Initial pH = 9.7; Initial Temp = 58.0 °F

Mixing time	pH	Temp.
5 min	12.8	57.0 °F
10 min	12.6	57.1 °F
30 min	12.7	59.1 °F

submitted sample for plate Count & pH and labled Sample #5

Mix #5 — 100g Sludge A/B; 253 ml A/B water; 1.0g Hydrated Lime → Initial pH = 9.8; Initial Temp = 57.9

Mixing time	pH	Temp.
5 min	10.1	56.7 °F
10 min	10.2	55.3 °F
20 min	10.3	60.0 °F

submitted sample for plate Count & pH and labled Sample #6

[signature]

6/5/95

NOTE: The quicklime was not well pulverized.
There was a lot of small chunks.
After mixing could still see some chunks
in the grit on bottom of bowl.

Mixes using Quicklime [CaO] and 207 A/B:

Mix 1A: 100g Sludge A/B
250 ml A/B water
1.0 g Lime (CaO)
> Initial pH = 9.5
Initial Temp. = 58.7 °F

mixing time	pH	Temp.
5 min	9.9	56.3 °F
10 min	9.7	55.7 °F
20 min	10.0	59.7 °F
40 min	9.9	60.7 °F

Submitted for plate count and pH; Labled Sample #7

Mix 2A: 100g A/B sludge
253 ml A/B water
2.5g Lime (CaO)
> Initial pH = 9.6
Initial Temp. = 58.9 °F

mixing time	pH	Temp.
5 min	10.0	56.8 °F
10 min	10.0	56.7 °F
20 min	10.2	60.2 °F
40 min	10.4	61.6 °F

Submitted for plate count and pH; labled Sample #8

[signature]

4/5/08

mix 3A 100 g A/B sludge @ 58.8% > Initial pH = 9.7
253 ml A/B water Initial Temp = 60.1 °F
5 g quick lime CaO

mixing time	pH	Temp.
5 min	9.9	58.4 °F
10 min	10.2	56.8 °F
20 min	10.6	60.7 °F
40 min	10.7	61.7 °F

Submitted for plate count and pH; Labled Sample # 9

mixture 4A 100 g A/B sludge > Initial pH = 9.8
253 ml A/B water Initial Temp. = 58.1 °F
10 g Lime (CaO)

mixing time	pH	Temp.
5 min	9.9	57.1 °F
10 min	10.3	56.0 °F
20 min	11.5	60.4 °F
40 min	11.8	61.4 °F

Submitted for plate count and pH; Labled Sample # 10

mix 5A 100 g A/B sludge > Initial pH = 9.7
253 ml A/B water Initial Tem. = 57.9
20 g quick lime CaO

mixing time	pH	Temp.
5 min	10.2	58.5 °F
10 min	11.1	57.6 °F
20 min	12.1	61.0 °F
40 min	12.6	60.0 °F

submitted for plate count and pH; labled sample # 11

11/5/95

mix 6A 100 g A/B sludge
253 ml A/B water
50 g quick lime (CaO)
> Initial pH = 9.7
Initial Temp. = 58.0

Mixing time	pH	Temp.
5 min	10.5	60.3°F
10 min	11.9	58.8°F
20 min	12.4	61.3°F
40 min	12.9	63.4°F

Submitted for plate count and pH; labled sample # 12

1/5/95

ADDITIVES

- ✓ Product 8003
- ✓ HR-4
- ✓ HR-12
- ✓ HR-15
- ✓ HR-25
- ✓ SCALECHEK LP-55 (scale inhibitor)

STABILIZER 434B (surfactant for latex cement)
STABILIZER 434C (surfactant for latex cement)
D-Air 2 (Anti-Foaming Agent)
D-Air 3 (Defoamer)
CFR-1
CFR-2, RED (cement Friction Reducer)
CFR-3 (cement Dispersant)
CFR-3L (Dispersant)
HALAD 344 (Fluid loss Additive)
FDP-C447 (Fluid loss Additive)

Rocky Flats

Crystal Habit Modifier Study

MATERIAL: Will test the effect various additives have on 207C mixed to Specific Gravity of 1.7 using A/B water.

Equipment & Procedure:

Will use 100 ml graduated cylinders to evaluate the amount of solid crystals and free liquid. Mix the specific additive by shaking the material in the graduate cylinder, then determine if any change in amount of solid crystals or in the mixture itself.

To get a uniform aliquot of 207C at 1.7 S.G. we will add for each batch we test the following:

$$\frac{X}{1.94} + \frac{Y}{1.32} = Z$$

X = weight of crystals required
Y = weight of water required
Z = [illegible] Volume needed

$$\frac{2.323Y}{1.94} + \frac{Y}{1.32} = Z$$

$$Y = 0.5115Z$$

$$X = 2.323Y = 1.188Z$$

Will use 90 ml of 207C to leave room for Additive addition.

$$X = 1.188(90-1)$$
$$= 107g \text{ of } 207C \text{ crystals}$$

$$Y = 0.5115(90-1)$$
$$= 46g \text{ or } 35 \text{ ml of } 207C \text{ water}$$

The additives will be added at 2% of the weight of solution and then adjusted from there depending on

[signature]

1/6/94

NOTE: Crystals do have some free liquid associated with them. For approx 55 ml of crystals there is ~~about~~ about 3 ml of free liquid on top.

visual observations: Each mix with these base contain the following for the first run:

Crystals = 107g
Water = 35ml
Additive = 3.0g (for 2% by wgt)

Baseline observation of 207C w/ no additives.

- The material is a dark green. The crystals or solids appear to be a mixture of clear crystals, a sandy material with some small stones. Greenish in overall color
- Volume of crystals in 90 mls of material is

Crystals = 54 ml
Liquid = 36 ml

NOTE: Appears to vary so will do exact baseline for each test.

TEST #1

ADDITIVE: PRODUCT 8003, Halliburton Services (405)251-5980
Looks like flat Coke or Pepsi (brownish clear)

Starting volume:

Solids: 53 ml
Liquid: 37 ml

Add 3g Product 8003.

No distinct color change immediately, but fines settled out when placed to site @ 1hr 40min

see page 30 for volumes.

1/6/94

After permitted to settle for 1 hr 40 min the following volumes were observed.

Volume crystals = 50 ml (crystals)
Volume fine solids = 15 ml (green)
Volume supernate liquid = 25 ml yellow or brownish

Shook sample back up and recorded settled solids (crystals) to see if any dissolving of crystals

Ending Volume:
Solids: 52 ml
Liquid: 41 ml

TEST #2

Additive: HR-4, Halliburton Services
solid brown powder, very light & fine

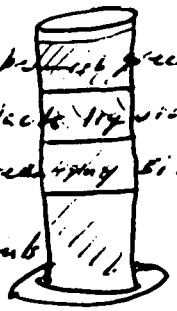
Starting Ratios
Solids = 54 ml
Liquid = 36 ml

Add 3.1 g of HR-4

Ending Ratios (mixed up after settled 1hr)

Solids = 52 ml
Liquid = 40 ml

After settled 1hr



TEST #3

Additive: HR-12, Halliburton Services
solid brown powder, very light, just like HR-4

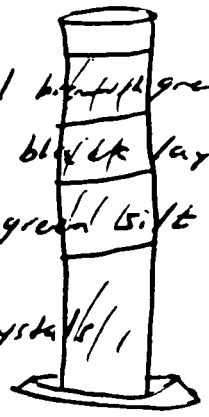
Starting Ratio:
solids = 52 ml
Liquid = 40 ml

Added 3.0 g of HR-12

Ending Ratio:
Solids = 52
Liquid = 40 ml

(note 5 ml from on top)

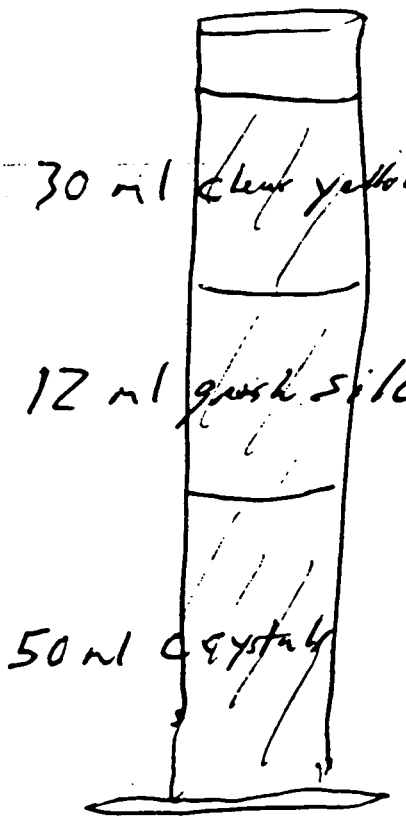
After settled 1 hr



1/6/94

TEST #5

After settled 1 hr



TEST #4

Additive: HR-15, Halliburton Services

Same as other HR, but slightly darker in color

Starting Ratio:

solids = 54 ml

liquid = 37 ml

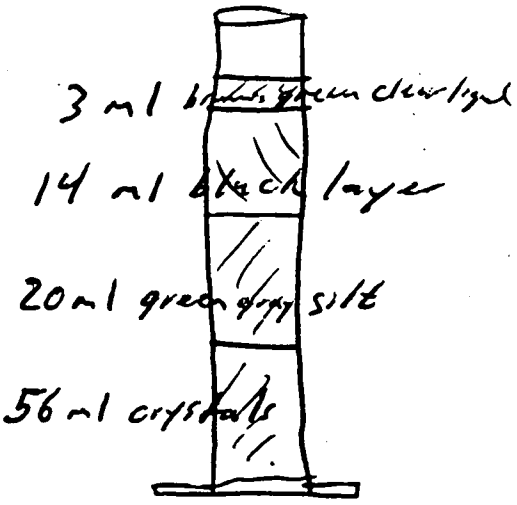
Added 3.0 g of HR-15

Ending Ratio:

solids = 56 ml

Liquid = 37 ml

After Settled - 1 hr



TEST #5

Additive: HR-25, Halliburton Services

Color and Texture of Sugar.

Starting Ratio:

solids = 54 ml

liquid = 38 ml

Added 2.3 g of of HR-25

When adding it began to foam up aggressively. Blew off wax paper top. No noticable temp change. Very aggressive reaction. Allowed to set for 1 hr and supernant turned clear yellow

Ending Ratio:

Solids = 53 ml

Liquid = 38 ml

1/6/94

Need to reduce volume to 80 ml in 100 ml graduated because will add 20 grams of additive and need space.

$y = 0.5115\,Z$

$y = 0.5115(80) = 41\,g$ or $41/1.32 = 31$ ml water

$X = 1.188(80)$

$= 95\,g$ crystals

$\frac{20\,g \text{ additive}}{136\,g \text{ total}} = 15\%$ by weight

Note Due to the material being so light we will reduce dosage to 10 gms

Rocky Flats

Did not see a change in crystal volume so will increase dosage of Additives!

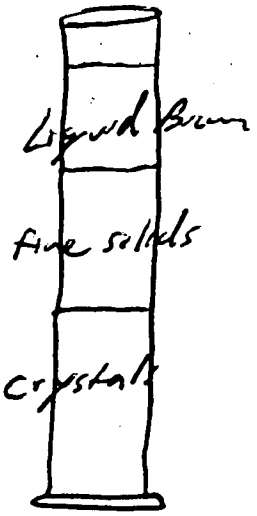
TEST #6

Additive: Product 8003.

Starting Ratio
Solids = 48 ml
Liquid = 32 ml

Added 20 g of Product 8003

Ending Ratio Settled for 30 min
Crystals = 44 ml
Fine solids = 20 ml
Liquid = 16 ml



TEST #7

Additive: HR-4

Starting Ratio
Solids = 49 ml
Liquid = 31 ml

Added 20 g of HR-4

This is way too much solids addition. Couldn't mix into all material. Formed a gas release (normal) Made a mucky mess. Hard on top, sloppy mess found solids. Seemed to remove crystals or turn to mush. Couldn't get crystal volume.

[signature] 1/6/98

TEST #8

Additive: HR-12

Starting Ratio

Solids = 50 ml
Liquid = 30 ml

Added 10 g HR-12

Dark brown mix. Can't determine when crystal line is. Poured out and seemed crystals live at 30 or 35 ml. Seemed to do something to crystals and mix, but to muddy to tell what.
LARGE volume may be too much to see what is going on

TEST #9

Additive: HR-15

Starting Ratio

solids = 51 ml
liquid = 29 ml

Added 10 g HR-15

Ending Values (settled 1 hr)

Solids = 45 ml → brown crystals
liquid = 35 ml → very dark brown

Crystals still in tact. Didn't seem to do very much.

[signature] 1/4/85

~~TEST #10~~

ADDITIVE: HR-25 Foamed Too much to try this ADDITIVE Again

New ADDITIVE

TEST #10

ADDITIVE: SCALECHEK LP-55
cherry Red liquid.

starting Ratio:
Solids = 52 ml
Liquid = 28 ml

added 20 g LP-55

NOTE: An initial foam formed and quickly went away.

When turned crystals into Additive A violent reaction occurred and material blew out of cylinder.

Very Reactive!

[signature] 1/6/95

TEST #11 207C Crystals = 107g > S.G. 1.7
207C water = 35 ml
Additive = 3g (2% by weight)

Additive: CFR-1
White fine sandy powder. fine sugar.

207C is mixed to Specific Gravity 1.7 and placed in a 100 ml graduated cylinder and amount of solid (crystals) is recorded.

Starting volumes:
Solids: 57 ml
Liquid: 31 ml

Added 3g CFR-1 (2%)

Ending volume:
solids: 53 ml
Liquid: 37 ml

Observation: small bubbles formed after about 10 min

TEST #12 Same make up and used CFR-1 again, but increased the amount of additive to 14.4g (10%)

Starting volumes:
Solids = 58 ml
Liquid - 28 ml

added 14.4g (10% by weight)

Ending volume: Solids = 55 ml
Liquid = ~~48~~ 48 ml

Observation: Larger bubbles formed and bubbled through crystals kept forming bubbles from bottom on. Shaking caused very aggressive release of a gas.

Rocky Flats

207 C Lime Addition Mixes

Mixes will be prepared using 207 C at a specific Gravity of 1.7 S.G. 300 g of the 207 C ~~and~~ crystals will be mixed with 98 ml of 207 C water as prepared with the A/B water in bucket. Note the the 55 gal drum which we are using has been prepared to S.G. of 1.7, but to get an uniform aliquot, the crystals and water are weighed separately in the proper ratio. The calculation to get the above number is as follows:

X = mass of crystals, in grams
y = mass of liquids, in grams
Z = Total volume of crystals & Liquid, in milliliters

To find proportions of crystals to liquid:

$$X = 2.323\ y$$

To find crystal & Liquid for some total mass, M:

$$X = 0.699\ M$$
$$y = 0.301\ M$$

To find crystal & Liquid for some total volume, Z:

$$X = 1.188\ Z$$
$$y = 0.5115\ Z$$

To find Crystals & Liquid Volumes for masses X+y:

$$V_x\ (\text{in ml}) = 0.5155\ x$$
$$V_y\ (\text{in ml}) = 0.7576\ y$$

1/9/95

Summary Table for 207C Lime Mixes

Sample Number	$Ca(OH)_2$ Hydrated lime addition	Description/ observation	Plate Count/Dup	Lab pH
3 Raw	0	Baseline Submittal	1000/<1000	10.1
#14	5g	mix #1B	1500/2000	11.2
#15	10g	mix #2B	1000/<1000	12.4
#16	20g	mix #3B	<1000/<1000	12.7
#17	50g	mix #4B	<1000/<1000	13.6
#18	100g	mix #5B	<1000/<1000	13.2

Sample Number	CaO quick lime	Description/ observation	Plate Count	Lab pH
#19	5g	mix 1C	<1000/<1000	12.6
#20	10g	mix 2C	<1000/<1000	13.3
#21	20g	mix 3C	1000/<1000	13.4
#22	50g	mix 4C	<1000/<1000	13.5
#23	100g	mix 5C	<1000/<1000	13.6
* #24	0	Raw	1000/<1000	—

* Resubmittal of 207A/5 Raw #24 (No pH)

[signature]

1/8/95
DATE

Hydrated Lime

LABLED: SAMPLE #13

Raw material: 300 g 207C crystals (from bucket mixed to 1.7 S.G.)
98 ml 207C (mixed @ 1.7 Bucket) Water

Initial Readings pH = 9.8
Temp. = 55.7 °F

NOTE: We mixed the Raw material for 5 additional min. then 5 more min the allowed to sit 10 min just like the lime addition mixes and got the following results. 5 min: pH=10.0 Temp 55.5°F; 10 min: pH= 9.9 Temp 55.7 °F; 20 min: pH = 9.8 Temp 55.7 °F

Mix #1B 300 g 207C crystals
98 ml 207C water
5 g Hydrated lime; $Ca(OH)_2$
> INITIAL pH = 9.8
INITIAL Temp. = 55.7 °F

Mixing time	pH	Temp.
5 min	10.0	55.2 °F
10 min	10.1	55.0 °F
20 min	10.1	57.6 °F

LABLED: Sample #14

The sample is mixed for 5 min at which point the initial pH and Temp. is recorded. The Lime is added and mixed in the bucket for 5 min at which point the 5 min pH & Temp. Recorded. Continued to mix for 5 more minutes and recorded 10 min. temp and pH. Stopped mixing and allowed to set for 10 min. and recorded 20 min pH & Temp. Then took sample for plate Count and Lab pH standards.

[signature] 1/9/95

NOTE: Checked the calibration of the pH probe between the 5 min and 10 min readings using pH = 10 standard. Probe read pH = 9.9 probe seems OK.

Mix 2B: LABLE: SAMPLE # 15

300 g 207C crystals
98 ml 207C water
10 g Hydrated lime $Ca(OH)_2$

> INITIAL pH = 9.8
> INITIAL Temp = 53.6 °F

Mixing Time	pH	Temp.
5 min	9.7	53.5 °F
10 min	9.7	53.7 °F
20 min	9.8	56.7 °F

Mix 3B: LABLE: Sample # 16

300 g 207C crystals
98 ml 207C water
20 g Hydrated lime $Ca(OH)_2$

> INITIAL pH = 9.8
> INITIAL Temp = 54.7 °F

Mixing Time	pH	Temp.
5 min	9.8	54.1 °F
10 min	9.8	54.0 °F
20 min	9.8	56.9 °F

1/9/95

Checked calibration of of pH probe results of pH=7 and pH=10 fluid

pH=6.96

pH=9.9

mix 4B: LABLE; Sample #17

300 g 207C crystals > INITIAL pH = 9.7
98 ml 207C water INITIAL Temp = 54.3°F
50 g Hydrated Lime $Ca(OH)_2$

mixing time	pH	Temp
5 mn	10.5	58.7 °F
10 mn	11.7	55.4 °F
20 mn	12.5	58.9 °F
30 mn	12.3	59.2 °F

Observation: Turned milky, but no major thickening at first became a thin milkshake consistency

mix 5B: LABLE: Sample #18

300 g 207C crystals > INITIAL pH = 9.8
98 ml 207C water INITIAL Temp = 54.1
100 g Hydrated Lime $Ca(OH)_2$

mixing time	pH	Temp
5 mn	12.4	56.3 °F
10 mn	12.5	57.2 °F
20 mn	12.7	59.7 °F
30 mn	12.7	60.2 °F

Observation: This large dosage of Lime produced a consistency of a pourable milky liquid. Like a milkshake. After mixed for about 5 mn became very thick, couldn't pour had to scoop with spoon Wendy's Frosty consistency

1/9

Quick Lime

Mix 1C: Lable: Sample #19
300g Crystals
98 ml 20°C water
5[redacted]g Quicklime CaO
> Initial pH = 9.7
Initial Temp = 55.0°F

Mixing Time	pH	Temp.
5 min	9.9	54.6 °F
10 min	10.1	54.9 °F
20 min	10.4	58.3 °F
30 min	10.6	59.1 °F

Mix 2C: Lable: Sample #20
300 g 20°C Crystals
98 ml 20°C water
10 g Quicklime CaO
> Initial pH = 9.7
Initial Temp = 55.2°F

Mixing Time	pH	Temp.
5 min	10.0	54.9 °F
10 min	10.6	55.5 °F
20 min	12.2	58.6 °F
30 min	12.2	59.5 °F

mix 3C: Ladle: Sample #21

300 g 207C crystals
98 ml 207C water
20 g Quicklime CaO

> INITIAL pH = 9.8
> INITIAL Temp = 54.8 °F

Mixing Time	pH	Temp
5 min	9.9	54.8 °F
10 min	10.4	56.1 °F
20 min	12.3	59.3°F
1 hr 20 min	12.6	61.0 °F

mix 4C: Ladle: Sample #22

300 g 207C crystals
98 ml 207C water
50 g Quicklime CaO

> INITIAL pH = 9.8
> INITIAL Temp = 54.5°F

Mixing Time	pH	Temp
5 min	10.2	55.5 °F
10 min	12.2	57.0 °F
20 min	12.6	61.0 °F
1 hr 20 min	12.8	62.8 °F

1/9

mix 5C ; Label : Sample #23

300 g 207C crystals > Initial pH = 9.7
98 g 207C water > Initial Temp = 55.4°F
100 g Quicklime CaO

Mix Time	pH	Temp
5 min	12.1	57.4°F
10 min	12.8	62.3 °F
20 min	12.8	65.5 °F

This mix using CaO rather than $Ca(OH)_2$ produced a mix which was not as thick as the previous mix while mixing but once stopped became very thick. Like pudding need to spoon out

Due to results of 207 A/B Lime Addition mixes will resubmit a sample of Raw Sludge for plate count.

207 A/B Raw Sludge @ 20% solids → Sample #24

Initial pH = 9.1
Initial Temp = 56.3°F

AL 1/9

Summary Table for PCTW

Sample Number	$Ca(OH)_2$ Hydrated Lime	Description/ observation	Plate Count	LAB pH
#26	5g	Mix #1D	<1000	13.0
#27	50g	Mix #2D	<1000	13.0
#28	100g	Mix #3D	<1000	12.9

Sample Number	CaO Quick Lime	Description/ observation	Plate Count	LAB pH
#29	5g	Mix #1E	<1000	12.9
#30	25g	Mix #2E	<1000	12.9
#31	50g	Mix #3E	<1000	12.8

#25	0	Raw	<1000	12.6

Rocky Flats

Pondcrete Triwalls Lime Addition Test

Mixes will be prepared using as delivered PCTW material. The % solids of the PCTW is 34.8 % solids. In order to mix in the hobart will need approx 700 gram of material for each mix. Mixes will be submitted for pH and plate count. From Baseline pH = 9.8 performed by soil pH method (Dilution method).

Raw Material: Labled Sample #25
300 g as delivered sludge

Initial Reading: pH = 12.7
Temp = 60.2 °F

Material is consistancy of a milk shake or Hardy's frosty. Could hold up spoon. Pours out in plops. Spoonable Material.

{Hydrated Lime}

Mix #1D LABLE: Sample #26
300 g "As Received" Pondcrete Triwall (PCTW)
5 g Hydrated Lime $Ca(OH)_2$

Mixing Time	pH	Temp
Initial	12.5	60.1 °F
5 min	12.6	58.3 °F
10 min	12.6	56.9 °F
20 min	12.5	60.0 °F

Observation: Became slightly thicker No noticable color change. Need to spoon out.

11/10/95

Mix #2D LABLE: Sample #27
300 g PCTW
50 g Hydrated Lime $Ca(OH)_2$

Time mixing	pH	Temp.
Initial	12.7	60.4 °F
5 min	12.6	58.9 °F
10 min	12.7	56.7 °F
20 min	12.7	60.5 °F

observation: Became very thick. Like fudge. Color became light brown. Smooth plasty

Mix #3D LABLE: Sample #28
300 g PCTW
100 g Hydrated Lime $Ca(OH)_2$

Time mixing	pH	Temp.
INITIAL	12.4	58.6 °F
5 min	12.7	58.4 °F
10 min	12.5	54.8 °F
20 min	12.7	60.5 °F

observation: Very thick, non pourable, Like Bread Dough consistency Moldable, packable material.

NOTE: To thick to get an accurate pH reading.

RL 11/10/95

[Quick Lime]

Mix #1E

LADLE: Sample #29
300 g PCTW
5 g Quick lime CaO

Time Mixing	pH	Temperature
INITIAL	12.5	58.7 °F
5 min	12.7	58.8 °F
10 min	12.8	57.3 °F
20 min	12.6	60.7 °F

observation. slightly pourable, also spoonable. Could not hold

Mix # 2E

LADLE: sample #30
300 g PCTW
25 g Quick Lime CaO

Mixing Time	pH	Temp
INITIAL	12.6	60.0
5 min	12.7	65.0
10 min	12.7	61.9
20 min	12.7	65.5

observation: Semi pourable, spoonable material couldn't hold up spoon. Like ~~[illegible]~~ ~~[illegible]~~ Wendy's Frosty.

[signature]

1/10/95

Mix #3E

LADLE: Sample #31
300 g PCTW
50 g Quick Lime CaO

Time Mixing	pH	Temp.
INITIAL	12.7	57.6
5 min	12.7	57.5
10 min	13.0	65.4
20 min	12.8	67.4

Observation: Thick paste like material. Consistency of soft icecream.

[signature]

1/10/95

Summary Table for CLARIFIER

Sample Number	$Ca(OH)_2$ Hydrated Lime	Mix	Plate Count	Lab pH
#32	0 - RAW	MIX		
#33	10g	#1F		
#34	50g	#2F		

Sample Number	CaO Quick lime	Mix	Plate count	Lab pH
#35	10g	#1G		
#36	50g	#2G		

Rocky Flats

Clarifer Lime Addition Test

Mixes will be prepared using as received clarifier waste. Due to limited quantity of material will will only perform test at four points. Will submit Raw for analysis

Raw Material: Labeled #32 for Plate Count

pH = 9.6

observation: As Recieved is a dark brown with slight greenish tint. Consistency of pudding. Not pourable can only spoon. Will hold up spoon in bucket.

Mix #1F Lable #33
300 g As Recieved Clarifier
10 g Hydrated Lime $Ca(OH)_2$

Mixing Time	pH	Temp.
Initial	9.6	58.8 °F
5 min	12.8	57.0 °F
10 min	12.4	54.9 °F
20 min	12.5	57.8 °F

observation: Very slight change. Thickened Slightly Still Consistency of pudding.

Robert F Smith 1/11/95

Mix # 2F Lable #34
300 g As Recieved Clarifier
50 g ~~As Recieved~~ $Ca(OH)_2$ ~~Clarif~~ Hydrated Lime

Mixing Time	pH	Temp.
INITIAL	9.6	59.2 °F
5 min	12.8	56.5 °F
10 min	12.6	55.0 °F
20 min	12.6	58.9 °F

Observation: Pasty, thick mix. Smooth. Very Stiff

Mix # 1G Lable #35
300 g As recieved Clarifier
10 g Quick Lime, CaO

Mixing Time	pH	Temp.
INITIAL	9.5	54.9 °F
5 min	10.0	57.7 °F
10 min	9.4	57.8 °F
20 min	10.5	60.5 °F
80 min	11.6	62.8 °F

Observation: Non pourable, Spoonable, will hold up spoon

[signature] 4/11/95

Mix #2G LABLE #36
300 g As Recieved Clarifier
50 g CaO quick line

Mixing Time	pH	Temp.
INITIAL	9.6	55.1 °F
5 min	~~11.0~~ 11.3	60.7 °F
10 min	12.0	58.0 °F
20 min	12.2	60.0 °F
80 min	12.5	64.1 °F

observation: Very thick, Non pourable, will hold up spoon, visable clumps of lime. Grithy. Sticks in bowl.

1/11/95

Pre-WAC MIXES using 207A/B @ 20%

Will mix 207A/B sludge "as received" at 58.8% solids with 207A/B water to achieve a mixture of 207A/B at 20% solids.

X (% solids) = solid content
X + Y = TOTAL mass
0.2 = desired percent solids

$$\frac{(X)(\%\ \text{solids})}{X+Y} = 0.20$$

$$(X)(\%\ \text{solids}) = 0.20X + 0.20Y$$
$$X(\%\ - 0.20) = 0.20Y$$
$$X = \left(\frac{0.20}{.588 - 0.20}\right)Y$$
$$X = 0.5156Y \quad \sim \quad Y = \frac{X}{0.5155}$$

X = grams sludge
Y = grams of 207A/B water

For all mixes add:
100 g 207 A/B sludge "as received"
194 ml 207 A/B water

and various amounts of additives to achieve a soil like consistency (warm dirt)

VIDIO TAPE TAKEN of all mixes.

Robert F Smith 1/17/95

NOTE: The consistancy of Quick lime VS Hydrated lime is quite different.

Quick lime CaO = Some small chunks much denser than Hydrated lime. Slight Brownish tint.

Hydrated lime $Ca(OH)_2$ = Powder, Fine, fluffy. pure white. Mixes well into mixtures. CaO has a tendancy to not break down, but have or leave chunks in bottom of bowl.

NOTE: To get to around 60% solids assuming Lime is ~~90%~~ solids all solids The amount of lime added would be.

$$\frac{100(.588) + Lime}{294 + Lime} = .60$$

$$58.8 + Lime = 176.4 + .6\,Lime$$

$$.4\,Lime = 117.6$$

$$L = 295g$$

Mix #1 294 g of A/B sludge at 20% solids

Will add CaO (quick lime) until a desired consistency is achieved.

Amount CaO added	observation
0	Thin, sloopy, pourable, Dark Green
50 g	Slightly thicker, pourable, liquid
25 g	Total 75 g = pourable liquid
25 g	Total 100 g = pourable slightly thicker liquid.
25 g	Total 125 g = pourable.
25 g	Total 150 g = Still liquid pourable.
25 g	Total 175 g = Still pourable
25 g	Total 200 g = Still pourable
25 g	Total 225 g = Able to spoon, still pourable
25 g	Total 250 g = ~~Bread dough~~ Consistency Oat Meal
25 g	Total 275 g = Not pourable, thick oat meal

CONT. pg 75

Mix #2 Hydrated Lime Mix

Will use Ca(OH)2 to achieve desired consistency to 294 g of A/B sludge at 20% solids

amount Ca(OH)2 added	observations
50 g	Pourable liquid.
25 g	Total 75 g = Slightly thicker still pourable
25 g	Total 100 g = Thick pourable. Can spoon
missed Reading → 50 g	Total 150 g = Spoonable mix. Smooth paste held spoon up.
25 g	Total 175 g = Consistency of cookie dough.
25 g	Total 200 g = Bread dough
25 g	Total 225 g = Still Bread dough.

CONT. pg 75

[signature] 1/13/95

{Mix #1 CONT.

Amount CaO added	observations
25g	Total 300g added = thick mix almost back to consistency of A/B soil sludge
25g	TOTAL 325g = Bread dough. Pulls off sides of bowl
25g	TOTAL 350g of quicklime to 294 of A/B sludge at 20% solid powders a Worm Dirt Consistency. Soil texture. End Test

NOTE: Filled a 8oz glass jar. Noticed a slight warm temp.
Room Temp 67°F
Mix temp ~106°F (max temp)

"SEE PAGE 77"

{Mix #2 CONT.

Amount $Ca(OH)_2$ added	observations
25g	Total 250g added = Penny a ball, stuck to blade. Bread dough
25g	TOTAL 275g added = Heavy Clay. Moldable
25g	TOTAL 300g added = Still sticks to probable, but looks like wants to break down to small pieces.
25g	TOTAL 325 added of $Ca(OH)_2$ Same
25g	TOTAL 350 added. Same
25g	Total 375g $Ca(OH)_2$ = Became more dense clay
25g	Total 400g Hydrated lime added to 294g 20% A/B sludge at 20% solids powders a worm dirt initial but mixing for while (5 min) made it ball back up
25g	Total 425g Worm dirt but moist.
25g	Total 450g Produced texture looking for.

Room Temp = 68°F
MIX temp = 70°F

1/18/14

Mix #1 Continued.

The mix which resembled clumpy dirt, cottage cheese, or worm dirt was placed in a jar and lid screwed on after temp was recorded. About 10-15 min later it was observed that steam was escaping from the lid so it was loosened and alot of steam came off. The mixture expanded and all was recorded on Vidio Tape. The Temperature went up to 206°F and the material turned to a fine powder. After 60 min the temp. dropped to 70°F (room temp 65°F).

~~Initial volume = 250 ml (A/B study @ 20% solid)~~

Long Term observations of Mix #2 (#2)

1/18/95 @ 3:00 pm : Looks like styrofoam stuffing. Small curd, free pouring. Still packable. Not hard, but won't combine without alot of effort or adding water.

11 days Cure : ~~Fluffy dry powder, would blow away if placed on ground & wind occurred~~ Pellots, loose individual & hard.

Long term observation of mix #1 (#1)

1/18/95 @ 3:00 pm : Formed white powder. Like ash. No moisture left. Like powder

11 day Cured : Fluffy dry powder

RL

1/13

7

Mix #7 long term observation:

1/10/95 2:00 pm: Dry, Worm Dirt form stayed, but became one hard mass stuck in jar

11 day cure: Curd shape (worm dirt shape) hard monolith with voids. Could not break with finger.

Mix #3 Testing of: Flyash Type II

Initial Mix is 294 g of 207 A/B sludge at 20% solids
Will add Flyash until desired consistency.

Amount TYPE II Flyash		Observations
50 g	Total added 50 g	fluid, pourable
50 g	Total added 100 g	fluid, pourable
50 g	Total added 150 g	fluid, pourable
50 g	Total added 200 g	fluid, pourable
50 g	Total added 250 g	fluid, pourable
50 g	Total Added 300 g	fluid, pourable
50 g	Total Added 350 g	Thicker, pourable milkshake
50 g	Total Added 400 g	thick milkshake, pourable
50 g	Total Added 450 g	Wendy's frosty, spoonable.
50 g	Total Added 500 g	Slightly thicker
50 g	Total Added 550 g	~~Cookie dough~~ cake icing
50 g	Total Added 600 g	Cake icing
50 g	Total Added 650 g	Thick cake Icing
50 g	Total Added 700 g	Cookie dough
50 g	Total added 750 g	Bread dough
50 g	Total Added 800 g	Same
50 g	Total Added 850 g	like molding clay
50 g	Total Added 900 g	Clumps out of bowl. One
50 g	Total Added 950 g	ball of bread dough
200 g	Total Added 1150 g	Clumps like wet dirt, but still clumps
50 g	Total Add 1200 g	Wet Dirt.

Room Temp 62.7 °F
Material Temp 69.9 °F

Placed in jar

1/17/96

Mix # 4 Long term observation

1/19/95 7:00 pm: Maintain small bead like balls, but formed hard monolith in Jar. Couldn't break out with fingers.

11 days cure: Small curd (Grape Nuts cereal). monolith, but able to break hard rounded pieces off with fingers.

Mix #4 TESTING of Cement

(Cement from Medusa Cement Company, portland Cement) Class III

Initial Mix is 294 g of 207 A/B sludge at 20% solids will add Flyash until desired consistency is achieved.

Amount Cement added		Observation
50 g	Total Added 50 g	fluid, pourable
50 g	Total Added 100 g	fluid, pourable
50 g	Total Added 150 g	fluid, pourable
50 g	Total Added 200 g	fluid, pourable
50 g	Total Added 250 g	fluid, pourable
50 g	Total Added 300 g	Slightly thicker, pourable, milkshake
50 g	Total Added 350 g	Cake Icing, spoonable, slightly pour.
50 g	Total Added 400 g	Wendy's frosty, spoonable
50 g	Total added 450 g	Cookie dough
50 g	Total Added 500 g	same, slightly thicker, becoming one ball holding on beater.
50 g	Total added 550 g	Bread dough
50 g	Total Added 600 g	Clay becoming stiff.
50 g	Total added 650 g	Clay, stiff
50 g	Total Added 700 g	same
50 g	Total Added 750 g	Dry Clay almost friable
50 g	Total Added 800 g	Really sticky together.
50 g	Total Added 850 g	Consistency of Dirt. Not warm dirt. moldable still sticks together
50 g	Total Added 900 g	warm dirt slightly wet
50 g	Total Added 950 g	Consistency of clumps of small soil (warm dirt)

Placed in Jar

Room Initial Temp = 67°F
Mix Temp = 70°F

1/17/95

Long term observation MIX 5

1/18/95 2:00 pm: Moist beach sand
no change from when
mixed.

11 day cord: Wet Sand

Mix #5 TESTING OF SAND

Initial 294 g of 207 A/B sludge at 20% solids

Amount of Sand added		Observation
100 g	Total added 100 g	pourable liquid, no change
400 g	Total added 500 g	pourable.
500 g	Total added 1000 g	like oatmeal, spoonable
200 g	Total added 1200 g	like wet sand, sand castle sand.
200 g	Total added 1400 g	"
200 g	Total added 1600 g	same
500 g	Total added 2100 g	Never reached dirt consistency Just wet sand.

placed sample in jar — No temp change expected Temp. not taken.

1/13/94

Mixes 6A → 6G were not placed in 8 oz glass jars because did not form a friable soil. A bbb ires formed.

Mix #6A TESTING OF: Cal-SEAL accelerator

INITIAL 294g of A/B sludge at 20% solids

Amount of Cal-seal added	observation
50g Total added 50g:	Initial no change in consistance removed and permitted to sit.

10 min → Supernant formed on top. Stired again easily
35 min → Same, no change.
1 hour → Formed supernant. Did not harden or dry out. Liquid.

Mix #6B Added 500g Cal-seal

Time	observation
While Mixing	Formed consistancy of Wendy's frosty spoon
Allowed to sit 5 min	Icecream, Could turn upside down, not pourable
30 min	Very stiff like hard modeling Clay. Moldable.

After 2 days 3.25 Tons/ft² Penetrometer Compressive strength

45.1 psi.

1/13/95

Mix #6C Added 100 g Cal-Seal

Liquid consistency when added to 294 g 207 A/D @ 20%

Observation: While mixing → liquid, pourable

Settling time	Observation
5 min	No change, Liquid, pourable
10 min	Supernatant formed on top slight 300 ml solids 10 ml Liquid (supernat)
20 min	
30 min	More supernatant formed 25 ml Clear liquid
45 min	
1 hour	

Mix #6D Added 150 g Cal Seal

Liquid consistency when added to 294 g 207 A/D @ 20%

Settling time	Observation
5 min	No change, Liquid pourable
10 min	Phase separation 290 ml solid 10 ml Clear liquid.
20 min	
30 min	More settling ~25 ml clear
45 min	No Hardening
1 hr	

RL

1/13/95

Rocky Flats

Mix #6E Cal-seal

294 g A/B sludge @ 20% solids
200 g Cal-seal

Observations: After 1 day set to a ~~to~~ Wendy's Frosty
Slow to set

Mix #6F Cal-seal

294 g A/B sludge @ 20% solids
300 g Cal-seal

observations: 1 hour set to Wendy's Frosty
Set after 1 day to clay. Able to
spoon, but could hold up side down.

Mix #6G Cal-seal

294 g A/B sludge @ 20% solids
400 g Cal-seal

observations: 1 hour set to Wendy's Frosty
1 day Very stiff. Able to
~~spoon~~ cut and hold up side down.
More lift.

Robert Smith 1/14/95

Volume of 295 ml of 207 A/B @ 20% solids
is 250 ml.

Long term observations for Mix #7

7½ days solid block w/ No voids,
Hard, Not a friable soil
and no individual particals.

Additional Pre-WAC Mixes

using 207 A/B @ 20% Solids

These mixes will use the information obtain from the previous six mixes to develope combination of additive to increase the binding effect for TCLP. We will also test a fine Silicalite (Fine silica Flour) produced by Halliburton Services called SSA-1. To produce 207 A/B at 20% solids 100 g of "as received A/B sludge is mixed with 194 ml of A/B water.

Mix #7 Will mix Class C Flyash and Silicalite at a ratio of 5.67 to 1 at a water to pozzolan Ratio of W/P = 1.25

294 g A/B @ 20% solids = 235 g water

$$1.25 = \frac{W}{P} = \frac{235}{P} \qquad P = \frac{235\,g}{1.25} = 188\,g$$

294 g A/B sludge @ 20% solids
160 g TYPE C Flyash
28.2 g SSA-1 (Fine Silica flour)

Initial Volume = 250 ml
Initial Temp = 56 °F
fluid, pourable, sloppy, Gritty

Add Flyash and silica: fluid, pourable, like ~~Glob~~ soup. pumpable.

Final: 340 ml & 54 °F

After 1 day formed solid monolith. spongy wet clay, no free liquids.

11/17/25

mix #8 Will mix silicalite (Fine silica flour) with $Ca(OH)_2$, hydrated lime at a ratio of 3 parts to 1 part at a water to pozzolan ratio of W/P = 1.25

$$1.25 = \frac{W}{P} = \frac{225}{P}$$

$$P = \frac{225 g \text{ Water}}{1.25 (W/P)} = 188 \text{ g}$$

294 g 207 A/O @ 20% solids
141 g Silica (STA-1)
47 g $Ca(OH)_2$ Hydrated lime

Initial Volume = 250 ml
Initial Temp. = 57.6 °F

Add Silica and Lime:

Made a milkshake consistency. Thick pourable fluid. pumpable. slightly spoonable.

Final Volume: 240 ml
Final Temp.: 56.2 °F

After set in 8 oz jar for 30 min temp 69.9 °F

After set for 1 day. 5 ml free liquid, remainder is very soft shaky. Blob.

Not a durable soil.

11/17/95

Mix #9 CaO & Flyash Mix

Initial 294g 207 A/B @ 20% solids will add quicklime to thick mix (pre determined in phase I to be approx 225g) and add flyash to desired worm dirt consistency.

294g A/B sludge
225g CaO

Initial volume 250 ml @ 55.3 °F
Oatmeal consistency temp = 60.0 °F

Amount Flyash added		observation
50 g	Total 50 g added	Thick oatmeal consistency
50 g	Total 100 g added	oatmeal runny
50 g	Total 150 g added	Pudding or Wendy's Frosty
50 g	Total added 200 g	Thick, spoonable, not pourable.
50 g	Total added 250 g	Same
50 g	Total added 300 g	Thick paste, cooke dough
50 g	Total added 350 g	Cookie dough
50 g	Total added 400 g	Bread dough.
50 g	Total added 450 g	Clay. dry Falling apart
50 g	Total added 500 g	large clay clumps
50 g	Total added 550 g	Worm Dirt

Final Volume : 1100 ml
Temp. : 63.8 °F

Long term observation
1/18/95 3:15 pm : Dry beads, ~~[illegible]~~ but will break down to dust when touch easily with finger. Powder.

7 days cure : Powder, wind would blow away product.

RC

1/17/95

Long term observation mix #10

1/18/95 3:25pm: remained in bead form, could pour out beads. Some free powder came out, but good separate balls.

7 days cure: Hard individual pellets. Didn't stick together. Some loose fine powder at bottom of jar.

Mix #10 CaO & Cement

294 g 207 A/B @ 20% solids, 250 ml @ 55.2°F
225 g CaO (quicklime), may oatmeal, 61.4°F

Amount of cement added		observations
50 g	Total added 50 g	Thin oatmeal consistency.
50 g	Total added 100 g	Thick oatmeal, spoonable
50 g	Total added 150 g	Cookie dough, Not pourable
50 g	Total added 200 g	Bread Dough, forming one ball
50 g	Total added 250 g	Same
50 g	Total added 300 g	Clay, Drying breaking up
50 g	Total added 350 g	Warm Dirt.

Final volume = 950 ml
Final Temp = 67.8°F

placed in 8oz glass jar.

NOTE: The volume taken, loosely pack, Did not bounce on table or vibrator which would have decreased volume greatly. loose Pack.

NOTE: The mix expanded in the jar over a 2 day period. When tryed to do volume test the soil texture or pea size particals turned to a powder by light touch. Couldn't get out as loose pack.

RC

1/17/95

Mix #11 CaO & Cal-Seal

100 g 207 A/B sludge "as received"
294 ml 207 A/B water
Will allow to mix 5 min between additions
fluid, liquid, pourable @ 55.4 °F
Initial Volume = 250 ml
225 g CaO (quicklime)

fluid, liquid, pourable, pumpable

Will add Cal-Seal slowly to allow to react.

Cal-seal added		Observation
50g	Total added 50g	Oatmeal, pourable, spoonable.
50g	Total added 100g	(Mix added in 100g increments and allowed
50g	Total added 150	to mix longer) Thick cookie dough
		not pourable, spoonable, one mass.
50g	Total added 200g	Bread dough. Became slightly
		dryer as mixed over 5 min
50g	Total added 250g	Clay breaking up
50g	Total added 300g	Worm dirt

Final Volume 900 ml
Final Temp 64.1 °F

Long term observation:
1/18/95 3:30 pm = hard small beads, small curd, but hard & able to break with fingers to smaller beads, Solid mass easily broken up.

7 day Cure = Hard individual pellets, Did not stick together, Poured out of jar, Small angular

1/17

SPECIFIC GRAVITY of 207 A/B

Quick Test

Determine Specific Gravity of 207 A/B at 20% solids using TRU-WATE MUD BALANCE.

add 95 g 207 A/B at 58.8% solid

$$\frac{95(.588)}{95+Y} = .20$$

$$\frac{95(.588)}{.20} - 95 = Y$$

$$Y = 184.3$$

add 184 ml 207 A/B water.

MUD BALANCE READING 1.18 SG

note: when put cup on lost about 10 ml of water

Trial 2 with exactly 210 ml to fill TRU-CUP

At Rocky Flats 207A/B SG Tanks
Low 1.07
med. 1.15
High 1.38

see p 187

MUD BALANCE READING

1.07 S.G.

may not be enough material
Did not spit out of top

Over % solids 22.2%

Added until came at top:

Reading 1.16 S.G

Best reading

Mix #12 CaO & Silica flour (SSA-1)

294 g A/B sludge @ 20% solids
225 g CaO

Initial volume of just 20% A/B sludge is 250 ml at at temperature of 55.6°F

Will add SSA-1 until desired consistency is achieved. Will allow to MIX 5 min between additions.

Fine Silica flour added		Observation
50 g	Total added 50 g	Wendy's thick, spoonable, still pourable
50 g	Total added 100 g	(added in 100 g increment and allowed to mix longer)
50 g	Total added 150 g	Thick cake icing, can't pour, spoonable. Not forming balls
50 g	Total added 200 g	Cookie Dough, formed one mass ball. Becomes close to bread dough as mixed for 5 min.
50 g	Total added 250 g	Clay
50 g	Total added 300 g	Clay starting to break up
50 g	Total added 350 g	Close to powder up, larger clumps
50 g	Total added 400 g	Worm dirt. Perfect pea size clumps.

Final Temp. = 77.3°F
Final Volume = 990 ml

NOTE: After set for 30 min the temp raised ~~though~~ to 87.8°F Did not feel a temp. rise in the other glass jars.

Long term observation: Loose, easily crushed to powder.

1/17/95

7 day cure = Very small particles, Turns to powder with larger pressure

NOTE: This →
Mix made Hard rocklike pellets. Other mixes didn't get to individual rocks as quickly

Higher Temp. Than other mixes

Long term observation Mix #13:

1/18/95 7:30pm: Uniform, small, balls.
Do not stick together,
can not be broken by fingers.
Pours out of jar. ⊗ ← actual size
Like dry cat food.

7 days Cure = Smooth round uniform Hard pellets, did not stick together
Pours out of jar like marbles.
Pea-size pellets. All other mixes had smaller size pellets.

Rocky Flats

Mix #13 $Ca(OH)_2$ & Flyash

Will preform Hydrated Mixes with same additives. Prepared 207 A/B at 20% by adding 100 g 207 A/B @ 58.8% and 194 ml A/B water.

294 g A/B Sludge @ 20% Initial Volume = 250 ml
100 g $Ca(OH)_2$ Hydrated lime Initial Temp. = 55.2 °F
Smooth creamy sew pourable, spoonable. Like a Wendy's frosty.

Flyash added		Observation
50 g	Total added 50 g	Thick Frosty or Cake Icing
50 g	Total added 100 g	Cake Icing, spoonable, not pourable
50 g	Total added 150 g	Not pourable, Cake batter.
50 g	Total added 200 g	Same
50 g	Total added 250 g	Cookie dough, smooth
50 g	Total added 300 g	Dry cookie dough
50 g	Total added 350 g	Same.
50 g	Total added 400 g	Same.
50 g	Total added 450 g	Bread dough
50 g	Total added 500 g	~~Same~~ Clayish
50 g	Total added 550 g	Same. Sticky molding clay
50 g	Total added 600 g	More sticky than other mixes. Hanging on mixer blade and side bowl.
50 g	Total added 650 g	Same, Heavy Dense clay
50 g	Total added 700 g	~~Almost~~ Trying to clump out of bowl
50 g	Total added 750 g	Breaking into chunks, clay
50 g	Total added 800 g	Same.
50 g	Total added 850 g	Pea size round clumps

Final volume = 1150 ml
Final Temp. = Initial 89.4°F, 15 min 101°F, 70 min 93°F

[signature] 1/12/95

Long term observations: MX #14

1/18/95 3:30 pm.

Kept warm dirt look, but is a hard monolith in jar. Can't break by shaking to get out of jar. Very Hard.

7 day Mix = Hard angular (curd like) Shape. Formed monolith with large void spaces. Pieces break off with finger pressure. Individual pieces very hard.

Mix #14 $Ca(OH)_2$ & Cement

294 mtg 207 A/B Sludge @ 20%
Initial volume = 250 ml
Initial Temp. = 55.4 °F

100 g Hydrated Lime, $Ca(OH)_2$
produced a creamy, semi-pourable mixture, spoonable material.

Cement added		Observation
50 g	Total added 50 g	Cake Icing. Spoonable,
50 g	Total added 100 g	Cake Icing or soft ice cream
50 g	Total added 150 g	Not pourable, cake batter
50 g	Total added 200 g	Same
50 g	Total added 250 g	Dry cookie dough
50 g	Total added 300 g	Same
50 g	Total added 350 g	Bread Dough
50 g	Total added 400 g	Same
50 g	Total added 450 g	Stiff clay starting to break up
50 g	Total added 500 g	Same
50 g	Total added 550 g	Clay begining to break up
50 g	Total added 600 g	Med size clumps
50 g	Total added 650 g	~~Heavy Dense Molding Clay~~ Same
50 g	Total added 700 g	Same. ~~Clinking out of bowl~~
50 g	Total added 750 g	Very close, but like curd, spongy
50 g	Total added 800 g	Worm Dirt, pea size chunks.

Final Volume = 1100 ml
Final Temp = 62.5 °F

[signature]

1/17/80

Long Term observation Mix #15:

1/18/95, 3:30: Kept beads or hard curd size. Stuck together into one mass, but able to break off or apart with fingers.

7 Day cure = Curd Shape, very hard peices, formed monolith w/ voids. Solid block could not be broken apart with finger pressure needed to ~~[illegible]~~ bust up with screwdriver.

Mix #15 $Ca(OH)_2$ & Cal-seal

294 g 207 A/O @ 20% solids
Initial Volume = 250 ml
Initial Temp = 55.1 °F

100 g Hydrated Lime, $Ca(OH)_2$
smooth, ~~fine~~ powder, spoonable.

Cal-seal added		observations
50 g	total 50 g added	Smooth, consistency, milkshake
50 g	total 100 g added	Spoonable thick
50 g	total 150 g added	Cake Icing
50 g	total 200 g added	Same
50 g	Total 250 g added	Cookie dough
50 g	Total 300 g added	Stick bread dough
50 g	Total 350 g added	Bread dough or wet clay.
50 g	total 400 g added	Starting to break into clay chunks
50 g	total 450 g added	Same — medium to large chunks
50 g	Total 500 g added	Same med. Chunk size
50 g	Total 550 g added	Same almost there
50 g	Total 600 g added	Chunks of clay
50 g	Total 650 g added	Clay med size
50 g	Total 700 g added	same
50 g	total 750 g added	wet warm dirt
50 g	Total 800 g added	Warm dirt

Final Volume = 1250 ml
Final Temp. = 61.8 °F

Rachel Smith 1/17/95

Long Term observation: MX #16

1/19/95 3:70: Very small beads, soft to touch, springing back. Could pack. Slightly Damp. Able to pour out of jar.

7 day cure = Small cured shapes, Able to crush individual pieces with finger to form powder.

mix #16 $Ca(OH)_2$ & Silica flour (SSA-1)

294 g 207 A/B @ 20% solids
Initial Volume = 250 ml
Initial Temp. 55.4 °F

100 g Hydrated Lime, $Ca(OH)_2$
smooth, spreadable.

Silica Added		Observation
50 g	Total 50 g added	smooth, semi paste spreadable.
50 g	Total 100 g added	spreadable thicker.
50 g	Total 150 g added	Cookie dough
50 g	Total 200 g added	same
50 g	Total 250 g added	dry cookie dough
50 g	Total 300 g added	sticky bread dough
50 g	Total 350 g added	Bread dough or Clay wetish
50 g	Total 400 g added	One pass clay ball.
50 g	Total 450 g added	same
50 g	Total 500 g added	same
50 g	Total 550 g added	same, Beginning to break into clay chunks
50 g	Total 600 g added	Clay.
50 g	Total 650 g added	same
50 g	Total 700 g added	same.
50 g	Total 750 g added	spongy worm dirt
50 g	Total 800 g added	worm dirt

Final Volume = 1300 ml
Final Temp. = 59.6 °F

RC

2/17/20

Long term observation: Mix #17

Avg. Actual size

After 5 hrs — Large hard balls ~~Formed~~ Stuck together to form one mass, but able to break apart w/ finger.

6 days cure — Hard uniform pellets, individual pellets did not stuck together. Poured out like marbles from jar.

Volume Increase Evaluation for Mix #17:

Initial 207 A/B Sludge volume = 250 ml
Loose pack product volume = 1400 ml
Packed product volume (calculated) = 649 ml

Volume of cylinder mold is 210 ml, so packed in mold to get ratio. Filled grad. cylinder with 210 ml and poured into packed mold, the water left is volume of packed material.

This Run = 109 ml

Total

$$\frac{X \text{ ml packed}}{1250 \text{ ml loose}} = \frac{109 \text{ ml packed}}{210 \text{ ml loose}}$$

cylinder

~~X = 631~~

X = 649 ml

Additional 207 A/B @ 20% Solids Pre-WAC Mixes

After review of the previous sixteen mixes we will perform or re-do a couple mixes. Mixes with Silica Flour will be redone adding the previous ratio of additions until a friable soil is achieved.

Mix #17 Flyash & Silica Flour

Will mix Class C flyash and Silica flour at a ratio of 5.67 to 1 until a friable (worm dirt) consistency is achieved.

Addition: 294 g 207 A/B @ 20% solids
160 g Type C Flyash
28.2 g SSA-1 silica flour

add at ratio of 5.67 to 1 Silica / Flyash until consistency achieved 53.3 g Flyash
9.4 g SSA-1

Initial (before any additions) volume & Temp = 250 ml @ 55.2 °F

Addition		Observation
Base Addition to w/p = 1.25	TOTAL adds 160 / 28.2	Pourable liquid, thin runny.
53.3 g Flyash, 9.4 SSA-1	213 g / 37.6 g	Pourable, fluid
53.3 g, 9.4 g	266.6 g / 47 g	Pourable
53.3 g, 9.4 g	319.9 g / 56.4 g	Pourable, milkshake
53.3 g, 9.4 g	373.2 g / 65.8 g	Semi-pourable, Wendy's Frosty
53.3 g, 9.4 g	426.5 g / 75.2 g	Cake Icing
53.3 g, 9.4 g	479.8 g / 84.6 g	Thick Cake Icing, not pourable
53.3 g, 9.4 g	533.1 g / 94 g	Cake batter & cookie dough
53.3 g, 9.4 g	586.4 g / 103.4 g	Cookie dough ball / pasty
53.3 g, 9.4 g	639.7 g / 112.8 g	Bread dough
53.3 g, 9.4 g	693 g / 122.2 g	Some range until Final
Total adds 266.5 g; 47	959.5 g / 169.2 g	Worm Dirt.

Final Volume = 1400
Final Temp = 65.9 °F

1/18/95

Volume Increase Evaluation! (Mix #18)

Initial 207 A/B Sludge = 250 ml
Final Product Loose = 1250 ml
Final Product Pack (calculated) = 631 ml

To determine compaction took a mold cylinder which is 210 ml volume, filled with loose pack material then tamped using standard factory procedures. When fully compacted determined volume of packed product.

Product packs to ~~106 ml~~ 106 ml

$$\frac{106 \text{ ml packed}}{210 \text{ ml loose}} = \frac{X \text{ packed}}{1250 \text{ ml loose}}$$

$X = 631$ ml pack

Long term observation for Mix #18:

After 4 hrs — Damp, spongy, medium balls uniform in size, can compact with fingers. One mass in jar, but can be loosen or broken apart with force to pour out.

6 days cure = small individual pellets (some still slightly moist) Able to crush to powder with fingers.

Mix #18

Will mix Silica flour (SSA-1) to $Ca(OH_2)$ at a Ratio of 3 to 1. Add will continue to add at this ratio until friable soil is achieved

ADDITION: 294 g 207A/D @ 20% solids
141 g Silica (SSA-1)
47 g $Ca(OH)_2$, Hydrated lime

Add: at a ratio of 3 parts Silica to 1 part SSA-1
or 50 g Silica flour
16.7 g $Ca(OH)_2$

Initial (207A/D sludge only) Volume & Temp. = 250 ml @ 55.8 °F

Addition		observation
Base addition to W/P = 1.25	Total added 141/47	Pourable liquid, fluid
50 g SSA-1 and 16.7 g Lime	191 g / 63.7 g	Pourable, milkshake
50 g , 16.7 g	241 g / 80.4 g	Cookie dough, cake Icing
50 g , 16.7 g	291 g / 97.1 g	Not pumable, cookie dough
50 g , 16.7 g	341 g / 113.8 g	Bread dough
50 g , 16.7 g	391 g / 130.5 g	Bread dough (same)
50 g , 16.7 g	441 g / 147.2 g	Clay, starting to break up
50 g , 16.7 g	491 g / 163.9 g	same
50 g , 16.7 g	541 g / 180.6 g	Clay w/ med. size chunks.
50 g , 16.7 g	591 g / 197.3 g	Broke down to chunks
50 g , 16.7 g	641 g / 214 g	friable soil, Worm Dirt, sticky
50 g , 16.7 g	691 g / 230.7 g	Dryed out to good Worm Dirt

Final Volume = 1250 ml Loose pack
Final Temp = 61.3 °F

11/18/95

Mix #19 Long term observation:

3 hrs — The mixture is expanding alot. Coming out of jar expanding so much. Heat natural.
Dry natural, formed into a powder with slight pressure.

6 days curing = Powder

Mix #19 Re-mix testing

CaO & Cement

294 g 20% A/B @ 20% solids Initial Volume = 250 ml
Initial Temp = 58.0 °F

275 g CaO (quicklime) "5 min mixing"
Temp. = 77.9 °F

Cement addition		Observation
50g	Total added 50g	Thick oatmeal, not pumable, spreadable
50g	Total added 100g	Thick cookie dough, firmly ball
50g	Total added 150g	Clay, breaking up to med. size chunks
50g	Total added 200g	Clumps of soil med size
50g	Total added 250g	Warm dirt, friable soil.

Final volume = 825 ml loose pack
Final Temp = 71.2 °F
Final Volume = Packed = 412.5 ml

$\frac{105\ ml}{210\ ml\ loose} = \frac{X\ packed}{825\ ml\ loose}$ } note! The volume is reduced by Exactly ½ by packing.

Note! Material placed in zip lock bag. After 1.5 hrs the temp. Raised to 147 °F

11/16/95

Long Term observation : Mix #20

set 1 hr = still damp, soft, holding shape, but can't pour out of jar without using a utensil to get out. slight finger pressure.

6 days curing = Hard monolith with some voids, can not break off with finger pressure. Individual pieces are very hard, small and irregular.

ml water in graduated cylinder

plastic mold = total vol

$$\frac{\text{Volume of Packed soil}}{\text{Volume loose soil}} = \frac{\text{volume packed}}{\text{volume loose}}$$

volume of mold

$$\frac{105}{210} = \frac{X}{1400\ ml}$$

Mix #20 Lime, Cement, Flyash Mix

Will preform a mix using quick Lime addition at 10% by weight of Raw Waste (207 A/B @ 20% solids) and Cement and Flyash at a ratio of 1 to 2 until the desired consistency is achieved.

294 g 207 A/B @ 20% solids ; Initial Vol. / Temp - 250 ml @ 58.7
29 g CaO Temp. = 60.2 °F
2:1 Flyash to cement Ratio

Cement added	Flyash added	Total added	observation
25 g	~~50~~ g	Total of ~~75~~ g added	Pourable, smooth, liquid
25 g	50 g	(50/100) 150 g	Liquid, pourable
25 g	~~50~~ g	(75/~~150~~) ~~225~~ g	Sand
25 g	~~50~~ g	(100/200) ~~300~~ g	milk shake
25 g	50 g	(125/250) 375	Cake Icing, Now Pourable
25 g	50 g	(150/300) 450	Thick Cake icing
25 g	50 g	(175/350) 525	Cookie dough
25 g	50 g	(200/400) 600 g	sticky bread dough
25 g	50 g	(225/450) 675 g	Bread dough
25 g	50 g	(250/500) 750 g	Clay, soft, one ball
25 g	50 g	(275/550) 825 g	Clay beging to break up.
25 g	50 g	(300/600) 900 g	clay, med. size balls
25 g	50 g	(325/650) 975 g	clay, med to small
25 g	50 g	(350/700) 1050 g	very dive, spongy consistant
25 g	50 g	(375/750) 1125 g	Worm Dirt

Final volume = 1400 ml
Final Temp = 64.8 °F
Final volume packed = 700 ml

$\frac{(105)(1400)}{210} = 700$

8/19/24

Long-term observations; mix #21

1 hr set — feels dry, but still soft,
Can be broken between fingers.
Uniform large beads. Packed structure
Can be poured from jar easily

6 day cure = Uniform very hard pellets,
Pellets did not stick together.
Poured out of jar like marbles

$$X = \frac{\text{Ml in graduated cylinder (Final loose vol)}}{210 \text{ ml}}$$

$$X = \frac{106\ (1150)}{210 \text{ ml}} = 580 \text{ ml}$$

Mix #21 Heavy Lime, Cement, Flyash

Will perform a mix using a large dosage of Quick lime and cement, Flyash at a ratio of 1 to 2.

294 g A/B at 20% solids ; Volume & Temp. = 250 ml @ 59 C.
150 g CaO, quick lime ; Temp 64.4°F
2:1 Ratio of Flyash to Cement

Cement added	Flyash added	Totals	Observation
25g	50g	(25/50) 75g	Liquid, Pourable
25g	50g	(50/100) 150g	milkshake, Pourable
25g	50g	(75/150) 225g	Same
25g	50g	(100/200) 300g	Cookie dough.
25g	50g	(125/250) 375g	Bread dough
25g	50g	(150/300) 450g	Clay, Starting to break up
25g	50g	(175/350) 525g	Clay, med size chunks
25g	50g	(200/400) 600g	Clay, soil, med size (Almost
25g	50g	(225/450) 675g	wet, sm. spongy worm dirt
25g	50g	(250/500) 750g	Worm Dirt, Finish Last
~~25g~~	~~50g~~	~~(275/550)~~	

Final Volume loose pack = 1150 ml
Final Temp. = 68.1 °F
Final Volume packed = 580 ml

1/18/95

Mix #22 long term observations:

5 day cure: Hard wet sand or solid clay clump.

Rocky Flats

Mix # 22 STARDUST Additive

Will add StarDUST as an additive.

294 g 207 A/B @ 20% solids
Initial Temp = 61.4°F
Initial Volume = 250 ml

29 g $Ca(OH)_2$, Hydrated lime
Initial Temp. = 62.6°F
~~Initial~~ Fluid, Liquid, Pourable

Will add StarDust until Desired consistency of a friable soil is achieved.

StarDust added		observation
20 g	Total added 20 g	fluid, pourable, liquid
20 g	Total added 40 g	Milkshake, pourable,
20 g	Total added 60 g	~~Cookie dough~~ Wendy's Frosty, Not Pourable, spoonable.
20 g	Total added 80 g	Fluffy oatmeal, spoonable
20 g	Total added 100 g	Thin cake Icing.
20 g	Total added 120 g	Cookie Dough.
20 g	Total added 140 g	Same
20 g	Total added 160 g	Same
20 g	Total added 180 g	Dryish cookie Dough.
20 g	Total added 200 g	Same
20 g	Total added 220 g	Same
20 g	Total added 240 g	Bread dough
20 g	Total added 260 g	Same
20 g	Total added 280 g	Same
20 g	Total added 300 g	Same, wet clay
In 50 g additions	1000 g	Wet sandy clay

STOPED Test
Put 8 oz jar.
climbed out of Bowl

[signature] 1/19/95

Mix #23 Quick Bulk Addition

Will Re-mix mix #13 $Ca(OH)_2$ & Flyash add all the components at once at the amounts determined to create a friable soil.

294 g 20% A/B sludge @ 20%
100 g $Ca(OH)_2$
850 g Flyash

Initial Temp and volume of 20% A/B sludge = 250 ml @ 58.1 °F

Addition of Lime & Flyash

Observation:
Final volume 1375 ml

Produced a powder, dry, pourable-solid, Looks like too much Bulk solids.

Will Re-do This test reducing the amount of Flyash.

5 day cure observation = Powder

1/18/95

Long term observation:

5 day curd = Individual pellets,
Irregular shaped (curd like),
Very hard pellets which
did not stick together.

Mix #24

Will preform mix #23 again reducing the amount of flyash added in an attemp to achieve a friable soil.

Will add flyash & Lime, but have additional pre weighed flyash available if need to make dryer.

294 g 207 A/B sludge @ 20% solids

Initial Temp. = 59.0°F
Volume Temp. = 250 ml

100 g $Ca(OH)_2$
650 g Flyash
> mixed together

Observations:
The mix formed a dry powder that went to a wet soil texture which resemble the earlier mix which needed more flyash. Added 50 g, 50 g, 50 g, 50 g for total of 850 g.

Big difference between mix #23 & mix #24 most likely due to Lime reaction time, #23 flyash most likely sucked up the moisture before lime had time to react.

Will try another mix, doing a pre-mix lime which will react and raise pH for Bacteria.

[signature] 1/19/95

Mix #25

A/B Initial volume = 250 ml

Loose Pack Final volume = 1000 ml

Packed Final volume = Pellets too Hard to Compact!

mix #25 Long term observation!

5 day cure = Individual very hard, uniform, round pellets. Did not stick together, easily pours out of jar.

Note: turned to Dry Beads at 35 min. temp raised to 100°F →

mix #26 Long term observation!

5 day Cure = Powder, very Fine.

Mix #25

Will perform a mix using a Lime pre-mix then adding the Flyash.

294 g 207A/0 @ 20% solids Temp = 54.6°F

100 g $Ca(OH)_2$ Temp = 61.3°F After 5 min mix

After allowing the Lime to mix for 5 min added the flyash.

850 g Flyash

Observation

The mix was almost identical to mix #23, a dry powder mix. It stayed this powder form about 5 min of mixing. Somewhere between 5 & 6 min the dry powder turned to a friable soil (worm dirt). Allowed to keep mixing and went to a slightly more binding mixture, still worm dirt. At 30 min. Material turned to uniform balls just like Mix #13, Temp = 72.6°. Will do this mix exactly same, but only allow to mix for 1 min 30 sec. to see if a change occurs without mixing.

Mix #26 SAME ADDITION.

Added same as above, but only mixed 1 min 30 second and stopped

After mixed = Dry Powder
Set 30 min = Temp 72°F Dry powder
then mix 5 min = Dry powder still. Temp 71°F
then mixed 40 min = Very fine powder.

11/19/85

#27 long term observation!

5 day curve = Very hard clay clays.

Mix #27 STARDUST Addition w/ Cement

Will add Stardust to soak up liquid and cement to bind it up.

294 g 207A/D @ 20% Solids
Initial Temp = 61.0 °F
Initial Volume = 250 ml

100 g $Ca(OH)_2$, Hydrated lime
Temp = 62.2 °F, milkshake

200 g Cement, Cookie dough or thick clay. Not pumpable

Add STARDUST		observation
20 g	Total added 20 g	Cookie dough, not pumpable, Thick.
20 g	Total added 40 g	Dry cookie dough, sticks to sides.
20 g	Total added 60 g	Bread dough, clayish.
20 g	Total added 80 g	Clay, one-ball, slightly breaking up.
20 g	Total added 100 g	Clay, same..
20 g	Total added 120 g	Same
20 g	Total added 140 g	Same
20 g	Total added 160 g	clay, same
20 g	Total added 180 g	same
20 g	Total added 200 g	Same
20 g	Total added 220 g	Clay, medium clumps,
20 g	Total added 240 g	same
20 g	Total added 260 g	Same
20 g	Total added 280 g	same.
Added 50 gram increments	950 g	Climbed out of Bowl, Wet Sandy Clay

STOPPED TEST.

1/18/95

Rocky Flats

Room Temp 61.4°F

ADDITIONAL A/B MIXES

Additional mixes will be performed using mix #13 additions and volume. Will adjust order of additions and mixing times and mixers used.

- Tried using the Hamilton Beach "Milkshake mixer", but the cup has bars running down the side and can't get a good mix and want pour out easily. First mix tried failed. Can't use this blender.

Set up large Fan Blade mixer (used for mixing polymer in 5 gal bucket).

- Metal bowl didn't work because of bump at bottom.
- Use plastic graduated beaker.

- Tried this set-up. Found out that alot of volume of 207 A/B & ~~Fly~~ Lime was left on beater blade.

Mixes using this method will require adjustment for the loss of about 20 ml of material.

[signature]

1/23/95

Mix #28 Lime & Flyash

This mix will test if the time the Lime is in contact with the 207 A/B effects the mix observed and will give us the desired product in the time alotted in the full scale.

294 g 207A/B @ 20% solids
100 g $Ca(OH)_2$ (Hydrated lime)

The lime was stirred in (gently just enough to make in contact, not as thorough a mix, hand mixed for 30 sec), Allowed to sit 15 min.

Added Mix to 850 g Flyash.

This mix was allowed to mix in Hobart and the following was observed

Mixing time	Observation
1 min	Dry powder, Fine
5 min	Some small chunks, Dry powder
11 min	turned to clay or friable soil, as wet as it will get, close to worm dirt, but larger clumps not small curd like saw before (may need more flyash?).
28 min	Pea size balls starting to form. This looks like what we call worm dirt.
34 min	More distinct balls (like rabbit droppings).
39 min 15 sec	Turned to uniform beads. Dry pourable gravel mix.
The 20 m	Crushed to a powder in mixer.

AR

1/27/95

ROCKY FLATS

PRE-WAC MIXES FOR 207 C

Mixes will be preformed on 207 C material at 1.7 S.G. The 207 C was prepared in bulk quantity in a 55 gal drum. To get a uniform aliquot we weighed out the settled solids (crystals) and supernatant (water) separately.
see page 9 for calculation.

To produce 207 C @ 1.75.6 for each mix!

X = 250 g Crystals
Y = 108 g Water
(82-1)
> from blue 55 gal drum.

Additives will be added in an effort to produce a flowable mix.

ORDER:

1) Combine water & crystals in kobalt bowl for approximately 5 min

2) Add additives in 50 g increments

3) If lime is added in conjunction with other additives allow time to mix for 5 min.

4) Will record: Temperature: Initial & Final
Volume: Initial, Loose packed, Leveled, Wet packed.

5) Place in 8oz glass and save left over in zip lock bag.

6) V100 Taken.

1/24/95

Mix #1A Long term observation Root:

1 day cure = Material Broke glass jar into 4 large pieces. Hard cylindrical mass. Easily crushed to powder.

2 day cure = Mass expanded more and formed large crack down center. Easily crushed to powder.

Plastic mold = Batch

$$\frac{\text{Volume Compacted material}}{\text{Volume Cylinder mold}} = \frac{\text{Volume Packed (X)}}{\text{Volume Batch}}$$

$$\frac{159\ ml}{210\ ml} = \frac{X\ ml}{600\ ml}$$

Mix #1A CaO Mix

~707.5 mls 250g 108°F

Initial 207 C material used: 210 ml or 358 g at S.G. or 1.7. Note when did a volume weight check it worked perfectly.

207C Crystals = 250 g
207C water = 82 ml

Initial temp = ~~59.1~~ 56.6°F
Initial Volume = 210 ml

Will add quick lime (CaO) at 50 g intervals

CaO Lime added		Observation
50g	Total added 50g	Temp = 57.1°F Fluid, pourable, Gritty
50g	Total added 100g	Temp = 58.2°F Thicker, pourable, fluid
50g	Total added 150g	Temp = 59.6°F Slightly pourable, Thick as milk shake
50g	Total added 200g	Temp = 62.1°F Thick oatmeal, spreadable, slightly pourable
50g	Total added 250g	Temp = 66.5°F Very thick oatmeal, Gritty, not pourable
50g	Total added 300g	Temp = 71.5°F Small beads or curds, still moist
50g	Total added 350g	Temp = 82°F Small hard beads. Can see some white Lime not mixed in. Good small hard beads.

Final Volume loose = 600 ml
Final volume Packed = 454 ml

First Day
Long Term observation:

15 min at Temp = 88.5°F very hard beads, separate pourable.
30 min set Temp = 88.5°F same
4 hrs set = No temp increase = expanded and coming out of jar. Still hard beads,
6 hrs set = Temp = 96.0°F Large volume expanded out of jar

4/24/85

Long term observation Mix #2A Cont.

1 day cure = Mixture of powder and round hard pellets no expansion noted.

2 day cure = Same as Day 1

$$\frac{130\text{ ml}}{210\text{ ml}} = \frac{X}{700\text{ ml}}$$

Mix 2A $Ca(OH)_2$ Mix

Initial addition is: 210 ml or 358g 20°C @ 1.7 S.G.

Initial Temp = 58.4°F

Will add Hydrated Lime ($Ca(OH)_2$) at 50g increments.

$Ca(OH)_2$ Lime added			Observation
50g	Total added 50g	Temp = 60.6°F	Fluid, pourable, gritty
50g	Total added 100g	Temp = 61.2°F	Cake Icing, not pourable, holds form
50g	Total added 150g.	Temp = 62.9°F	Cookie dough
50g	Total added 200g.	Temp = 64.2°F	Hard clay
50g	Total added 250g	Temp = 64.8°F	Spongy wet dirt, almost there
25g	Total added 275g	Temp = 61.2°F	Friable soil, still moist
25g	Total added 300g	Temp = 63.3°F	Hard small beads. Uniform in size and color, pours out in small beads.

Final volume loose = 700 ml

Final volume packed = 460 ml

Long term observation:

20 min set = temp = 67.4°F, all loose beads, Hard.

4 hrs set = No Temp change.

6 hrs set = NO expansion, no temp, still individual hard balls

11/24/05

Mix #3A long term observation!

1 day cure = Hard small uniform pellets.

2 day cure = Hard small uniform pellets, with slight finger pressure easily pops from jaw like bebe's

↑ Actual size

$\frac{140}{210} \times \frac{\text{[illegible]}}{1050}$

Mix 3A FLYASH MIX

Prepared 207C material @ 1.7 S.G

207C crystals = 250 g
207C water = 82 ml = 82 g

Initial Temp = 58.7 °F
Initial volume = 210 ml
(195-1)

~699 solids [illegible] 209 [illegible] 1039

will add flyash in 50 g increments until a friable mix is achieved.

Flyash added		observation
50 g	total added 50 g	Fluid, pourable, liquid
50 g	Total added 100 g	Same
50 g	Total added 150 g	pourable, fluid liquid
50 g	Total added 200 g	pourable, soupish, liquid
50 g	Total added 250 g	Thin Milkshake, pourable
50 g	Total added 300 g	Milkshake, spoonable, pourable
50 g	Total added 350 g	Smooth Wendy's Frosty, spoonable, slightly pourable
50 g	Total added 400 g	thin cake icing, not pourable
50 g	Total added 450 g	Thick cake icing
50 g	Total added 500 g	Same
50 g	Total added 550 g	Cookie Dough, sticks to sides of bowl
50 g	Total added 600 g	Bread dough, one ball or clump.
50 g	Total added 650 g	Bread dough or soft clay
50 g	Total added 700 g	Try to climb out of bowl. Clay ball.
50 g	Total added 750 g	Clay, med size chunks
50 g	Total added 800 g	Med size clay or soil chunks
50 g	Total added 850 g	Same
50 g	Total added 900 g	Clumps, friable soil, slightly moist wood dirt
50 g	Total added 1000 g	Worth Dirt, Friable Soil

Final Temp = 64.2 °F
Final Loose volume = 1050 ml
Final Packed volume = 700 ml

[signature]

1/24/95

● to ●
↑ actual size

Mix # 4A Long term observations:

2 day cure = Small hard uniform pellets. Need strong finger pressure to break up enough to get to pour out of jar.

$\frac{138\ ml}{210\ ml} = \frac{x}{950\ ml}$

Mix 4A Cement Mix

Prepared 207 C material @ 1.7

207 C cylinder = 250g
207 C water = 82 ml
Initial Temp. = 59.1 °F
Initial Volume = 210 ml

Will add cement in 50 g increments until a fluid soil is added.

Cement added		Observation
50g	Total added 50g	Fluid, pourable, Liquid
50g	Total added 100g	Same
50g	Total added 150g	Pourable fluid liquid
50g	Total added 200g	Pourable, thin milk shake
50g	Total added 250g	Thick milk shake, pudding, spoonable, slight pour
50g	Total added 300g	Not pourable, Cake Icing.
50g	Total added 350g	Thick cake Icing.
50g	Total added 400g	Same
50g	Total added 450g	Bread dough, ball, moist
50g	Total added 500g	same starting to break up slightly
50g	Total added 550g	Clay, soft, large chunks
50g	Total added 600g	large clumps, soil, moist, spongy
50g	Total added 650g	moist friable soil, medium size clay, spongy
50g	Total added 700g	Pea size moist soil spongy
50g	Total added 750g	moist friable soil, some dirt, but spongy
50g	Total added 800g	Worm dirt friable soil, slight moisture sheen
50g	Total added 850g	Worm Dirt hard round water beads

Final Temp = 54.0 °F
Final loose Volume = 950 ml
Final Packed Volume = 624 ml

1/27/95

Mix #5A Long term observation =

1 day cure = Small uniform Hard pellets

2 day cure = Noticed expansion of material. Pushed out of jar in solid form (Like a "push-up")

Hard uniform pellets easily ~~[illegible]~~ Monolith easily separated into pellets with finger pressure. Slight free lime (white spots)

$$\frac{146}{210} = \frac{x}{850}$$

Mix 5A CaO & FLYASH

This mix will test Quicklime and Flyash addition. The lime will be added to a thick pourable mix (see pg 141) and then flyash added until a friable soil is achieved.

207 C @ 1.7 S.G.

Initial temp. = 61.0 °F
Initial Volume = 210 ml

Add:
150 g CaO ~ 5 min. Mix
Temp = 62.0 °F

Will add Flyash in 50 g increments until friable soil is achieved.

FLYASH ~~CaO~~ added		Observations
0 g		Pourable, thin Milkshake, clotted
50 g	Total added 50 g	Pourable, Milkshake, slightly spoonable
50 g	Total added 100 g	Spoonable, Oatmeal, not pourable
50 g	Total added 150 g	Cake Icing, Spoonable
50 g	Total added 200 g	Cookie dough, Sticks to rollers
50 g	Total added 250 g	Bread dough
50 g	Total added 300 g	Same
50 g	Total added 350 g	Clay, medium size chunks.
50 g	Total added 400 g	Soil, med size chunks, Clumpy.
50 g	Total added 450 g	Soil Friable Clumps
50 g	Total added 500 g	Same, Balls are not uniform, need one more
50 g	Total added 550 g	Uniform beads, friable soil

Final Temp = 64.0 °F
Final Volume loose = 850 ml
Final Volume Packed = 591 ml

1/24/95

Mix #6A long term observations

1 day cure = Hard small uniform pellets

2 day cure = Expanded out of jar
like an Icecream "Push-up"
Small Uniform pellets
which are separated
for mass with slight
finger pressure. A good
amount of white powder or
lime coming out.

$\frac{133\,ml}{210\,ml} = \frac{X\,ml}{775\,ml}$

Mix 6A CaO & Cement

Will test the addition of cement to 207 C and CaO mixture

207 C @ 1.75.6

Initial Temp = 61.0°F
Initial Volume = 210 ml

add
150 g CaO mix for 5 min. Temp = 62.3°F
~~Thick milkshake~~

Will add Cement in 50 g increments until a friable soil is achieved.

Cement Added		Observations
0 g		Pourable, thin milkshake, fluid.
50g	Total added 50g	Pourable, milkshake, gritty, spoonable.
50g	Total added 100g	Spoonable, oatmeal, not pourable
50g	Total added 150g	Cookie dough or brownie mix. Gritty
50g	Total added 200g	Bread dough, forming one ball.
50g	Total added 250g	Clay, large chunks
50g	Total added 300g	Same
50g	Total added 350g	Soil, med size chunks, gritty.
50g	Total added 400g	Soil, pea-size chunks, slight moist sheen.
50g	Total added 450g	Friable soil, uniform beads

Final Temp = 63.9°F
Final Volume Loose = 775 ml
Final Volume Packed = 491 ml

1/24/95

mix #7A Long term observation:

1 & 2 day observation = Small hard, uniform pellets. A medium amount of frog pressure required to break up the mudlike.

$\frac{148}{210} = \frac{x-1}{950}$

Mix #7A $Ca(OH)_2$ & FLYASH

Will test the addition of Hydrated lime and Flyash to 207 C

207 C Initial Temp. = 60.0 °F
Initial Volume = 210 ml

add 100g $Ca(OH)_2$ and mix for 5 min.

Temp. = 64.6 °F
observation = Thin cake icing.
Wendy's Frosty, spoonable, not pourable

Will add Flyash in 50 g increments until a friable soil is achieved.

Flyash added		observation
50g	Total added 50g	Cookie Dough, Not pourable, spoonable
50g	Total added 100g	Same, slightly thicker
50g	Total added 150g	~~Bread Dough or~~ Sticky cookie dough, sides sticky
50g	Total added 200g	Bread dough
50g	Total added 250g	Clay, one ball, not breaking up.
50g	Total added 300g	Clay medium size chunks
50g	Total added 350g	med size chunks of soil.
50g	Total added 400g	Same, size chunks reducing
50g	Total added 450g	Same, round balls not smooth.
50g	Total added 500g	Same
50g	Total added 550g	Same
50g	Total added 600g	Beads still clinging to eachother
50g	Total added 650g	Pellets

Final Temp = 62.8 °F
Final Volume loose = 950 ml
Final Volume Pack = 669 ml

[signature] 1/24

Mix #8 Long term Observation:

1 day cure = Uniform hard pellets

2 day cure = Monolith which formed by pellets sticking together needed alot of finger pressure to separate into hard uniform small pellets which poured from jar.

No expansion.

$$\frac{142}{206} = \frac{x-1}{875}$$

h=10.16
d=5.08
h'=7.62

Mix #8A $Ca(OH)_2$ & Cement

Will test the addition of Hydrated lime and cement to 207 C material at 1.7 S.G.

207 C Initial Temp. = 60.0 °F
Initial Volume = 210 ml

add

100 g $Ca(OH)_2$ mix for 5 min

Temp = 64.7 °F
observation = Thin cake icing, Wendy's Frosty, not pourable, spoonable

Will add cement in 50 g increments until a friable soil is achieved

cement added		observation
50 g	Total added 50 g	Cookie Dough, Thick, Not Pourable.
50 g	Total added 100 g	Same, slightly thicker
50 g	Total added 150 g	Wet Bread dough, forming ball
50 g	Total added 200 g	Bread dough
50 g	Total added 250 g	Clay, Med. chuncks
50 g	Total added 300 g	Clay medium size chuncks.
50 g	Total added 350 g	Soil, moist, spungy chuncks
50 g	Total added 400 g	Worm dirt, but has wet sheen.
50 g	Total added 450 g	Same
50 g	Total added 500 g	Same
50 g	Total added 550 g	Almost there, but still slightly Damp.
50 g	Total added 600 g	Friable soil, small pellets or beads.

Final Temp = 62.5 °F
Final Volume loose = 875 ml
Final Volume Pack = 592 ml

[signature] 1/24/95

Mix # 9A Long term observation:

1 day cure = Regular size hard uniform pellets.

2 day cure = Pellets easily removed from jar with very slight finger pressure. Hard uniform pellets.

$\frac{142}{210} = \frac{X\text{ml}}{750}$

Mix #9A CaO & Flyash & Cement

Will test the addition of Lime, Flyash, and cement at a ratio of 2 flyash to 1 cement. Lime will be added at 10% by weight. Lime will be added to 207C and run to Cement/Flyash mixture.

358 g 207C @ 1.7 5.6
Initial Temp = 59.7°F
Initial Volume = 210 ml

35.8 g CaO Temperature = 59.8°F
fluid, pourable, very sloppy liquid.

Flyash added	cement added	Tot	observation
50g Flyash	25g Cement	(50/25)	fluid, pourable, thin milkshake
50g	25g	(100/50)	pourable, milkshake
50g	25g	(150/75)	thin cake icing, Not pourable
50g	25g	(200/100)	Cookie dough
50g	25g	(250/125)	Bread dough
50g	25g	(300/150)	Soil Clumps, moist
50g	25g	(350/175)	Moist warm dirt, clumpy soil
50g	25g	(400/200)	Same
50g	25g	(450/225)	Pellets uniform size

Final Temp = 63.6°F
Final volume Loose = 750 ml
Final volume Packed = 507 ml

1/24/85

Mix #10A Long term observation:

1 day cure = Hard, uniform round pellets

2 day cure = Need medium amount of finger pressure to remove or break-up to individual pellet to pour from jar.

Note: When compacting for packed volume it was observed that not all was compacted equally and top of cylinder was smooth and not bottom was still round pellets

$$\frac{192}{210} = \frac{x}{925}$$

Mix #10A $Ca(OH)_2$ & Flyash & Cement

Will test some additive as mix #9A, but use 10% by weight of Hydrated Lime.

358 g 20% @ 1.75.6
Initial temp. = 59.8 °F
Initial Volume = 210 ml

35.8 g $Ca(OH)_2$ Hydrated lime
Temp. = 63.9 °F
pourable, thin milkshake.

Flyash added	cement added	Total	Observations
50 g Flyash	25 cement	(50/25)	Thick slightly pourable, spreadable, Thick milkshake
50 g	25 g	(100/50)	Not pourable, spreadable Cake Icing.
50 g	25 g	(150/75)	Cookie Dough, sticks to sides.
50 g	25 g	(200/100)	Bread dough
50 g	25 g	(250/125)	Clay, wet
50 g	25 g	(300/150)	Soil in large clumps
50 g	25 g	(350/175)	large clump moist warm dirt, soil
50 g	25 g	(400/200)	same
50 g	25 g	(450/225)	Pellets, small round Hard
50 g	25 g	(500/250)	↳ pellets

Final Temp = 62.7 °F
Final Volume loose = 925 ml
Final Volume packed = 625 ml

1/24/85

Mix #11A Long term observation!

1 day cure = Small to very small almost powder particals. Did not Stick together. Poured easily from jar.

Note: Maybe could have made additional additions to dry further dry out pellets, Hard to decide exactly when to stop adding. Same for Mix # 12 A →

$\frac{140}{210} = \frac{X}{900}$ } More again the compaction was not uniform along the length of the cylinder molds Top more compacted than bottom. Will need to do in Lifts to get equal compaction.

Rocky Flats

Mix # 11 A Cal-Seal

This mix will test the amount of Halliburton Services Cal-seal needed to achieve a pumpable soil.

358 g 207 C @ 1.7 S.G.
Initial Temp. = 59.2 °F
Initial Volume = 210 ml

35.8 g CaO 5 min mix; Temp = 59.6 °F
observation: fluid, pourable, liquid

Cal-Seal added		observation
50 g	Total 50 g added	Fluid, pourable, liquid.
150 g	Total Added 150 g	Milkshake, pourable.
50 g	Total Added 200 g	Cake Icing, spoonable, Not easily pourable.
50 g	Total added 250 g	Cookie Dough, Not pourable
50 g	Total added 300 g	Bread dough, one dough ball.
50 g	Total Added 350 g	Clay, med. size chunks, breaking up.
50 g	Total Added 400 g	Soil Clumps, medium size, white shown.
50 g	Total Added 450 g	Worm dirt, moist coal size soil mix
50 g	Total Added 500 g	Drying out, some size chunks, friable soil
50 g	Total Added 550 g	Coal pellets, slightly moist and clumping.
50 g	Total added 600 g	pellets, small uniform in size.

Final Temp = 63.0 °F
Final Volume Loose = 900 ml
Final Volume Packed = 600 ml

Richard F Smith 1/25/95

Mix #12A Long term observations:

1 day cure = pellets ~~duty~~ easily separated from eachother with finger pressure. Pellets can be broken with fingers to powder or paste.

NOTE: This mix was probably stopped too early and could have gone another two (100) additions.

$\frac{(2)}{210} = \frac{X}{800}$

Mix #12A Silica Flour

This mix will test the amount of Halliburton Services SSA-1 (fine silica flour) needed to produce a pumpable mix.

358 g 207C @ 1.7 S.G.
Initial Temp = 59.1 °F
Initial Volume = 210 ml

35.8 g CaO 5 min mix; Temp = 59.7 °F
observation: fluid, pumpable, liquid.

Silica flour added		Observation
50 g	Total added 50 g	fluid, liquid, pumpable
100 g	Total added 150 g	Thin milkshake, fluid, pumpable
50 g	Total added 200 g	Thick milkshake, pumpable, spoonable
50 g	Total added 250 g	Cookie Dough, not pumpable, sticks to sides
50 g	Total added 300 g	Bread dough, Looks same as mix #11A at this point
50 g	Total added 350 g	Clay or soil, Breaking up to soil,
50 g	Total added 400 g	Soil chunks, looks dry, but large & clumpy
50 g	Total added 450 g	Worm dirt, moist cord size soil clumps
50 g	Total added 500 g	Drying out, some size clumps of soil
50 g	Total added 550 g	Added a pellet, small beads material

Final Temp = 67.4 °F
Final Volume loose = 885 ml
Final Volume packed = 512 ml

1/25/85

Mix #13A Long term observation:

1 day cure = small to very small to almost powder particals. Did not stick together.

$\frac{149}{210} = \frac{x}{800}$

Mix # 13A Lime [CaO], Flyash, Cement

This mix will test the Heavy amount of Lime (42% by weight) to a thick pumble material. The cement & Flyash will be added at a ratio of 1:2.

358g 20% @ 1.75 S.G.
Initial Temp = 59.0°F
Initial Volume = 210 ml

150g CaO sun mix; Temp. = 63.4°F
observation. = Thick, gritty oatmeal, pumble, but thick.

Flyash added	cement added	Total	Observations
50g	25g	(50/25 = 75g)	Not pumble, Thick milkshake, almost cake icing.
50g	25g	(100/50 = 150g)	Thick cake icing, sticks to sides
50g	25g	(150/75 = 225g)	Cookie dough,
50g	25g	(200/100 = 300g)	Clay to bread dough, one ball really
50g	25g	(250g/125 = 375g)	Warm dirt, large clumps or balls
50g	25g	(300/150 = 450g)	Small bead warm dirt, still moist.
50g	25g	(350/175 = 525g)	Pellets, hard, small round. Some as small as powder.

Final Temp = 64.8°F
Final Volume Loose = 800 ml
Final Volume Packed = 568 ml

4/25/95

Mix #1/4 Long term observation =

1 day cure = medium size pellets, uniform, round very hard. Able to pour out of jar with only slight finger pressure.

$\frac{153}{240} = \frac{x}{850}$

Mix #14 A Lime [$Ca(OH)_2$]; Flyash, Cement

This mix will add Hydrated lime to a consistance of thick porrable added at (28% by weight) Flyash & Cement added at a ratio of 2:1

358g 207C @ 1.7 S.G.
Initial Temp = ~~[illegible]~~ 58.8°F
Initial Volume = 210 ml

100g $Ca(OH)_2$ 5 min mix; Temp = 63.7°F
observation: = Cake icing, can't pour. Spoon could just be held up.

Flyash added	Cement added	Total	observation
50g	25g	(50/25 = 75g)	Cookie dough, Not porrable, sticks to sides
50g	25g	(100/50 = 150g)	almost bread dough, still slightly sticky to sides.
50g	25g	(150/75 = 225g)	Bread dough
50g	25g	(200/100 = 300g)	Clay, breaking to large clumps.
50g	25g	(250/125 = 375g)	Worm Dirt, large clumps or balls
50g	25g	(300/150 = 450g)	mud size bead, still moist.
50g	25g	(350/175 = 525g)	Partly still moist not pellets yet
50g	25g	(400/200 = 600g)	pellets, hard

Final Temp = 63.2 °F
Final Volume loose = 850 ml
Final Volume packed = 619 ml

[signature] 1/25/95

MIX #15A Long term observation:

1 day cure = Varied size pellets, medium to very small. Very hard pellets.

$\frac{145}{210} = \frac{x}{900}$

Mix #15A Lime [$Ca(OH)_2$], Cal-Seal

This mix will test the amount of Halliburton Services Cal-Seal needed to achieve a friable soil.

358g 20°C @ 1.7 S.G.
Init. temp. 59.3°F
Init. vol. 210ml

35.8g $Ca(OH)_2$ 5 min mix temp. 63.7°F
observation: Thin milkshake, pourable, fluid

Cal-Seal added	Total added	Observation
50g	50g	Thick milkshake; spreadable & pourable
50g	100g	Cookie dough
50g	150g	same
50g	200g	moist Bread dough, slightly stick to sides
50g	250g	Bread dough
50g	300g	same
50g	350g	Clay, beginning to break up.
50g	400g	large clay clumps, moist
50g	450g	Worm Dirt, moist
50g	500g	same
50g	550g	pea size worm dirt, still moist
50g	600g	small (bebe) size worm balls, still moist.
50g	650g	small clean, balls, but still moist
50g	700g	small uniform pellets, Dry Hard

Final Temp = 62.8°F
Final volume loose = 900ml
Final volume packed = 621 ml

11/25/95

Mix #16A Long term observations

1 day cure = pellets, some cured some still moist.
The cured pellets are very hard the moist pellets can be crushed to powder or pesh.
Pours out of jar like marbles.

$\frac{140}{210} = \frac{x}{950}$

Mix #16A Lime [$Ca(OH)_2$], Silica Flour

This mix will test the amount of Halliburton Services SSA-1 needed to achieve a friable soil.

358g 207c @ 1.7 S.G.
Init. Temp. 59.0°F
Init. Vol. 210 ml
35.8g $Ca(OH)_2$ 5 min mix temp. 63.5°F
observation: Thin milkshake, pourable, fluid.

Si Flour added	Total added	Observations
50g	50g	milkshake, pourable mixture.
50g	100g	Cake Icing.
50g	150g	same
50g	200g	Cookie dough
50g	250g	moist Bread dough, still sticking to sides.
50g	300g	same
50g	350g	Bread dough
50g	400g	Clay, beginning to break up.
50g	450g	Large mix of Clay dirt clumps.
50g	500g	same
50g	550g	pea size mix dirt, still moist
50g	600g	Small marble balls, still moist
50g	650g	small round clumps, but still moist
50g	700g	Almost fine
50g	750g	pellets, small marble Hard Dry

Final Temp = 63.2°F
Final Volume Loose = 950 ml
Final Volume packed = 633 ml

12/5/85

Mix #17A FLYASH & Silica Flour

This mix will test the addition of flyash & Silica flour at a ratio of 5.67 to 1. This ratio will be added to 207A/B at 20% and 5% lime until a stable soil is achieved.

358 g 207C @ 1.7 SG.
Initial Temp = 62 °F
Initial Volume = 210 ml
18 g $Ca(OH)_2$ 5 min mix Temp = 67.8 °F
observation: fluid, soupy, pourable Liquid.

Add 160 g Type C Flyash
28 g SSA-1 (Fine Silica Flour)
observation: Thick milkshake, spreadable, only very slightly pourable.
add at a ratio of 5.67 : 1 flyash to Silica flour or
53 g Flyash & 9.5 g SSA-1

Flyash	SSA-1	Total	observation
53 g	9.5 g	(53/9.5 = 62.5 g)	Wendy's frosty, thin cake batter, Not pourable.
53 g	9.5 g	(106/19 = 125 g)	Cookie dough, sticky to touch
53 g	9.5 g	(159/28.5 = 187.5 g)	Brownie mix, thick cake dough
53 g	9.5 g	(212/38 = 250 g)	Bread dough, one ball or blob
53 g	9.5 g	(265/47.5 = 312.5 g)	Dry Bread dough or Clay
53 g	9.5 g	(318/57 = 375 g)	Clay begins to break apart
53 g	9.5 g	(371/66.5 = 437.5 g)	large Clumps warm Dirt
53 g	9.5 g	(424 g/76 = 500 g)	pea-size Crumbs warm dirt.
53 g	9.5 g	(477/85.5 = 562.5)	small pea-size round semi moist pellets
53 g	9.5 g	(530/95 = 625)	Uniform Round hard pellets.

TOTAL 690 g Flyash & 123 g SSA-1 silica flour
Final temp = 64.8 °F
Final volume loose = 1000 ml
Final volume Packed = 714 ml

1/27/95

Rocky Flats

Final PRE-WAC mixes for 207 A/B

This round of testing will preform side-by-side mixing to determine the following:

- Can the Hobart mix at various speeds to better simulate a pug mill or Hopper?
- Does the time given for lime to react with 207A/B sludge effect the final product?
- What is the appropriate water to pozzolan (w/p) range we should be using for our WAC mixes?
- Does a bulk addition have the same effect on other mixes (ie Lime, cement, Flyash & Lime, flyash, silica flow) as it did for the Lime, Flyash mix?

Mix #1 will preform the same mix using Speed 1 and Speed #3 on the Hobart and observe the properties of the mixture over a period of time.

Mix #2 Will preform the same mix using Lime added in Hobart and mixed for 5 min and a flash mix ~30 sec. to see if time of Lime reaction is required. If necessary will compare Lime added to flyash vs Lime added to A/B sludge if no change in above test.

Mix #3 Will perform a Lime/flyash mix varing the amount of flyash to find an appropriate w/p range.

Mix #4 Will preform a test testing the bulk addition to the other mixes selected to be preformed on the WAC mixes

- $Ca(OH)_2$
- $Ca(OH)_2$, Flyash, Silica flour
- $Ca(OH)_2$, Cement, Flyash

Robert F. Smith

1/27/95

Additional Observations:

207 A/B & Lime: Smooth creamy milkshake consistancy. Pourable.

Long term observations:

Mix #1 mixer #1

3 hrs cure: Cured to clumps, but broke apart easily.

Mix #1 Mixer #2

3 hrs cure: Big chunks, very hard, able to break in half. @ 2" size

Rocky FLATS

Mix #1 Hobart Mixer Speed Test

Use exact mix in both mixers:

100g 207 A/B sludge "as recieved"
194ml 207 A/B water
mix Low speed for ~5 min.
100g $Ca(OH)_2$
mix Low speed for ~5 min
850g Flyash
mix in different mixers at various speeds record observations ~~as~~ ~~[illegible]~~ the material changes.

Mixing Time	Mixer #1 Low speed	Mixer #2 High speed
0	Dry Powder	Initial product loss on start up
1 min	Dry Powder	Material flying around bowl
2 min	Dry Powder Some small balls	Balls formed, worm Dirt Alot of material on side.
4 min	Some small clumps. Like Brown sugar consistence	Clay, Big pieces Dough Getting really beat up. Must see video!
6 min	More like brown sugar	Clay Ball thick material
7 min 30 sec	Worm Dirt, alot on sides of bowl	Shear pin on Hobart Broke. Mix too stiff Broke Mixer. Smooth Clay friable, breaks easily
11 min	Large curd worm Dirt Good friable moist soil.	

Note: would probably turn to pellets at 30 min if left to mix.

NOTE The pin didn't Break if just stoped. Worked when material removed. Mixer OK.

SEE PAGE 185

[signature]

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Long term observations!

Mix #2

mixer #1 :
2 hrs cure = Warm temp. ≈ 85°F
Dirt, with some clumps.
Fine size dirt particals
Side pieces Held together

Mixer #2 - 2hr cure = Look the same
as Mixer #1

Mix #2 Lime Reaction time / Additions Test

This mix will use the exact same mix except the way the lime is added will be varied.

294 g 207 A/B @ 20% solids
100 g $Ca(OH)_2$ Added two ways
850 g Flyash

Mixer #1 → Lime mixed with A/B sludge on low in Hobart for 5 minutes. Then added to flyash

Mixer #2 → Lime mixed with large fan blade for 30 sec. Then added to flyash.

Mixing Time	Mixer #1 (5 min)	Mixer #2 (Flash)
15 sec	Dry powder some clumps	SAME as #1
1 min	Some clumps powder	Same, but seems dryer
2 min ~~[illegible]~~	small patrol moist	slightly Dryer, just starting to stick to sides
2 min 30 sec	SAME	
3 min	Warm Dirt	Sticking to side some powder and some small clumps
3 min 30 sec	SAME	SAME
4 min	Warm Dirt heavy sticking on sides, moist	Starting to form moisture soil some powder some clump
5 min 30 sec.	Achieve warm Dirt consistency in middle Side packed with material	Still coated to side, wet sand, some clumps which break up easily. ~~[illegible]~~ ~~[illegible]~~ Sides Not pack all sandy like consistency

[signature]

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Mix #3 Flyash Volume (w/p) Adjustment

This mix will adjust the amount of flyash added (varying the w/p ratio) in an attempt to develope a range for the WAC mixes.

mixer #1 294 g 207 A/B @ 20% solids
100 g $Ca(OH)_2$
500 g Flyash

mixer #2 294 g 207 A/B @ 20% solids
100 g $Ca(OH)_2$
700 g $Ca(OH)_2$

Mixing Time	mixer #1 (Low) 500g	mixer #2 (High) 700g
15 sec	worm Dirt Clumps immediately	Small pea size, powder
30 sec	Bread dough, climb out of bowl. Clay like	Worm Dirt.
1 min	Clay, stiff one ball	Pea size worm dirt friable soil
1 min 30 sec	SAME	Starting to form bread dough large to medium size clumps
2 min	Hard stiff Clay	Clay or Bread Dough
2 min 30 sec	same	SAME
3 min 10 sec	Clay, soft Moldable.	Clay, soft, moldable Dryer easier to break apart.

Long term cure:

2 hrs: Hard Hard

[signature] 1/29/95

Mix #4 — Bulk Addition for Other WAC Mixes

This mix will test the full quantity addition of the other mixes expected to be included in the actual WAC mix found.

Mixer #1
294 g 207 A/B @ 20% solids
15 g $Ca(OH)_2$
mix for 5 minutes in Hobart.
960 g Flyash
170 g SSA-1 (silica fume)
5% by weight
> 5.67 to 1 Ratio

Mixer #2
294 g 207 A/B @ 20% solids
15 g $Ca(OH)_2$
mix for 5 minutes in Hobart.
375 g Cement
750 g Flyash
5% by weight
> 2:1 Ratio

Mixing Time	Mixer #1	Mixer #2
15 sec	some clumps of Powder	Powder w/ some clumps
1 min	Dry powder clumps	Dry powder som small clumps
1 min 30 sec	stocky to sides, larger clumps starting to form	some
2 min	same	More small clumps.
2 min 30 sec	Almost worm dirt Stocking to sides of bowl friable soil	Powdery some clumps Still powdery, starting to become moist.
3 min 30 sec	Worm Dirt, clods stuck to the sides	same
4 min	Good worm Dirt	Moist Soil, starting to form small balls
5 min	Friable, moist worm Dirt Sides Hard packed	Uniform loose soil. Can Squeeze to a moist soil ball

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Mix #5 Another Hobart Speed Mix

Will the exact same mix:

294 g 20% AB @ 20% solids
100 g $Ca(OH)_2$
add and mix low speed for 5 min.
850 g Flyash
mix at speed #2 which is the medium speed.

Mixing Time	Mixer #3 (medium speed #2)
30 sec	Dry powder, some small clumps
1 min	Still mostly powder, some soil clumps
2 min	More clumps, starting to clay to sides less powder
2 min 45 sec	Center worn dirt, Clay to sides
3 min 30 sec	Sides fell off. Mostly worn dirt clumps
4 min	larger clumps, worn Dirt, sides cleaned off.
4 min 30 sec	Clay clumps
5 min	Clay, large clumps. Friable clay, breaks in pieces or clumps.

Long term cure:

2.5 hrs ~ Like mix #1 mixer #1, slightly warm to touch. One clump, but with slight pressure breaks apart. Small dia particles.

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Specific Gravity of 207 A/B using Mud Balance

From page 100 ~ 207 A/B @ 20% solids S.G = 1.16

x = sludge x(% solids) = solids content
y = water x + y = Total mass

$$\frac{\text{solids}}{\text{Total mass}} = \%\ \text{solids} \qquad \frac{(x)(\%\ \text{solids})}{x+y} = 10\%$$

$$\frac{(x)(588\%)}{x+y} = 10\%$$

$$(x)(.588) = .1x + .1y$$

$$.588x - .1x = .1y$$

$$x = 0.2049y$$

To fill mud balance:
x = 40.0g
y = 195 ml

MUD BALANCE
207 A/B @ 10% solids S.G = 1.075

$$\frac{(x)(588)}{x+y} = .30$$

$$.588x - .3x = .3y$$

$$x = 1.042y$$

To fill mud balance:
x = 135.5g
y = 130ml

MUD BALANCE
207 A/B @ 30% solids S.G = ~~1.0~~ 1.23 TM 1-31-95

Robert F. Smith 1/30/95

Rocky FLATS

CLARIFIER PRE-WAC MIXES

These pre-waste Acceptance criteria mixes will evaluate the amount of various pozzolans required to achieve a friable soil mix.

The clarifier will be tested in its "as recieved" state. The clarifier is a thick, non-pourable, will hold a spoon erect when placed in material. Consistency of Pudding or a thick ~~a~~ Wendy's Frosty.

Preformed MUD BALANCE on "As recieved" Material

Result = 1.28 S.G.

For mixes 250 g = ~~[illegible]~~ 195 ml volume

[signature]

2/2/95

CLARIFIER & Hydrated Lime

Mix #1

This test will evaluate the amount of $Ca(OH)_2$, Hydrated lime, required to achieve a friable soil.

Mixture: 250 g Chuckum "as received" Initial Temp = 61.8°F
Initial Volume = 195 ml

Add: Will add 25 g increments of Hydrated Lime in Hobart on low speed

Lime added		Observations
25g	(25g Total)	Cookie dough, thick pasty
25g	(Total added 50g)	Dry cookie dough
25g	(Total added 75g)	Fudge, very stiff, sticking to sides
25g	(Total added 100g)	Sticking to side, clay
25g	(Total added 125g)	Beginning to ball up to a firm cookie dough
25g	(Total added 150g)	Bread dough, balled up
25g	(Total added 175g)	Clay, beginning to dry and break up
25g	(Total added 200g)	Hanging on to mixer blade, drying up. Dense clay
25g	(Total added 225g)	Moist friable soil, Medium curd Worm Dirt Good clumpy soil.
25g	(Total added 250g)	Small curved Worm Dirt, would stop here as a good friable soil, but will continue to see what happens. Note Took 40 min to get here. Temp = 62.4°F
25g	(Total added 275g)	Small, more round worm dirt, beginning to look dry.
25g	(Total added 300g)	Same
25g	(Total added 325g)	Small round, uniform, hard pellets, Took 53 min of mixing add adding to get here

Final Temp = 61.4°F
Final Volume = 650 ml

2/2/95

Flyash added (Cont.)	Observations (Cont.)
50g (total added 600g)	Smaller clay ball, more Round ½" dia Large Coarse worm dirt.
50g (total added 650g)	Worm Dirt, medium size round balls still moist looking. Good Friable Soil. 1hr 15 min to get to this point
50g (total added 700g)	Same, slightly clearer, rounder balls. Looks like Deer droppings.
50g (total added 750g)	Smooth round balls, still sticking together slightly. Almost pellets.
50g (total added 800g)	Really close, Like moist pellets.
50g (total added 850g)	Pellets, small round Hard 1 hr. 30 min mixing time. Final Temp = 61.5°F Final volume = 1000 ml

Clarifier & Lime w/ Flyash

Mix # 2

This test will ~~test~~ evaluate the amount of flyash, Type C, which is added to Clarifier and 5% by weight of Hydrated Lime to create a friable soil consistency.

mixture: 250 g Clarifier "as received"
12.5 g Hydrated lime
Initial Temp = 61.0 °F
Initial volume = 195 ml

Addition: Will add 25 g ~~###~~ increments of type C flyash in the hobart on low speed.

Flyash added	Observation
25g (Total added 25g)	Smooth icing or cookie dough.
25g (Total added 50g)	Very thick cake icing, sticking to sides
25g (Total added 75g)	Thick mound, smooth cookie dough
25g (Total added 100g)	Smooth thick ~~cake~~ cookie dough, stick to sides
25g (Total added 125g)	Very sticky smooth very thick cake icing.
25g (Total added 150g)	Fudge consistency. Sticks to sides.
25g (Total added 175g)	Very thick smooth, stick to sides
25g (Total added 200g)	Same
25g (Total added 225g)	Still sticking. Very thick
25g (Total added 250g)	Cookie dough. Just begging to pull away from sides
25g (Total added 275)	SAME
25g (Total added 300)	Same
25g (Total added 325g)	Beg'g to pull off sides to form clay
25g (Total added 350g)	Bread dough. After 25g more observation
50g (Total added 400g)	Bread dough formed one ball
50g (Total added 450g)	Clay, one ball, beginning to break apart.
50g (Total added 500g)	Clay, hard, stiff. Drying out.
50g (Total added 550g)	Clumpy moist soil or clumpy clay balls (1" dia.)

SEE PAGE 192

2/2/95

CONT

Flyash	Silica Flour	Total	Observation
45.4g	8g	(926.4/126 = 854.4)	Small curd worm dirt Small curd still sticky to touch
45.4g	8g	(771.8/136 = 907.8)	Almost pellets
45.4g	8g	(817.2/144 = 961.2)	pellets, small ● round clean hard, Took 53 min to get here.

Final Temp = 61.2°F
Final Volume = 1000 ml

CLARIFIER w/Lime, Flyash & Silica Flour

Mix #3

This test will evaluate the amount of flyash and fine silica flour (SSA-1) at a ratio of 5.67:1 is need to be added to clarifier sludge with 5% ~~sludge~~ lime by weight.

mixture: 250 g Clarifier sludge "as delivered"
12.5 g Hydrated lime

Initial Temp = 60.0°F
Initial Volume = 195 ml

Addition of flyash and silica flour in a 5.67:1 ratio or 45.4 g Flyash & 8 g silica flour until a friable soil is achieved.

Flyash	Silica Flour	Total	Observations.
45.4g	8g	(45.4/8 = 53.4g)	Thick, smooth, cake Icing, sticking to sides
45.4g	8g	(90.8/16 = 106.8g)	Cookie dough, smooth sticking to sides
45.4g	8g	(136.2/24 = 160.2g)	Same
45.4g	8g	(181.6/32 = 213.6g)	Dry cookie dough
45.4g	8g	(227/40 = 267g)	Forming bread dough, coming off sides
45.4g	8g	(272.4/48 = 320.4g)	Bread dough
45.4g	8g	(317.8/56 = 373.8g)	Bread dough one ball.
45.4g	8g	(363.2/64 = 427.2g)	Dry bread dough or Clay
45.4g	8g	(408.6/72 = 480.6g)	Begging to break up. Couple clay pieces
45.4g	8g	(454/80) = 534g)	Large clay clumps
45.4g	8g	(499.4/88) = 587.4g)	Large curd worm dirt, Friable clay balls
45.4g	8g	(544.6/96) = 640.8g)	Good Worm Dirt, mix time 34 min, medium size curd. Sort of sticky
45.4g	8g	(590.2/104 = 694.2g)	Round, smooth ball, clean small curd worm dirt.
45.4g	8g	(635.6/112 = 747.6g)	Like deer droppings, Still slightly sticky
45.4g	8g	(681/120 = 801g)	Almost Pellets

See page 194

[signature]

2/2/95

Flyash	Cement	Total	observation
30g	15g	(480/240 = 620g)	medium size curd worm dirt, sticky
30g	15g	(510/255 = 665g)	same.
30g	15g	(540/270 = 710g)	Small round curd worm dirty, still slightly sticking to its self. Like deer droppings.
30g	15g	(570/285 = 755g)	- Close to pellets.
30g	15g	(600/300 = 900g)	Pellets, Round, small & hard Pellets Time to get here 59 min

Final Temp = 61.0 °F
Final Volume = 900 ml

CLARIFIER w/ Lime, Cement & Flyash

Mix #4

The test will evaluate the amount of Flyash and Cement, at a ratio of 2 to 1, is need to be added to the Clarifier with 5% by weight of Hydrated Lime, until the desired consistency is achieved.

mixture:

250 g Clarifier sludge "as received"
12.5 g Hydrated lime.

Initial Temp = 61.6°F
Initial Volume = 195 ml

addition of Cement and flyash at a 1/2 ratio. Incremental addition w 15 g cement and 30 grams flyash until a smooth soil is achieved.

Flyash	Cement	total	Observation
30 g	15 g	(30/15 = 45 g)	Thick, smooth cake Icing, sticking to side.
30 g	15 g	(60/30 = 90 g)	Cookie dough, smooth, sticking to sides.
30 g	15 g	(90/45 = 135 g)	Same
30 g	15 g	(120/60 = 180 g)	Dry cooking dough. Stuck to sides
30 g	15 g	(150/75 = 225 g)	Smooth dry packed on sides
30 g	15 g	(180/90 = 270 g)	Bread dough
30 g	15 g	(210/105 = 315 g)	moist Bread dough, sticking to sides
30 g	15 g	(240/120 = 360 g)	Bread dough, one ball
30 g	15 g	(270/135 = 405 g)	Same
30 g	15 g	(300/150 = 450 g)	Clay, one ball
30 g	15 g	(330/165 = 495 g)	very large clay chunks, broke up.
30 g	15 g	(360/180 = 540 g)	large (~1") clay chunks.
30 g	15 g	(390/195 = 585 g)	Medium size brown soil chunks
30 g	15 g	(420/210 = 630 g)	Worm Dirt, Approx 38 mm. Friable Soil
30 g	15 g	(450/225 = 675 g)	Good size, cured worm dirt, still slightly moist.

2/2/95

207C Specific Gravity Study

Because of large batch of 207C @ 1.7 S.G. (prepped 1-4-95), as rec'd material may have slightly altered S.G.

Run mud balance analysis of as rec'd material.
S.G. = 1.98

Goal: Determine calculations to dilute 207C @ 1.98 to S.G. of 2.0, 1.75, and 1.5.

- Because 207C as rec'd is S.G. = 1.98, no dilution is possible to get S.G. = 2.0. Use as rec'd material @ 1.98 ~~as~~ 2.345 in place of S.G. = 2.0 in WAC mixes.

Calculation:

$X \equiv$ mass of 207C @ 1.98 (grams)
$Y \equiv$ mass of AB water (grams)
$Z \equiv$ goal specific gravity

Assume S.G. of AB water is 1.0.

$$\frac{X+Y}{(X/1.98)+Y} = Z$$

$$X + Y = \frac{ZX}{1.98} + ZY$$

$$X\left(1 - \frac{Z}{1.98}\right) = Y(Z-1)$$

$$X = Y\left(\frac{Z-1}{1-\frac{Z}{1.98}}\right)$$

201

T. E. Mullaney

2-3-95

199

For S.G. = 1.75 :

$x = 6.457y$

For S.G. = 1.5 :

$x = 2.062y$

Check of calculation by mud balance :

Mud balance cup volume = 218 ml

S.G. = 1.75 : $x = 330.3$ g
$y = 51.2$ g = 51.2 ml

mud balance reading : 1.75

S.G. = 1.5 : $x = 220$ g
$y = 106.7$ g = 106.7 ml

mud balance reading : 1.50

% solids check :

@ 1.98
x = 57.2g
y = 0g
TARE = 146.3g
INIT = 203.5g
FINAL = 193.5g
% solids = 82.5%

@ 1.75
x = 46.6g
y = 7.2g = 7.2 ml
TARE = 146.2g
INIT = 200.3g
FINAL = 184.5g
% solids = 70.8%

@ 1.5
x = 55.1g
y = 26.7g = 26.7 ml
TARE = 145.8g
INIT = 227.8g
FINAL = 192.0g
% solids = 56.3%

D. E. Mulcahy

2-3-95

LABORATORY LOG BOOK

P025-95

ROCKY FLATS

- 207 A/B WAC
- PART OF CLAR. WAC

1/30/95 Thru 2/7/95

NUS

025-45 Rocky Flats

TITLE Rocky Flats

PROJECT NO. 207 A/B

BOOK NO. WAC

Work continued from Page

These 207 A/B Waste Acceptance Criteria mixes will test a variety of additives at varing % solids waste stream and various W/P ratios.

This group of mixes will test the addition of TYPE C Flyash to 207 A/B with hydrated Lime.

10% solids mix

$$\frac{(X)(58.8\%)}{X+Y} = 10\%$$

$$(X)(.588) = .1X + .1Y$$

$$.558X - .1X = .1Y$$

$$X = 0.2049Y$$

X = 50g 207 A/B "as received"
Y = 244 ml 207 A/B water

20% solid mix

X = 100g
Y = 194 ml

30% solids mix

$$\frac{(X)(.588)}{X+Y} = .30$$

$$.588X - .3X = .3Y$$

$$X = 1.042Y$$

X = 150g
Y = 144 ml

Work continued to Page

SIGNATURE		DATE
		11/30/95
DISCLOSED TO AND UNDERSTOOD BY	DATE	WITNESS	DATE

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Book No.
P176-94

PROJECT NO.
BOOK NO.

2-1-95

48 hour UCS test of 207A mixes made 1-30-95.

BATCH ID	WT (g)	LB_F	PST	% solids
1	351.9	1280	408	10
2	390.4	>2000	>637	10
3	373.5	>2000	>637	10
4		*		
5	337.7	715	228	20
6	373.8	>2000	>637	20
7		*		
8	336.3	715	228	30
9	288.4	174	55.4	30

PSI calc. = LB_F/area, area = 3.14

* cylinders broke during removal from mold

drawings of cylinders on pg 62

TITLE Rocky Flats

PROJECT NO.

BOOK NO.

Work continued from Page

Lime & Flyash Mixes

WAC TESTING

Mix #1 — 207 A/B @ 10% solids @ 0.24 w/p

50 g = 207 A/B "as received" (58.8% solids)

244 ml = 207 A/B water

Initial volume = 275 ml

Initial Temp. = 59.4 °F

Thin, fluid, pourable

113 ~~100~~ g = Hydrated Lime $Ca(OH)_2$

Temp. = 58.1

observation = Fluid, pourable, Liquid

991 g = Flyash mixed on speed #2

material turned to clumpy powder for 1 min then turned to a clumpy soil mix. Let mix for 2 min 30 sec.

A lot of packed material on side of bowl and clumpy clay in middle. Didn't run Final volume.

Packing Cylinder. Very clumpy and dry. Lots of voids, UCS

Zip lock bag for Analysis - Dry soil, clumpy, Just like dirt, Hard, Snaps with finger pass ath dynamic.

Submitted material for TCLP

Paint Filter Liquids Test

Bulk Density

LABLE: 013095-1-207A/B

5 hrs cure; Individual clumps pennies very hard

P299756 & P299757

Work continued to Page

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DATE 11/30/95

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Copied from: P176-94
Book No.

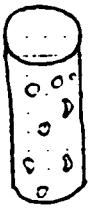
52

1

fractured

full cylinder
some small voids
crushed pea size hardness

2



no failure

full cylinder
very smooth and solid
voids of air pocket variety and few

3

no failure

full cylinder
very smooth and solid
few air pockets

4

UCS test not run

not a full cylinder, ends crumbled when taken out of mold, reduced in size to approx. 2" x 2"
sandstone consistency

5

chipped top
internal failures

full cylinder
generally small voids
cement-like appearance

6

no failure

full cylinder
air pocket voids only
very smooth and solid

7

UCS test not run

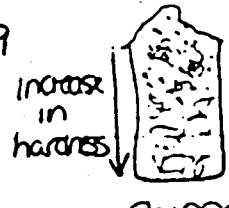
not a full cylinder, broke during removal from mold
very gritty
reduced in size to approx. 1" x 2"

8

bulged on top

full cylinder
crushed pea-size hardness
uniform sized balls
well packed on bottom 3/4 of cylinder

9



chipped top

full cylinder
sandstone consistency
a few horizontal crack-type voids

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #2 207 A/B @ 10% solids @ 0.28 w/p

207 A/B "as received" = 50 g
207 A/B water = 244 ml

Initial Temp = 59.3°F
Initial Volume = 275 ml

Hydrated Lime = 113 g

Temp = 57.4 °F
observation: Flat, pourable, liquid.

Flyash = 833 g

mixed on speed #2 for a total of 2 min 30 sec. After 30 sec. turned to warm dirt. Then after 1 min turned to clay or bread dough. ~~Fried~~ Material balled up and tried to get out of bowl. Could not run final volume.

Packing cylinder – formed a solid block or packed in like clay moist.

Zip lock bag – Molding clay, one ball or clump
Submitted for TCLP, PFLT, Bulk Density
LABLE: 013095-2-207A/B
5 hrs cure: very hard monolith block. Can't even brake on table.

P299758

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Work continued to Page

SIGNATURE Robert F Smith

DATE 1/30/95

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TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #3 207A/B @ 10% solids @ 0.34 W/P

Material Mix:

207A/B "as received" = 50g
207 A/B water = 244 ml

> Initial Temp = 56.3°F
> Initial Volume = 275 ml

Hydrated Lime = 113g — Mixed in Hobart, low speed for 5 minutes. Temp = 56.5°F

Flyash TYPE C = 667g — Mixed in Hobart, medium speed

ADDITIONS: OBSERVATIONS

207A/B @ 10% is a fluid, pourable, watery liquid. Addition of Lime makes a smooth, very thin, fluid, pourable. Observation as time. Flyash added in on dries:

Initial - turned to warm dist quickly
15 sec = large clay chunks
1 min = Cookie dough, sticking to sides of bowl
2 min 30 sec = smooth, clay, moist, stiff.

Could not do a volume test because not able to pour out of bowl into graduated beaker.

Packed cylinder by bouncing on table. No voids packed tight.
LABLE = 0130T5-3-207A/B

4.5 hr cure: very hard monolith. Was to touch. Can't break with hands.

P299759 & P299760

Work continued to Page

SIGNATURE

DATE 1/30/04

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix # 4 207 A/B @ 20% solids @ 0.24 w/p

MIXTURE:

207 A/B "as received" = 100 g
207 A/B water = 194 ml
> Initial Temp = 56.2 °F
Initial Volume = 260 ml

Hydrated Lime = 100 g — Mixed in Hobart, low speed for 5 minutes. Temp = 58.1 °F

Flyash Type C = 900 g — Mixed in Hobart on medium speed.

Additional observations:

207 A/B @ 20% solids is a thick, powdery liquid. Addition of lime created a thin milkshake consistency. Added Flyash

Initial — powder, dry
15 sec — powder, some small moisture clumps.
1 min — Soil, beginning to stick to sides of bowl
2 min = more soil clumps, small in size, still alot like powder
2 min - 10 min = Scraped sides which were hand packed and created a dirt like material. Clump in hand like a ball which breaks up easily.

Volume packed: Loose pack = 1300 ml
Packed Volume = 957 ml

P299761 & P299762

Packed cylinder looked like packed soil.
LABLE = 013095-4-207A/B
4 hr cure: some small hard pellets, some powder core.

Work continued to Page

SIGNATURE

DATE 1/20

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.
BOOK NO.

Work continued from Page

Mix #5 207 A/B @ 20% solids @ .28 w/p

mixture:

207 A/B "as received" = 100 g
207 A/B water = 194 ml

> Initial Temp = 60.5 °F
Initial Volume = 260 ml

Hydrated lime = 100 g — mixed in Hobart for 5 min on low speed. Temp = 61.0 °F

Flyash Type C = 750 g — mixed in Hobart on medium speed (#2).

Addition observations:

207 A/B w/ Lime consisting of smooth thin milkshake
Addition of flyash in one dump. Observation w/ Time
Initial → powder w/ some moist clumps
30 sec → striking to sides, powder w/ small clumps
1 min → clumpy moist soil, w/ powder.
2 min → clump soil. Pack side of bowl
2 min 30 sec → Two types of material: Center of bowl is clumps of soil, friable clay clumps. & Sides of bowl a hard pack friable flat soil pack. Combined formed a moist soil.

Volume preformed. ~~(Packed cylinder before removal to take volume)~~.
Loose Pack = 1200
Packed = 600

Made a cylinder. Like packed dirt

3.5 hrs cure = Various size particles from powder to quarter size chunks. Like Dryed worm dirt. Looks very good compared to others.

P299763

Work continued to Page

SIGNATURE [signature] DATE 1/30/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #6 207 A/B @ 20% solids @ 0.34 W/P Ratio

Mixture:

207 A/B "as received" = 100g
207 A/B water = 194 ml

> Initial Temp = 60.0°F
Initial Volume = 208 ml

Hydrated Lime = 100 g

Mixed in Hobart on Low for 5 min. Temp. = 61.0°F

FLYASH TYPE C = 600 g

Mixed in Hobart on medium speed setting #2.

Additional observations:

207 A/B w/ Low consistency of smooth pourable thin milkshake. Flyash added and mixed in Hobart on above mode:

Initial → large soil clumps, stuck to sides quickly.
15 sec → Moist clay/soil clumps.
1 min → Moist soil or clay heavy side pack
1 min 30 sec → moist clay.
2 min → Bread dough, stiff clay. Climb out of bowl
2 min 30 sec → Clay, molding clay.

Did not perform volume check because not a pourable or loose product.

Packed a cylinder into a non-void monolith. easily.

3 hrs Cure: Hard monolith's very hard block.

P299764 & P299765

Work continued to Page

SIGNATURE

DATE 1/28/04

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #7 207 A/B @ 30% solids @ 0.24 w/p

mixture:

207 A/B "as recieved" = 150 g
207 A/B water = 144 ml

> Initial temp = 59.1 °F
Initial volume = 240 ml

Hydrated Lime = 87 g

mixed on low speed for 5 min
Temp = 61.1 °F

FLYASH TYPE C = 771 g

mixed in Hobart on medium speed. ~~for~~

Addition observation: ~~Fotor~~

207 A/B at 30% solids is a pourable, fluid, liquid, like a very thin milkshake. Addition of Lime created a Thick cake icing consistency. Not pourable, stiff. Addition of flyash

Initial → Pellets imediately
15 sec → breaking down to some pellets; dirt.
1 min → Dry powder or dirt consisting
2 min → some ~~[illegible]~~ clumps. Sticking to side
2 min 30 sec → Two materials; powder or slightly moist dirt in center; walls of bowl caked with soil, able to scrap off w/ finger.

Volume Loose = 1250 ml
Volume Packed = 828 ml (packed by bouncing on table)

P299766 & P299767

2.5 hrs cure: powder.

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Work continued to Page

SIGNATURE			DATE
[signature]			1/20/95
DISCLOSED TO AND UNDERSTOOD BY	DATE	WITNESS	DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #8 207 A/B @ 30% solids @ 0.28 w/p

mixture:

207 A/B "as Received" = 150 g → Initial Temp = 58.4 °F
207 A/B water = 144 ml → Initial Volume = 240 ml

Hydrated Lime = 87 g — mixed on low speed 5 min
Temp. = 60.8 °F

Flyash Type C = 649 g

Mix on Med. speed #2

Addition observations:

207 A/B at 30% solids is a ~~thick~~ very thin milkshake consistency.
Addition of Lime created a thick cake icing consistency.
Not pourable. Addition of Flyash.

Immediate → Clumpy soil.
15 sec → ~~wet~~ ?
1 min → Moist clumpy soil
2 min 30 sec → Warm Dirt. med. coarse moist.

Volume loose = 1000
Volume Packed = 500 — packed by banging on table

2 hrs cure: ~~Dirt~~ warm dirt, Looks like mix #5, moist warm dirt.

P299768

Work continued to Page

SIGNATURE

DATE 1/20/15

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #9 207 A/B @ 30% solids @ 0.34 w/p

mixture:

207 A/B "as Received" = 150 g
207 A/B water = 144 ml

Initial Temp = 60.4 °F
Initial volume = 240 ml

Hydrated Lime = 87 g

mixed in Hobart on low for 5 min Temp = 61.8 °F

Flyash Type C = 519 g

mixed on Speed #2

Addition observations:

207 A/B @ 30% solids is a fluid, liquid, pourable liquid. Addition of Lime provided a thick non pourable material. Addition of flyash.

Immediate → uniform pea-size chunks
15 sec → began to brake down to moist soil.
30 sec → Moist soil some clumps, like moist powder
1 min → moist some chunks
2 min → Hard pack on side of bowl. Loose material in center. Moist Dirt.

Volume loose = 1000 ml
Packed Volume = 662 ml

1 hr cure: clumps, some powder & clumps. wide range of particle sizes.

P299769 & P299770

SCIENTIFIC BINDERY PRODUCTIONS 1111 SOUTH WABASH AVENUE CHICAGO ILLINOIS 60605

Work continued to Page

SIGNATURE [signature] DATE 1/30/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

Second Round of WAC MIXES

Z07 A/B mixed with
Hydrated Lime at 5% by weight
Flyash and fine Silica flour (SSA-1)
at a ratio of 5.67 flyash to
1 part silica flour.

Lime added in Hobart, Low speed for 5 min

Flyash & SSA-1 added in Hobart, med. speed for 2 min 30 sec.

Volume cylinder = $V = \frac{d^2}{4}\pi h$

$= \frac{(5.06\text{ cm})^2}{4}\pi (10.16) = 206\text{ ml}$

Ratio: $\frac{109\text{ ml}}{206\text{ ml}} = \frac{x\text{ ml}}{1600\text{ ml}}$

cylinder = Total volume

Packed cylinder Volume $h = 2.125" = 5.398$ cm

$\frac{(5.09)^2}{4}\pi (5.398) = 109.4$

TITLE Rocky Flats

PROJECT NO.

BOOK NO.

Lime, Flyash, Silica Flour Mixes

Work continued from Page

Mix #1A 207 A/B @ 10% solids @ .20 w/s

mixture:

50 g	207 A/B Sludge "As Received" (58.8% solids)
244 ml	207 A/B water
14.7 g	lime, Hydrated $Ca(OH)_2$
1126 g	Flyash, Type C
199 g	Silica flour, fine SSA-1

Mixing observations: 207 A/B @ 10% solids is a pourable, fluid, like colored water. Initial Temp = 57.0°F

Initial Volume = 275 ml

5% Lime addition still very fluid, liquid. Temp = 57.7°F 5 min mixed on slow Hobart speed.

Addition of the Flyash and Silica flour (5.67 to 1 ratio). Observations during mixing:

5 sec → moist soil clumps in powder

30 sec → small soil clumps, still fluffy

1 min → sticking to sides, very small curd worm dirt.

1 min 30 sec → Packed on sides w/ large curd worm dirt in center

2 min 30 sec → Hard pack on sides, large soil clumps in center

Volume loose = 1600 ml

Volume packed = 850 ml (bouncing cylinder on table)

NOTE: There are still some voids in mix.

Bounce packed a cylinder and placed remaining material in zip-lock bag for analysis submittal.

LABLE: 013195-1A-207A/B

P299925

P299926 (TCLP)

Work continued to Page

SIGNATURE

DATE 1/31/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

Copied from:
LAB BOOK NO:
P176-94

2-2-95

48 hour UCS test of 207A/B mixes made 1-31-95

batch ID	wt(g)	LBF	PSI	%solids
1 A	388.7	1281	408	10
2 A	414.1	>2000	7637	10
3 A	394.4	>2000	>7637	10
4 A	374.1	797	254	20
5 A	397.8	>2000	>7637	20
6 A	392.5	>2000	>7637	20
7 A		*		
8 A	321.2	214	68.2	30
9 A	386.2	>2000	>7637	30

PSI calc. = LBF/area, area = 3.14

* cylinder broke during removal from mold

drawings of cylinders on pg. 64

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #2A 207A/B @ 10% @ 0.25 L/P ratio

mixture:

50 g 207A/B Sludge "as received"
244 ml 207A/B water
14.7 g Lime, Hydrated
901 g Flyash, TYPE C
159 g Silica flour, SSA-1

Mixing observation: 207A/B @ 10% slide very fluid water. Initial Temp = 57.2°F
Initial Volume = 275 ml

5% Lime addition still very fluid, liquid. Temp = 57.7 °F

Addition of the Flyash and Silicaflour (5.67 to 1 ratio) and placed in Hobart on med. speed #2 and observed over time.

mixing duration: 5 sec → Clay chunks, large
30 sec → Bread dough, one ball
1 min → Bread dough, starting to break up dry at slightly
1 min 30 sec → Stiff clay
2 min 30 sec → molding clay.

volume loose → Clay ball, or chunk 900 ml
volume Packed → No voids 650 ml

Note Packed using rubber end tamper.

Packed cylinder and put remains in zip lock bag for analysis
Label: 013195-2A-207A/B

P299927

Work continued to Page

SIGNATURE [signature] DATE 11/30/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

Copied from: LAB Book No.: P176-44

batch ID	illustration	type of failure	description of cylinder consistency
1		hairline crack top bulged	crushed pea size hardness density appears greater toward bottom more voids occur at top cement-like appearance
2		did not fail	very smooth and solid air pockets generally nonexistent, no other voids
3		did not fail (some chipping occurred)	very smooth and solid air pockets generally nonexistent, no other voids
4		large crack ran approx. 1/3 of the way down, also small hairline fractures occurred	gritty appearance and texture few and small voids
5		did not fail (chipping occurred, lgst. ~ 3/4 inch)	somewhat smooth and solid density appears greater toward bottom air pockets more abundant but small
6		did not fail (chipping occurred, surface cracking)	very smooth and solid air pockets generally nonexistent, no other voids
7		during removal from mold	very gritty and dry reduced in size by approx. 1" density much greater at bottom
8		large amount of chipping and cracking (lgst. chip ~ 3" long)	gritty appearance and texture small and numerous voids density much greater at bottom
9		did not fail (chipping; surface cracking)	very solid many small air pocket voids clumped appearance on top

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix *3A 207 A/B @ 10% @ 0.30 w/p ratio

mixture:

50 g 207 A/B sludge "as received"
244 ml 207 A/B water
14.7 g Lime, Hydrated
751 g Fly ash, TYPE C
132 g Silica Flour, SSA-1

mixing observations: 207 A/B @ 10% is like coloredwater. Initial Temp = 58.8°F
Initial volume = 275 ml

5% Lime addition: Slightly thicker Temp. = 59.8°F

Addition of flyash and Silica flour (5.67 to 1 ratio) and placed in Hobart at med speed #2 and observed over mixing time.

mixing time 30 sec → Cake Icing
1 min → Same
2 min 30 sec → smooth cake icing

Packed Volume = 650 ml NOTE: mixt easily packed dry No voids.

LABLE: 013195-3A-207A/B P299928
P299929 (CLCP)

Work continued to Page

SIGNATURE

DATE 1/31/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

free space

$h = 3.81$ cm or 6.35 packed height

$$V = \frac{(5.08)^2}{4}\pi\left(\cancel{}\ 6.35\right) = 128.7$$

$$\frac{129}{210} = \frac{X}{1450}$$

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #4A 207 A/B @ 20% solids @ .20 w/p ratio

mixture:

100 g 207 A/B sludge "as received"
194 ml 207 A/B water
14.7 g Hydrated Lime
999 g Type C Flyash
176 g Fine Silica Flour, SSA-1

mixing observations: 207 A/B at 20% solids is a fluid ~~5.29~~
5% Lime addition

Addition of silica flour and flyash (ratio of 1 to 5.67), placed in Hobart at medium speed #2 and observed over time.

mixing time 30 sec → powder some small clumps
1 min → Sticking to sides. Some small soil clumps.
2 min 30 sec → moist dirt, like Brown Sugar

Loose volume = 1450 ml
Packed volume = 889 ml

LADLE? 013195-4A-207A/B

P299930
P299931 (TCLP)

Work continued to Page

SIGNATURE

DATE 1/31/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #5A 207 A/B @ 20% solids @ .25 w/p

mixture:

100g 207 A/B sludge "as received"
194 ml 207 A/B water
14.7g Hydrated Lime
799g Flyash, Type C
141g Silica flour = SSA-1

mixing observation =

207 A/B at 20% solids of fluid. Initial Temp = 60.5°F
Initial Volume = 260 ml

Addition of Lime gives same fluid consistency Temp = 59.5°F

The flyash and silica flour added and observed over mixing time. 5 sec → large soil clumps
30 sec → Clinging to sides. Side pack with center of bowl worm dirt consistency.
1 min → large soil clumps in middle, sticking to sides
2 min → Sides starting to pull off and make one uniform mix.
2 min 30 sec → Medium size (~1"-.5" dia) clumps. Good mix. NOTE: This mix looks like the pre-wac mixes when it we let it mix a little longer would turn to round balls then hard pellets.

Volume loose = 1300 ml
Volume Packed = 600 ml

Lab Lk: 013125-5A-207 A/B P299932

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Work continued to Page

SIGNATURE [signature] DATE 1/31/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix 6A — 207 A/B @ 20% solids @ .30 #/f

Mixture:

100 g 207 A/B sludge "as delivered"
19.4 ml 207 A/B water
14.7 g Hydrated lime
66.5 g Flyash
11.8 g Silica flour, SSA-1

Mixing observations:

207 A/B at 20% solids is fluid. Initial Temp = 60.5 °F
Initial Volume = 260 ml
Addition of Lime → same fluid, water consistency Temp = 59.5°F

The flyash and silica flour added & mixed and observed over many period:

5 sec → Clay ball
30 sec → Bread dough
1 min → Stretchy clay
2 min 30 sec → Molding clay consistency.

Clay can only get a packed volume

Packed Volume = 600 ml

Label: 013195-6A-207A/B

P299933
P299934 (TCLP)

Work continued to Page

SIGNATURE			DATE 1/31/95
DISCLOSED TO AND UNDERSTOOD BY	DATE	WITNESS	DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #7A 207A/B @ 30% solids @ .20 w/p ratio

mixture:

150 g 207A/B Sludge "As Received"
144 ml 207A/B water
14.7 g Hydrated lime
875 g Type C Flyash
154 g Silica flour, SSA-1

mix observation:

207A/B at 30% solids is a pourable, fluid, like ~~chocolate~~ milk consistency

Initial Temp = 58.1 °F
Initial Volume = 240 ml

Addition of 5% lime → fluid, liquid only slightly thicker

Temp = 59.0F

Addition of flyash and silica flour (5.67 to 1) and mixed in Hobart for 2 min 30 sec on medium speed.

mixed @ 5 sec → material flys around, but looks like fine pea-size soil clumps in the powder

30 sec → small clumps mostly powder

1 min → sticking to sides in a dry paste or packed Dirt.

2 min → Alot of material on sides, most powder in center

2 min 30 sec. → moist powder

Loose volume = 1350 ml
packed volume = 821 ml

LABLE: 013195-7A-207A/B

PZ99935
PZ99936 (TCLP)

Work continued to Page

SIGNATURE

DATE 1/31/85

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

mix #7A

$1.5" = 6.35cm$

$V = \frac{(5.01)^2}{4}\pi(6.35) = 127.7-$

$\frac{128}{210} = \frac{x}{1350}$

mix #A

$\frac{128}{210} = \frac{x}{1100}$

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix # 8A 207 A/B @ 30% solids @ .25 w/p ratio

Mixture:

150 g 207 A/B sludge "as delivered"
144 ml 207 A/B water
14.7 g Hydrated Lime
700 g Type C Flyash
129 g Silica flour, SSA-1

Mix observation:

207 A/B at 30% solids fluid, thickness of milk. Temp = 56.4 °F
Volume = 240 ml

Addition of 5% lime by weight cause very little change in the material consistency, still fluid, liquid.
Temp. = 57.9 °F

Addition of flyash and Silica flour (5.67 to 1) added and mixed for 2 min 30 sec on ~~[illegible]~~

mixed for 5 sec → Round soil balls in rapidly mixing powder.

30 sec → Sticking to sides of bowl. Powder & small moist Dirt balls in center.

1 min → Mostly just moist powder

2 min 30 sec → Alot of material on sides. Some small moist balls, mostly powder.

Loose volume = 1100 ml
Packed volume = 670 ml

LABLE: 013195-8A-207A/B P299937

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Work continued to Page

SIGNATURE [signature] DATE 1/31/95

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #9A 207 A/B @ 30% solids @ .30 w/p ratio

Mixture:

150 g 207 A/B sludge "as delivered"
144 ml 207 A/B water
14.7 g Hydrated Lime
583 g Flyash, TVA C
103 g Fine Silica flour

Mix Observation:

207 A/B at 30% solids is fluid, consisting of milk. Temp = 59.3°F
Volume = 240 ml

Add Lime at 5% by weight consisting of milk to very thin milkshake.
Temp = 59.4°F

Addition of flyash and silica flour at rate of 5.67 to 1.
Observation over mixing time)

mixed for 5 sec → Powder turned quickly to balls bouncing around in bowl.

30 → Dry worm dirt - pea size balls, some sticking to sides

1 min → Moist worm dirt, med. size balls. Sticking to sides of bowl.

2 min 30 sec → Worm dirt with packed soil on sides walls. Angular curd balls not uniform.

Loose Volume = 1000 ml
Packed Volume = 500 ml

Lable: 013195-9A-207A/B

P299938
P299939 (TCLP)

Work continued to Page

SIGNATURE

DATE 1/31/85

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

Copied from:
LAP Book P174-94

2-3-95
48 hour UCS test of 207A/B mixes made 2-1-95

baton ID	wt(g)	LBF	PSI	% solids
1	381.1	822	262	10
2	408.9	>2000	>637	10
3	406.1	>2000	>637	10
4			*	
5	382.7	1240	395	20
6	406.8	>2000	>637	20
7	346.9	512	163	30
8	360.5	338	108	30
9	353.5	697	222	30

PSI calc. = LBF/area, area = 3.14

* cylinder broke during removal from mold

drawings of cylinders on pg 66

$V = (6.75)\pi \frac{5.00}{4}$

$\frac{129}{210} = \frac{x}{1750}$

TITLE Rocky Flats

PROJECT NO.

BOOK NO.

Work continued from Page

207A/B w/ Lime, Cement, & Flyash

Mix #1B 207A/B @ 10% solids @ .20 W/P

Mixture: 50g 207 A/B sludge "as received"
244 ml 207 A/B water
14.7 g Hydrated Lime
883 g Flyash, Type C
442 g Cement, TYPE I/II

Mix Observation:
207 @ 10% solid Initial Temp = 58.1 °F
Initial Volume = 275 ml
Add 5% by weight of Lime: Very thin pourable fluid like water. Temp = 57.7 °F

Addition of Portions at .20 of a ratio of 2-Flyash to 1-Cement.
Observation of mix in Hobart at speed #2.
Mixing 5 sec → Clumps pea-size of moist particals flying around with powder
30 sec → Powdery - small clumps and starting to stick to sides of bowl in packed Dirt consistency
1 min → Moist powder or Dirt
2 min → Moist Dirt, some side stickage
2 min 30 sec → Moist Dirt consistency. Able to squeeze in hand to form ball which breaks apart with very little effort. Dry mix.

Volume loose = 1750 ml
Packed volume = 1072 ml LABLE: 020195-1B-207A/B

5 hr Cure; Powder semi moist but able to make it fine powder

Work continued to Page

SIGNATURE Robert Smith DATE 2/1/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

copied from LAB BACK - P174-94

batch ID	illustration	type of failure	description of cylinder consistency
1		cracks on outside, some bulge at top	cylinder not completely full very dry and gritty small air pocket voids, numerous small grain size
2		did not fail small chipping at bottom	full cylinder very smooth and solid air pockets generally nonexistent, no other voids
3		did not fail small chipping at bottom	full cylinder very smooth and solid air pockets generally nonexistent, no other voids
4		during removal from mold	very gritty and dry chips broke off from both top and bottom during removal reduced in size by approx. 1"
5		several cracks along one side, bulge at top	cylinder not completely full solid appearance small air pocket voids larger grain size
6		did not fail some chipping top + bottom	full cylinder very smooth and solid air pockets generally nonexistent, no other voids
7		large amount of cracking and chipping and bulging	cylinder not completely full very dry and gritty small grain size - sandy appearance voids generally nonexistent
8		several hairline cracks	cylinder not completely full broke in half ø thru center during removal very dry, gritty, no real voids
9		several cracks and bulges	cylinder not completely full solid appearance small air pocket voids larger grain size

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix # 2B 207 A/B @ 10% solids @ 0.25 W/P ratio

Mixture: 50 g 207 A/B sludge "as received"
244 ml 207 A/B water
14.7 g Hydrated Lime
707 g Flyash Type C
353 g Cement. Type I/II

Mix observation:

207 A/B @ 10% solids Initial Temp = 58.6°F
Initial Volume = 275 ml

Add 5% by weight of Lime: very thin, pourable, fluid, like water. Temp = 54°F
Mixed in Hobart Low speed for 5 min

Addition of Pozzolans at .25 at a ratio of 2:1 (Flyash : Cement)
Mixed in Hobart on med. speed #2 and observed.

mixing 5 sec → Large clay clumps, dryish looking.
30 sec → Bread Dough
1 min → Stuck Cake Icing.
2 min → very sticky Cake Icing.
2 min 30 sec → Clay, stiff, consistency of Fudge.

Volume Packed = 650 ml Note: can only do packed volume because a clay.

LABLE: 020195-2B-207A/B

5 hr Cure: Hard monolith, can't break with hands. Still looks moist.

Work continued to Page

SIGNATURE

DATE 2/1/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix # 3B 207 A/B @ 10% Solids @ 0.30 w/p ratio

Mixture:

50 g 207 A/B Sludge "as delivered"
244 ml 207 A/B water
14.7 g Hydrated lime
589 g Flyash, Type C
294 g Cement, Type I/II

Mix Observation:

207 A/B @ 10% solids; initial volume 275 ml; Lime addition still very liquid, fluid. No temp. increase

Addition of pozolans to W/P of .30 at Flyash to cement at 2:1. Mixed in Hobart at medium speed #2

Time mixed 5 sec → large clay clumps, looked dry.

30 sec. → Bottom packed, clay on bottom of Very Dry cake icing

1 min 30 sec → Cake Icing

2 min 30 sec → Very moist, smooth clay or Thick cake icing. Very close to mud.

Packed Volume only: 650 ml

LAGLG: 020195-3B-207 A/B

4 hr cure. Hard, looks moist, able to break of small pieces, but very hard in general.

Work continued to Page

SIGNATURE

DATE 2/1/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

1.25" fuse

$\frac{(.508)^2}{4} \pi (6.985) = \frac{141}{210} = \frac{x}{150^2}$

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #4B 207A/B @ 20% @ 0.20 w/p ratio

Mixture:

100 g 207 A/B Sludge "as received"
194 ml 207 A/B water
14.7 g Hydrated Lime
783 g Flyash, Type C
392 g Cement, Type I/II

mix observation:

207 A/B @ 20% solids Initial volume = 260 ml; Addition of Lime caused no temp increase.

Addition of pozzolans to 0.20 w/p ratio at 2 parts flyash to One part cement.

Time mary: 5 sec → Powder w/ peasize pellets at moist material flying around in bowl.

30 sec → Begining to stick or pack on sides of bowl. Powder w/ moist clumps.

1 min 30 sec → Moist dirt, some pack on sides

2 min 30 sec → Moist soil, can make a soil ball by squeezing in hand, ball breaks apart with very little pressure.

Loose Volume = 1500 ml
Packed Volume = 1011 ml LABLE: 020195-4B-207A/B

4 hr cure: moist, powder, will clump in squizzy head. Fine Powder.

Work continued to Page

SIGNATURE

DATE 2/1/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #5B 207 A/B @ 20% solids @ 0.25 w/p Ratio

Mixture:

100 g 207 A/B sludge "as received"
194 ml 207 A/B water
14.7 g Lime, Hydrated
627 g Flyash, TYPE C
313 g Cement, TYPE I/II

Mixing observation:

207 A/B @ 20% solids, Initial Temp = 60.5°F
Initial Volume = 260 ml
Addition of 5% by weight of Lime: Temp = 60.8°F

Addition of Peroxides at a ratio of .25 with a flyash to cement ratio of 2:1.

addition observations 5sec → Small moist soil chunks mixing w/ powder flying around in bowl.

30 sec → Beginning to cling to sides of bowl. Moist powder in center.

1 min → A large amount of side packing center moist dirt.

2 min 30 sec → Hard side pack with center a moist powdery small clumps.

Volume loose = 1300 ml
Volume Packed = 650 ml LABEL: 020195-5B-207A/B

3 hr cure: Wet dirt/soil. Dry, but has some larger clumps.

Work continued to Page

SIGNATURE

DATE 2/1/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #6B 207 A/B @ 20% solids @ W/P of 0.30

Mixture:

100 g 207 A/B sludge "as received"
194 ml 207 A/B water
14.7 g Lime, Hydrated
522 g Flyash, Type C
261 g Cement, Type I/II

mixing observations:

207 A/B @ 20% solids : initial Temp = 60.1°F
Initial Volume = 260 ml

Addition of 5% by weight of Lime. Temp = 60.5°F

Addition of Pozzolans at a ratio of .30 with a flyash and cement of (2:1 ratio).

Addition observations 5 sec → large moist clumps
30 sec → Excellent worm dirt. medium size curd clumps. Moist friable soil clumps.
1 min → Good worm Dirt
1 min 30 sec → Bread dough, Dryish
2 min 30 sec → ~~moist bread dough~~ Stiff Molding clay.

Packed Volume = 600 ml LABLE: 020195-6B-207A/B

3 hr cure: Very thick on dry side Molding clay: Crumbles under hand pressure.

Work continued to Page

SIGNATURE: [signature] DATE 2/1/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

$\frac{141}{210} = \frac{t}{1400}$

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #7B 207 A/B @ 30% @ 0.20 w/p ratio

mixture:

150 g 207 A/B Sludge "As recieved"
144 ml 207 A/B water
14.7 g lime, Hydrated
687 g Flyash, TYPE C
343 g Cement, Type I/II

mixing observation:

207 A/B @ 30% sludge, Initial Temp = 58.8 °F; Volume = 275 ml
Addition of 5% lime Temp = 60.1 °F Thin milkshake.

Addition of Pozzolans at a ratio of 2 flyash to 1 cement.
Mixing observation over time
5 sec → Pellets flying around with powder
30 sec → Beginning to pack on sides some balls and moist dirt.
1 min 30 sec → Moist Dirt, no more clumps some side packing.
2 min 30 sec → moist to Dry powder. Some hard pack on sides. Able to make soil ball by squeezing in hand, Break with very little pressure

Loose Volume = 1400 ml
Packed Volume = 940 ml LABLE: 020195-7B-207 A/B

2 hr cure: Fine powder, consistency of brown sugar.

Work continued to Page

SIGNATURE [signature] DATE 2/1/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

$\frac{141}{210} = \frac{4}{1150}$

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

mix #8B 207 A/B @ 30% @ 0.25 w/p ratio

mixture:

150 g 207 A/B sludge "as received"
144 ml 207 A/B water
14.7 g Lime, ~~Type C~~ Hydrated
540 g Flyash, Type C
275 g Cement, Type I/II

mix observation:

207 A/B @ 30% solids, Initial Temp.: 59.6°F Initial Volume: 275 ml
Addition of 5% by weight of lime, Temp = 60.6°F

Addition of powders, at a ratio of 2 flyash to 1 cement.
mixing observation 5 sec → moist soil ball - powder flying around in bowl w/ paddle
30 sec → Slight soil pack on walls of bowl. Powder with some small balls.
1 min 30 sec → Some small clumps. Slightly on sides of bowl.
2 min 30 sec → Moist Dirt or powder will pack by squeezing in hand, but Breaks apart easily with little pressure.

Loose Pack = 1150
Volume Packed = 772 LABEL: 020195-8B-207 A/B

2 hr cure = Fine powder, consisting of brown sugar.

CLIENT BINDERY PRODUCTION 1234 SOUTH WABASH AVENUE CHICAGO ILLINOIS 60616

Work continued to Page

SIGNATURE

DATE 2/1/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

Work continued from Page

Mix #9B — 207A/B @ 30% @ 0.30 w/p ratio

Mixture:

150 g 207A/B Sludge "as received"
144 ml 207A/B water
14.7 g Lime, Hydrated
458 g Type C Flyash
229 g Type I/II Cement

Mix observation:

207A/B @ 30% solids ~~@ 30% Specific~~ Initial Temp. = 59.2°F
Initial Volume = 275 ml

Addition of Lime at 5% by weight
Temperature = 61.1°F

Addition of pozzolans to 0.30 w/p, using a Flyash to Cement ratio of 2:1. Mixed in a Hobart on medium speed for 2 min 30 sec with intermittent observations.

5 sec → Powder & some soil balls flying around in bowl.

30 sec → Beginning to stick to sides of bowl.

1 min → Hard pack on sides of bowl, Center moist, soil like, some soil clumps - small.

2 min → very hard pack on sides. Moist dirt.

2 min 30 sec → Moist soil. Able to squeeze into ball which breaks easily with little pressure. Would get worm dirt if allowed to work longer.

Loose Volume = 1000 ml
Pack Volume = 500 ml
LABLE: 020195-9B-207A/B

1 hr Cure = resembles Potting soil, some clumps, moist dirt.

Work continued to Page

SIGNATURE		DATE
		2/1/95

DISCLOSED TO AND UNDERSTOOD BY	DATE	WITNESS	DATE

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48 hour UCS test of 207A/B mixes made 2-2-95

BATCH ID	Wtg	LBF	PSI	% SOLIDS
MIX 1C	*			
MIX 2C	385.2	1101	351	20
MIX 1D	405.2	>2000	>637	10
MIX 2D	**			

PSI Cal. = LBF/area , area = 3.14

* - Cylinder fell apart while being removed from the mold
** - Cylinder fell apart during removal from the mold.

See page 68 for drawings of cylinders

$1\frac{1}{4}'' \sim 6.985h$

$V = \frac{(5.08)^2}{4} \pi\, 6.985$

$\frac{141}{210} = \frac{x}{1000}$

TITLE ROCKY FLATS

PROJECT NO.

BOOK NO.

Work continued from Page

207 A/B WAC Mixes – Supplementary

Hydrated Lime Only

Mix # 1C — 207 A/B @ 20% solids @ 0.59 L/P Ratio

Mixture: 100 g 207 A/B sludge "as received"
194 ml 207 A/B water
~~14.7 g Hydrated Lime~~
398 g Hydrated Lime, $Ca(OH)_2$

Mix Observation:
207 A/B @ 20% solids; Fluid, liquid Initial Temp = ~~260 ml~~
Initial Volume = 260 ml

Addition of Hydrated lime.
5 sec → Dry powder w/ some clumps of moist product.
30 sec → Stirring on side of mixing bowl. Moist powder made.
1 min 30 sec → Heavy pack on sides of bowl. Dry powder in center.
2 min 30 sec → Dry powder w/ some soil clumps

Final Temp = 60.6 °F
Loose Final Volume = 1000 ml
Packed Volume = 674 ml

LABLE: 020295-1C-207A/B P300088
P300089 (TCLP)

Work continued to Page

SIGNATURE [signature] DATE 2/2/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

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LAB Book P174-94

68

BATCH ID	ILLUSTRATION	TYPE OF FAILURE	DESCRIPTION OF CYLINDER CONSISTENCY
MIX 1C		Failed during removal from mold.	Sawdust consistency very light
MIX 2C		Started to crack at top and crumble	very solid bottom - air pockets visible top of cylinder not as solid as bottom
MIX 1D		Did not fail. Started to slightly crack at top	full cylinder, air pockets visible.
MIX 2D		Failed during removal from mold	falls apart very easily. very light very fine dust after breaking apart.

$2.25 \sim 5.715\,cm$

$V = \frac{(5.08)^2}{4}\pi(5.715)$

$\frac{116}{210} = \frac{x}{1050}$

TITLE

PROJECT NO

BOOK NO

Work continued from Page

Mix #2C 207 A/B @ 20% solids @ 0.31 w/p ratio

mixture:

100 g 207 A/B sludge "as received"
194 ml 207 A/B water
14.7 g Hydrated lime
758 g Cement, Type I/II

mix observation:

207 A/B @ 20% solids; fluid, liquid Initial Temp =
Initial volume =

Addition of 5% by weight of hydrated lime and plaster in Hobart on medium speed.

mix time 5 sec → Dry powder and some clays flying around in bowl.

30 sec → moist soil or dirt. Some small clumps

1 min 30 sec → moist soil.

2 min 30 sec → moist soil or dirt. Can squeeze in hand to hold shape. Ball easily comes apart

Final Temp = 60.0 °F
Loose volume = 1050 ml
Packed volume = 579 ml

LABLE: 020295-2C-207A/B P300090
P300091 (TCLP)

Work continued to Page

SIGNATURE JCB DATE 2/2/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Duplicate mixes for QA/QC

Mix #1D

Dup. mix for 207 A/B sludge @ 10% solids
@ 0.24 w/p ratio (Mix #1 pg. 2 013095-1-207A/B)

mixture:

50g 207A/B sludge "as-received"
244ml 207 A/B water
113g Hydrated lime
991g Type C Flyash

mix observation:

207 A/B sludge Initial Temp = Initial Volume = 275ml

Addition of the flyash and placed in Hobart on medium speed #2 and observed.

Mix permitted to mix for 2min 30 sec as before

Submitted for TCLP & Do UCS on cylinder after 48 hr cure.

LABLE: 020295-1D-207A/B

Work continued to Page

SIGNATURE [signature] DATE 2/2/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #2D

Duplicate mix for 207 A/B @ 30% solids @
0.20 w/p Ration (mix #7B pg 26) 020195-7B-207A/B

mixture:

150 g 207 A/B sludge "as recieved"
144 ml 207 A/B water
14.7 g Hydrated lime
687 g Flyash Type C
343 g Cement Type I/II

mix observations:

207 A/B sludge: Initial Temp =
Initial Volume = 240 ml

The pozzolanes are added and mixed on speed #2 for 2 min 30 sec like previous mix and submitted for TCLP analysis.

Submit for TCLP and make cylinder for UCS dep.

LABLE: 020295-2D-207A/B

Work continued to Page

SIGNATURE [signature] DATE 2/2/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE Rocky Flats

PROJECT NO. CLARIFIER WAC

BOOK NO.

Work continued from Page

CLARIFIER WAC mixes

These waste acceptance criteria mixes will evaluate the addition of various additives selected in the PRE-WAC testing at various waste loadings.

The waste loading will be evaluated at three percent solids The Clarifier will be tested

① As Received = 38.1 % solids

② 30 % solids and

③ 20 % solids.

Assume: will reduce solids using 207 A/B water and assume the water does not contribute to the solids loading.

X = sludge
y = water

$$\frac{X(.381)}{X+y} = 0.30$$

will need 400g for each mix.

$$X(.381) = 0.30\,(400g)$$

X = 315 g Clarifier "as delivered"

y = -315 + 400 = 85 g 207 A/B water

for 20% solids $\frac{X(.381)}{X+y} = 0.20$

$$X(.381) = 0.20(400)$$

X = 210 ml 207 A/B

y = 190 g Clarifier

SIGNATURE

DATE 2/3/95

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LAB Book: P174-94

~48 hour UCS test of ~~ZOT A/B~~ CLARIFIER mixes made 2/3/95

Batch ID	Wt (g)	LBf	PSI	% Solids
1 A	402.0	>2000	>637	20
2 A	400.0	>2000	>637	20
3 A	386.9	>2000	>637	20
4 A	415.0	>2000	>637	30
5 A	375.9	1750	557	30
6 A	363.9	1595	508	30
7 A	362.8	908	289	38.1
8 A	364.1	1562	497	38.1
9 A	390.3	>2000	>637	38.1

PSI calc. = LBf/area , area = 3.14

SEE Page 72 for Drawings.

TITLE

PROJECT NO. FLYASH

BOOK NO.

Work continued from Page

Mix #1A Clarifier @ 20% solids @ 0.24 w/p ratio

mixture:

190 g Clarifier "as received"
210 ml 207 A/B water
20 g Hydrated lime, $Ca(OH)_2$
1333 g Flyash Type C

mix observations:

Clarifier sludge at 20% solids is a fluid, liquid, water like consistency. Initial Temp. = 60.2°F pH = 12.7
Initial Volume = 350 ml

Addition of 5% by weight of Hydrated lime. It's a thin milkshake, pourable, fluid.

Mixing Time → 5 sec → large clay clumps
30 sec → smooth cake batter
30 sec → 2 min → same
2 min 30 sec → smooth moist cake
Icing or Clay.

Final Volume = 850 ml NOTE: clay retained so only add to displaced volume.
Temp Final = 64.7°F

LABLE - 020395-1A-CLAR P300108
P300109 (TCLP)

5 hr cure =

Work continued to Page

SIGNATURE

DATE 2/2/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

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Batch ID	Illustration	Type of failure	Description of Cylinder Consistency
1A		Did not fail Started to flake at top.	Very smooth and solid
2A		Did not fail. Started to flake at top & bottom	Very smooth and solid
3A		Did not fail. Started to flake at top & bottom	Very smooth and solid
4A		Did not fail	Very smooth and solid
5A		Started to break apart. Failed	Very smooth
6A		failed. Started to break apart	Very smooth
7A		Failed. Started to break apart.	Semi smooth. - Crumbles at the top
8A		Failed	Air pockets throughout the cylinder
9A		Did not fail	Very smooth and solid

Work continued from Page

Mix # 2A Clarifier @ 20% solids @ 0.28 w/p ratio

mixture:

190 g Clarifier "as received"
210 ml 207 A/B water
20 g Hydrated lime, $Ca(OH)_2$
1143 g Flyash, Type C

mix observation:

Clarifier at 20% solids is a very liquid, fluid, water consistency.

Initial Temp = 60.0°F

Initial Volume = 350 ml

pH = 12.7

Addition of Lime at 5% ~~solids~~ by weight provided a milkshake consistency, fluid, pourable.

Mixing time 5 sec → large clay clumps
30 sec → Smooth cake icing
1 min → stretchy smooth icing.
1 min 30 sec. thru 2 min → Same
2 min 30 sec → Smooth thick cake icing, stiff clay mold.

Final Volume = 800 ml NOTE: Clay so could only have a packed vol
Final Temp. = 68.7°F

LABLE: 020395-2A-CLAR P300110

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Work continued to Page

SIGNATURE

DATE 2/3/85

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

2-3-SJ

5 HOUR OBSERVATION

1	A	SOLID - MONOLITH . DRY -
2	A	SOLID - MONOLITH - MOIST - WARM
3	A	SOLID - MONOLITH - MOIST
4	A	SOLID - NON MONOLITH MOIST
5	A	MOLDING CLAY - WET
6	A	MOLDING CLAY - WET SOFTER THAN 5A
7	A	SOIL - SOME CLUMPS - MOIST
8	A	SOLID CLUMPS - NON MONOLITH - FRIABLE SOIL
9	A	SAME AS 8A

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #3A CLARIFIER @ 20% solids @ 0.34 w/p Ratio

Mixture:

190 g Clarifier "as recieved"
210 ml 207 A/D water
20 g Hydrated lime, $Ca(OH)_2$
941 g Flyash, Type C

mixing observation:

Clarifier sludge @ 20% solids if a water consistency addition of lime creates a thin milkshape, pourable, fluidish.

Initial volume = 350 ml pH = 12.7

mixing time 5 sec → large clay clumps sticking to sides quickly.

30 sec → Cake icing and ~~and~~ on sides of bowl sticky same all way till end

2 min 30 sec → Moist, Clay wet molding clay, cake icing not able to form ball.

Final volume = 700 ml → packed only because is clay material

LABLE = 020395-3A-CLAR

P300111
P300112 (TCLP)

Work continued to Page

SIGNATURE [signature] DATE 2/7/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #4A — CLARIFIER @ 30% solids @ 0.24 L/P ratio

mixture:

315 g Clarifier "as received"
85 ml 20% A/o water
20 g Hydrated Lime, $Ca(OH)_2$
1167 g Flyash, Type C

mixing observations:

Clarifier sludge at 30% solids is a pourable fluid w/ the consistency of pea-soup. Addition of Lime created a non-pourable, smooth, thick milkshake or wet cake icing consistency. Initial volume = 330 ml pH = 12.7

mixing time 5 sec → powder & moist soil clumps flying around in bowl.
30 sec → moist clumps and powder.
1 min → large clay clumps, dryish
1 min 30 sec → starting to stick to sides and form larger clay ball.
2 min → Clay like or bread dough, stiff and hard, pulled away from sides of bowl.
2 min 30 sec → Stiff molding clay, two large balls... Dryish / Hard

Final Volume → 950 ml

LABEL: 020395-4A-CLAY

P300113
P300114 (TCLP)

Work continued to Page

SIGNATURE

DATE 3/3/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #5A — Clarifier @ 30% solids @ 0.28 w/p ratio

Mixture:

315 g Clarifier "as received"
85 ml 20% A/B water
20 g Hydrated Lime, $Ca(OH)_2$
1000 g Flyash, Type C

Mix observations:

~~Clarifier~~ at 30% solids is a soupy, thick liquid. Addition of Lime at 5% by weight. Initial Volume = 370 ml

pH = 12.7

Addition of flyash in one bulk addition and mix on #2 speed

Time mix 5 sec → large moist soil or clay clumps, start stuck to sides

30 sec → Cake Icing stayed on my and distal change.

2 min 30 sec → Very smooth cake Icing.

Final Volume = 850 ml — could only do packed volume because of consistency.

LABLE: 020395-5A-CLAR P300114

Work continued to Page

SIGNATURE

DATE 2/3/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #6A Clarifier @ 30% solids @ 0.34 w/p ratio

mixture:

315 g Clarifier "as received"
85 ml 207 A/B water
20 g Hydrated Lime, $Ca(OH)_2$
824 g Flyash, TYPE C

mix observation:
~~207 A/B~~ Clarifier at 30% solids: soupy fluid liquid consistency. Addition at 5% ~~solids~~ by weight. Initial volume = 330 ml

pH = 12.7

Addition of flyash
mixing time 5 sec → immediately packed to side in a cake icing consistency.
30 sec → very smooth cake icing consistency, sticky never changed.
2 min 30 sec → very smooth cake icing

Final volume = 750 ml

LABLE: 020395-6A-CLAR

P300116
P300117 (TCLP)

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Work continued to Page

SIGNATURE [signature] DATE 2/7/95

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$1\frac{1}{2}$" pound force spur 6.35 cm

$V = \frac{(5.08)^2}{4} \pi (6.35)$

$\frac{129}{210} = \frac{x}{1550} = 950 - 1$

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix # 7A Clarifier @ 38.1% solids @ 0.24 w/s ratio

mixture:

400 g Clarifier "as received"
20 g Hydrated lime, $Ca(OH)_2$
1033 g Flyash, Type C

wet observations:

~~Clarifier~~ at 38.1% is a pudding or Wendy's frosty
Addition of Lime gives a consistency of cake
Icing. Initial volume = 712 ml

pH = 12.6 very thick material so pH is difficult to get

mixing observations 5 sec → Powder and moist soil small chunks flying around in bowl.
30 sec → Powder w/ moist soil small clump's. Starting to stick to sides.
2 min → some packing on walls
2 min 30 sec → Most soil or Dirt,

Loose volume = 1550 ml
Packed volume = 950 ml

LABLE: 020795-7A-CLAR P300118
P300119 (TCLP)

Work continued to Page

SIGNATURE DATE 3/7/95

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #8A Clarifier @ 38.1% solids @ 0.28 w/p Ratio

mixture:

400 g Clarifier "as recieved"
20 g Hydrated Lime, $Ca(OH)_2$
886 g Flyash, Type C

mix observation:

Clarifier at 38.1% solids is a non-pourable, thick material of the consistency of pudding or a Wendy's frosty. Addition of Lime @ 5% solids give a consistency of fudge or a cake icing. Initial volume = 312 ml w/o Lime.

pH = 12.6

note: material so thick its difficult to get a good pH.

Mixing observation 5 sec → made balls of moist soil.
1 min → Moist soil or Dirt some side bowl clingage.
2 min → Clay clumps large in sizes pulling away from walls
2 min 30 sec → Bread dough.

Final Volume = 850 ml only a packed volume due to consistency of material.

LABLE: 020395-8A-CLAR P300120

Work continued to Page

SIGNATURE [signature] DATE 2/7/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #9A Clarifier @ 38.1% solids @ 0.34 L/P ratio

mixture:

400 g Clarifier "as received"
20 g Hydrated Lime, $Ca(OH)_2$
729 g Flyash, Type C

mix observation: Initial volume = 312 ml

Clarifier at 38.1% solid is consistency of pudding or a Thick Wendy's Frosty. Addition of lime created a Thick pudding or Cake Icing. Very thick cake icing.

pH = 12.7

Time observation. 5 sec → Powder w/ moist soil clumps flying around in bowl.
30 sec → moist soil w/ clumps. Pack on side of mixing bowl.
1 min → Clay clumps, large, with heavy side wall packing.
1 min 15 sec → pulled off side of walls and formed a bread dough.
2 min → Cookie dough
2 min 30 sec → Cake Icing.

volume = 700 ml note! a clay or bread dough so only a packed volume.

LABLE: 020395-9A-CLAR P300121
P300122 (TCLP)

Work continued to Page

SIGNATURE [signature] DATE 2/3/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

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Continued from Page

2-9-95

48 hour UCS test of clarifier mixes made 2-7-95

baton ID	wt(g)	LBF	PSI	% solids
1B	373.0	1532	488	20
2B	401.1	>2000	7637	20
3B	393.7	>2000	7637	20
4B		*		
5B	395.1	>2000	7637	30
6B	397.1	>2000	>637	30
7B		*		
8B		*		
9B	395.1	>2000	>637	38.1

PSI calc. = LBF/area, area = 3.14

* - cylinder failure occurred during removal from mold

drawings and descriptions on pg. 76

2.125

$V = \frac{d^2}{4} \pi h$

$= \frac{(5.00)^2}{4} \pi (7.70)$

$\frac{109}{210} = \overline{190}$

TITLE Rock Flats

PROJECT NO. Flyash & Silica Flour

BOOK NO.

Work continued from Page

Mix #1B Clarifier @ 20% solids @ 0.20 w/p ratio

mixture:

190 g Clarifier sludge "as recieved"
210 ml 207 A/B water
20 g Hydrated lime, $Ca(OH)_2$
1360 g Flyash, Type C
240 g Silica Flour

mix observations: Hydrated lime is added at 5% by weight and the pozzolans are added at a ratio of 5.67 Flyash to One Silica flour to the desired consistency as determined in the pre-mix mixes. Initial Temp = 59.4°F
Initial Volume = 350 ml (not initial Vol/Temp pre lime)
After Lime added Temp = 57.4°F pH = 12.6

Addition of pozzolans and mixed in Hobart on speed #2 for 2½ min.

15 sec → Moist soil almost some clay clumps
30 sec → Sides of bowl packed, moist to clumpy soil in center of bowl.
1 min → Heavy side wall pack, becoming moister
2 min 30 sec → Cookie dough sticking to sides, but looking drier.

Final loose Volume = 1900 ml
Final Packed Volume = 990 ml

LAGLE 020795-1B-Clar P300676
P300677 (TCLP)

Work continued to Page

SIGNATURE DATE 2/7/95

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Copied from LAD Book P174-94

Batch ID	Illustration	type of failure	description of cylinder consistency
1B		cracked, chipped	almost a full cylinder dry and gritty density appears greater toward bottom dumped grain size at top
2B		did not fail, small chipping at top & bottom	full cylinder smooth and solid air pockets generally nonexistent no other voids
3B		did not fail chipped at top & bottom	full cylinder smooth and solid air pockets generally nonexistent, no other voids
4B		during removal from mold	very dry, gritty, sandy reduced in size by approx 1.5" very small grain size
5B		did not fail cracking did occur	almost a full cylinder mostly smooth and solid increased air pocket voids toward bottom
6B		did not fail small chipping at bottom	full cylinder smooth and solid air pockets generally nonexistent, no other voids
7B		during removal from mold	very dry, gritty, sandy reduced in size by approx. 2" very small grain size
8B		during removal from mold	very dry, gritty, sandy reduced in size by approx 2" very small grain size
9B		did not fail small chipping at bottom	full cylinder mostly smooth and solid crack-like air pocket voids throughout

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #2B Clarifier @ 20% solids @ 0.25 w/p ratio

mixture:

190 g Clarifier "as received"
210 ml 20% A/B water
20 g Hydrated lime, $Ca(OH)_2$
1088 g Flyash, Type C
192 g Silica flour

mixing observations: The consistency of the Clarifier sludge & 20% A/B water is a very thick, water-like consistency. Initial Temp = 59.9°F
Initial volume = 350 ml
Addition of Lime creates a smooth, pourable milkshake consistency. Temp = 58.2°F pH = 12.18

Addition of pozzolans and mixed in Hobart on speed #2 for 2 min DC

15 sec → Clumpy clay chunks, 1" dia.
30 sec → Bread dough
1 min 30 sec → Cake batter, sticking to sides of bowl.
2 min 30 sec → Cake batter, smooth, sticky.

Final Volume (packed only) = 900 ml

LABEL: 020795-2B-CLAR P300678

Work continued to Page

SIGNATURE

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

DATE 2/7/95

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix # 3B Clarifier @ 20% solids @ 0.30 w/p ratio

Mixture:

190 g Clarifier sludge "as recieved"
210 ml A/B water
20 g Hydrated lime, $Ca(OH)_2$
907 g Flyash, Type C
160 g Silica flour.

Mix observations: The consistency of the clarifier w/ 207 A/B water @ 20% solids is a fluid water-like consistency. Addition of Lime @ 5% by weight created a milkshake type consistency
pH = 13.1
Addition of pozzolans in Hobart at speed level #2 for 2.5 min.
15 sec → Bread dough
30 sec → Cake Icing, sticky
1 min 30 sec → Smooth cake Icing, slightly moister.
2 min 30 sec → Cake Icing, stiff, sticky

Final Volume (packed only) = 800 ml

LABLE: 020795-3B-CLAR P300679
P300680 (TCLP)

Work continued to Page

SIGNATURE [signature] DATE 2/7/95

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

$$V = \frac{(5.08)^2}{4} \pi (7.29)$$

$$\frac{149}{210} = \frac{X}{18000} = 12.58$$

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #4B Clarifier @ 30% solids @ 0.20 W/P ratio

mixture:

315 g Clarifier Sludge "as received"
85 ml 207 A/B water
20 g Hydrated Lime, $Ca(OH)_2$
1198 g Flyash, Type C
210 g Silica Flour

Init Vol = 330

Mix observation: The consistency of the blended of 207 A/B water is a milkshake consistency, pourable. Addition of the Lime @ 5% by weight created a pudding consistency, non-pourable, smooth & shinny. pH = 12.8

Addition of the pozzulan in Hobart on Medium #2 speed.

15 sec → Clumpy soil or powder, loose flying around and out of bowl.
30 sec → Top soil or clumpy powder
1 min 30 sec → same
2 min 30 sec → Moist powder, able to form a rough soil ball in hand which breaks apart easily. Moist soil.

NOTE: Would probably be blown around in the wind.

Final Loose Volume = 1800 ml
Final Packed Volume = 1258 ml

P300681
P300682 (TRIP)

LABEL: 020795-4B-CLAR

Work continued to Page

SIGNATURE			DATE
			2/7/95
DISCLOSED TO AND UNDERSTOOD BY	DATE	WITNESS	DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from: Page

Mix # 5B CLARIFER @ 30% solids @ 0.25 w/p ratio

mixture: 1

315 g Clarifier sludge 'as received'
85 ml 207 A/B water
20 g Hydrated lime, $Ca(OH)_2$
952 g Flyash, Type C
168 g Silica flour

mix observation: Clarifier sludge and 207 A/B water creates a pourable, thick fluid the consistency of a milkshake. Addition of the lime at 5% by weight creates a pudding consistency, a non-pourable mixture. pH = 12.8

Addition of the pozzolan in Hobart on speed #2
15 sec → Soil clumps in powder flying around in bowl.
30 sec → Packing against bowl sides, soil clumps and powder (mush) in center
1 min → Side wall pack, worm dirt medium size mixed in center
1 min 30 sec → Hard side wall pack, Clay chunks 1" dia in center
2 min → large, hard, dry clay clumps in center
2 min 30 sec → Still hard side wall pack and center Dry clay, stiff.

Volume packed only = 900 ml

LABEL: 020785-5B-CLAR P300683

Work continued to Page

SIGNATURE

DATE 2/7/85

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #6B CLARIFIER @ 30% solids @ 0.30 w/p ratio

Mixture:

315 g Clarifier Sludge "as received"
85 ml 207 A/B water
20 g Hydrated Lime, $Ca(OH)_2$
793 g Flyash, Type C
140 g Silica flour

Mix observation: Clarifier Sludge and 207 A/B water created a pourable, thick fluid consisting of a milkshake. Addition of 5% lime by weight created a pudding consisting a non-pourable material. pH = 13.0

Addition of Pozzolans in Hobart on speed #2

15 sec → Soil clumps flying about in bowl and powder.
30 sec → Clay clumps 1" dia.
1 min → Bread dough
1 min 30 sec → Beginning to stick to sides of bowl. Cookie dough consistency.
2 min → Cake Icing.
2 min 30 sec → Cake Icing, Sticky.

Volume packed only = 750 ml

LABEL = 020795-6B-CLAR

P300684
P300685 (TCLP)

Work continued to Page

SIGNATURE

DATE 2/7/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #7B CLARIFIER @ 38.1% solids @ 0.20 W/P ratio

Mixture:

400 g Clarifier sludge "as delivered"
20 g Hydrated Lime, $Ca(OH)_2$
1054 g Flyash, Type C
186 g Silica flour

Initial Vol = 312

Mix observation: Clarifier sludge ~~and 20% lime content~~ "as received" is a thick non-pourable material consistency of a pudding or Wendy's frosty. Addition of the lime at 5% by weight produced a thick non pourable material the consistency of cake icing. smooth pH = 12.8

Addition of pozzolans and mixed in Hobart on speed #2.

15 sec → powder, Loose, flying around and out of mixer.
30 sec → Powder with some small moist balls
1 min → beginning to pack like dirt on sides of bowl.
2 min → Center powder with sticky packed soil or dirt.
2 min 30 sec → powder to moist powder. Can squeeze in hand to form soil ball which breaks easily.

Final loose Volume = 1800 ml
Final Packed volume = 1125 ml

P300686
Labels: 020795-7B-CLAR P300687 (CTLP)

Work continued to Page

SIGNATURE

DATE 2/2/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #8B Clarifier @ 38.1% solids @ 0.25 w/p ratio

Mixture:

400 g Clarifier sludge "as received"
20 g Hydrated lime, $Ca(OH)_2$
843 g Flyash, Type C
145 g Silica flour.

Initial vol = 712

Mix observation: Clarifier sludge "as received" is a non-pumpable thick smooth mud with the consistency of pudding. The addition of Hydrated lime at 5% by weight created a smooth, stiff cake icing consistency
pH = 12.8
Addition of pozzolans and mixed in Hobart on speed #2

15 sec → powder & some small chunks fly around and at at bowl.
1 min → Mostly powder w/ some small chunks and beginning to pack on sides of bowl.
2 min 30 sec → Moist dirt able to squeeze in hand to make ball, but breaks down easily.

Final Loose Volume = 1400 ml
Final Packed Volume = 1201 ml

P300688

Label = 020795-8B-CLAR

Work continued to Page

SIGNATURE

DATE 2/7/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #9B Clarifier @ 38.1% solids @ 0.30 w/p ratio

Mixture:

400 g Clarifier Sludge "as received"
20 g Hydrated lime, $Ca(OH)_2$
703 g Flyash, Type C
124 g Silica flour

Mix Observation: Clarifier sludge "as delivered" is a non-pourable material the consistency of pudding. The addition of Lime at 5% by weight produced a thick, non pourable cake icing material
pH = 13.4

Addition of pozzolans and mixed in Hobart on speed #2.

15 sec → Powder and small clumps flying around in bowl.
30 sec → Side walls packed powder and center moist soil or powder
1 min → Heavy pack on walls
1 min 30 sec → Medium curd size Worm soil, Hard pack on walls.
2 min → Medium size clay clumps, beginning to ball up. Very hard wall pack.
2 min 30 sec → Close to bread dough, but only a dropish Clay large balls.

Final Packed Volume only = 750 ml

Lance: 020795-95-CLAR P300689
P300690 (TCLP)

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Work continued to Page

SIGNATURE [signature] DATE 2/7/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

LABORATORY LOG BOOK

P030-95

ROCKY FLATS

- CLAR. WAC (PART)
- PCTW PRE-WAC

2/6/95 Thru 2/9/95

NUS

book: P030-95

Rocky Flat

2-6-95

1" or 3" pressed = 7.62 cm

$V = \frac{(5.08)^2}{4}\pi(7.62)$

$\frac{154}{210} = \frac{x}{1500}$

NOTE: cylinder on 50 and 70 ml Volumetric flasks are cylinder packing.

TITLE Rocky FLATS

PROJECT NO. Lime, Cement, and Flyash

BOOK NO.

Work continued from Page

CLARIFIER WAC TESTING.

continued from Book: P025-95

Mix #1C Clarifier @ 20% solids @ 0.20 w/p Ratio

mixture:

190 g Clarifier sludge "as recieved"
210 ml 207 A/B water
20 g Hydrated Lime, $Ca(OH)_2$
533 g Cement, Type I/II
1067 g Flyash, Type C

mix observation: Clarifier is a pudding consistency or thick frosty addition of water creates a fluid, water cracking. of Lime makes a thick cake icing consistency
Initial Temp = 57.0 pH = 12.8 Initial volume = 350 ml
mixing time 5 sec → powder w/ moist soil clumps.
30 sec → powder w/ some moist soil clumps.
1 min → slight pack on sides of bowl all powder in center.
2 min 30 sec → side packed soil center powder with some small clumps. Slightly moist.

Final Volume Loose = 1500 ml
Final Volume Packed = 1103 ml

LABLE: 020695-1C-CLAR

3 hr Cure: Powder, Small pellets.

P300661
P300662 (TCLP)

Work continued to Page

SIGNATURE [signature] DATE 2/6/95

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

Copied from LAC Book P174-94

2-8-95

48 hour UCS test of clarifier mixes made 2-6-95

batch ID	wt (g)	LB_F	PSI	% solids
1 C	299.3	156	49.7	20
2 C	415.3	>2000	>637	20
3 C	367.9	1395	444	20
4 C	398.3	>2000 ~~68~~	>637	30
5 C	290.2	68	21.7	30
6 C	403.9	>2000	>637	30
7 C	263.4	121	38.5	38.1
8 C	283.7	110	35.0	38.1
9 C	286.0	120	38.2	38.1

PSI calc = LB_F/area, area = 3.14

see pg. 74 for drawings

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #2C Clarifier @ 20% solids @ 0.25 L/P ratio

Mixture:

190 g	Clarifier Sludge "as received"
210 ml	20% A/C water
20 g	Hydrated lime, $Ca(OH)_2$
427 g	Cement, Type I/II
853 g	Flyash, Type C

Mix observations: To the clarifier 5% by weight lime is added. Temp. No change. pH = 13.0. Addition of powder

mixing time 5 sec → powder w/ some clumps flying around bowl.

30 sec → large clay clumps

1 min → Bread dough, one ball.

2 min 30 sec → Bread dough or stiff clay.

Final Volume = 850 ml, could only do packed volume because a clay material.

LABLE: 020695-2C-CLAR

P300663

3 hour cure: Hard monolith

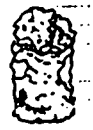
Work continued to Page

SIGNATURE

DATE 2/9/85

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

 Copied from LAB Book P174-94

Batch ID	Illustration	type of failure	description of cylinder consistency
1C		chips and cracks on top	cylinder not completely full dry and gritty small, numerous air pocket voids small grain size
2C		did not fail	full cylinder smooth and solid air pockets generally nonexistent; no other voids
3C		numerous vertical cracks	full cylinder smooth and solid air pockets generally nonexistent, no other voids
4C		did not fail	full cylinder smooth and solid air pockets generally nonexistent, no other voids
5C		cracked, bulged, chipped on top	cylinder not completely full dry and gritty small, numerous air pocket voids small grain size
6C		did not fail	full cylinder smooth and solid air pockets generally nonexistent, no other voids
7C		cracked, bulged, chipped, on top	cylinder not completely full dry and sandy few air pocket voids grain size very small
8C		cracked, bulged, chipped on top	cylinder not completely full dry and gritty small, numerous air pocket voids small grain size
9C		cracked, bulged, chipped on top	cylinder not completely full dry and gritty small, numerous air pocket voids small grain size

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #3C CLARIFIER @ 20% solid @ 0.30 w/p Ratio

mixture:

190 g Clarifier Sludge "as recieved"
210 ml 207 A/B water
20 g Hydrated Lime, $Ca(OH)_2$
356 g Cement, Type I/II
711 g Flyash, Type C

mix observations: As delivered clarifier sludge and 207 A/B water added. Initial Temp = 58.5 °F. Addition of Lime at 5% by weight. Temp = 58.9 °F and pH = 12.7.

mixing in of Pozzolans

5 sec → Cake icing
30 sec → wet cake icing, sticking to sides.
1 min → Same
1 min 30 sec → Sloopy mud or thick milkshake
2 min 30 sec → Same.

Final Volume = 600 ml muddy so could only do packed volume.

LABLE: 020695-3C-CLAR

P300664

2 hour cure: Soft mud ball P300665 (TCLP)

Work continued to Page

SIGNATURE DATE 2/6/95

DISCLOSED TO AND UNDERSTOOD BY DATE WITNESS DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix II 4C — Clarifier @ 30% solids @ 0.20 w/p ratio

mixture:

315 g Clarifier Sludge "as received"
85 ml 207 A/P water
20 g Hydrated Lime, $Ca(OH)_2$
467 g Cement, Type I/II
933 g Flyash, Type C

mix observations: Mixture of Clarifier sludge & 207 A/P water gave an initial Temp = 59.4°F with a consistency of pea-soup. Lime added Temp = 59.4°F and pH = 12.9. Addition of dry powders. Initial volume = 770 ml

5 sec → Powder and moist soil clumps flying around bowl.
30 sec → Bread dough
1 min → Molding Clay
1 min 30 sec → Starting to stick to sides of bowl, very thick cake icing.
2 min 30 sec → Thick cake icing

Final Volume = 700 ml packed volume only

LABELS: 020695-4C-CLAR P300666
P300667 (TCLP)

2 hour cure: Warm to the touch, hard nodules.

Work continued to Page

SIGNATURE

DATE 2/06/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

3rd packet

$\frac{154}{210} = \frac{x}{1200}$

917

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix # 5C — CLARIFIER @ 30% solids @ 0.25 w/p ratio

mixture:

315 g Clarifier Sludge "as received"
85 ml 207 A/B water
20 g Hydrated Lime, $Ca(OH)_2$
373 g Cement, Type I/II
747 g Flyash, Type C

mix observations: Mix of Clarifier sludge and 207 A/B water. Initial temp = 56.4°F addition of Lime and mixed for 5 min on low. Temp = 58.0°F pH = 12.7

Additions at the possitions.

5 sec → Powder & some moist ball flying around in bowl.
30 sec → Moist powder with some chunks.
1 min → Same
1 min 30 sec → Powder, moist
2 min 30 sec → Powder, some sticky to bowl walls.

Loose Volume = 1250 ml
Packed Volume = 917 ml

LABLE: 020695-5C-Clar

1 low cure: small pellets like granular powder. P300668

Work continued to Page

SIGNATURE

DATE 2/6/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO

BOOK NO.

Work continued from Page

Mix # 6C Clarifier @ 30% solids @ 0.30 w/p ratio

mixture:

315 g	Clarifier Sludge "as received"
85 ml	207 A/B water
20 g	Hydrated Lime, $Ca(OH)_2$
311 g	Cement, Type I/II
622 g	Flyash, Type C

mix observation: Mixed Clarifier sludge and 207 A/B with hand. Temp = 56.7°F. Added Lime at 5% by weight and mixed in Hobart on low for 5 min. Temp = 58.0°F pH = 13.0 Non Runny, wet cake consistency. Thick Workability. addition of pozzolan:

5 sec → Powder with moist soil balls.

30 sec → Moist powder with Round moist balls. Close to worm dirt

1 min → Worm dirt, starting to stick to sides. Turned to large clay Balls.

1 min 30 sec → Bread dough

2 min 30 sec → Very dry cooking dough sticking to sides. Fudge.

Packed Volume = 650 ml

LABLE: 020695 - 6C - Clar.

P300669

P300670 (FCLP)

1 hour cure: Hard monolith, still moist looking.

Work continued to Page

SIGNATURE

DATE 02/06/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

$$V = \frac{d^2}{4}\pi h$$

$$= \frac{(5.08)^2}{4}\pi(7.62\ldots) = \frac{154}{210} = \frac{x}{1500}$$

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

MIX #7C CLARIFIER @ 38.1% solids @ 0.20 W/P Ratio

Mixture:

400 g Clarifier sludge "as recieved"
20 g Hydrated Lime, $Ca(OH)_2$
413 g Cement, Type I/II
827 g Flyash, Type C

Mix observations: Clarifier sludge is a pudding or thick wendy's frosty consistency. Initial Temp = 61.0 °F Addition of lime at 5% by weight made a consistency of thick cake icing. Temp = 59.7°F pH = 13.0 Initial volume = 312 ml

Addition of pozzolans

5 sec → Powder flying around bowl
30 sec → Moist powder with some clumps.
1 min → Some powder pack on sides of bowl
1 min 30 sec → Mostly Powder to moist powder
2 min 30 sec → Powder, moist powder, some clumps.

Final Loose volume → 1500 ml
Final Packed volume → 1103 ml

LABLE: 020695-7C-CLAR

P300671
P300672 (TCLP)

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Work continued to Page

SIGNATURE [signature] DATE 2/6/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

$1.20'' = h = 2.8' = 7.112$

$\frac{(5.08)^2}{4} \pi (7.112)$

$\frac{144}{210} = \frac{x}{1150}$

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #8C CLARIFIER @ 38.1% solids @ 0.25 W/P ratio

Mixture:

400 g	Clarifier Sludge "as received"
20 g	Hydrated Lime, $Ca(OH)_2$
331 g	Cement, TYPE I/II
661 g	Flyash, Type C

mix observations: Clarifier sludge is consisting of pudding. Initial temp = 60.8 °F

Addition of Lime at 5% by weight. Made a consistency of thick cake icing. Temp. = 59.3 °F

pH = 13.1

Addition of pozzolans

5 sec → Powder & some moist balls flying around in bowl.

30 sec → Powder some moist clumps

1 min → Some side pack, mostly powder

2 min 30 sec → Moist powder

Final Loose Volume → 1150 ml

Final Packed volume → 789 ml

LABLE: 020695-8C - CLAR P300673

Work continued to Page

SIGNATURE

DATE 4/6/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

$1'' = 3'' \cdot h = 7.62$

$V = \frac{(5.08)^2}{4} \pi (7.62)$

$\frac{154}{210} = 180$

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

Mix #9C CLARIFIER @ 38.1% solids @ 0.30 w/p ratio

Mixture:

400 g Clarifier Sludge "as recieved"
20 g Hydrated Lime, $Ca(OH)_2$
276 g Cement, Type I/II
551 g Fly ash, Type C

mix observations: Clarifier sludge is the consistency of pudding or a thick Wendy's frosty. Temp = 61.5°F
Addition of Lime at 5% by weight produced a thick cake icing consistency. Temp = 60.5°F
then pH = 12.8

Addition of Activator

5 sec → Powder w/ some moist chunks.
30 sec → Side wall pack
1 min → Moist Powder to Dry Powder
1 min 30 sec → Moist powder in center with hand soil pack on walls.
2 min 30 sec → Hand soil pack on Bail sides, Center moist soil or powder.

Final Loose Volume = 1100 ml

Final Packed Volume = 807 ml

LABLE: 020695-9C-CLAR P300674
P300675 (TCLP)

Work continued to Page

SIGNATURE TLR DATE 2/6/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE ROCKY FLATS

PROJECT NO.
BOOK NO. PRE WAC

Work continued from Page

PONDCRETE TRIWALLS PRE-WAC MIXES

These pre-waste Acceptance criteria mixes will evaluate the amount of various pozzolans required to achieve a friable soil mix.

The Pondcrete Triwalls will be tested in its "as recieved" state.

The Pondcrete Triwall (PCTW) material is a semi-pourable thick material, consistency of a thick milkshake or wendy's frosty. A thick mud, spoonable.

pH "as recieved in Bucket" = 13.1

MUD BALANCE

Specific Gravity = 1.32 s.c.

% solids 34.8

Work continued to Page

SIGNATURE [signature] DATE 2/7/85

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

PCTW & Hydrated Lime w/ Flyash

Mix #1

This test will evaluate the amount of flyash, Type "C", which is added to PCTW and 5% by weight of Hydrated lime to create a tirable soil consistency.

Mixture: 250 g PCTW "as recieved" pH = 13.1 Vol = 190 ml
12.5 g Hydrated Lime, $Ca(OH)_2$ Temp = 63.7°F
consistency of cake icing

Addition: Will add in 50 g increments type C flyash in Hobart on low speed until desired consistency is achieved.

Flyash added	Observations
50 g (Total added 50 g)	A thick cake Icing
50 g (Total added 100 g)	SAME
50 g (Total added 150 g)	Cookie dough, still sticky to sides
50 g (Total added 200 g)	Bread dough, but still strong to sides
50 g (Total added 250 g)	mushy clay or bread dough (16 min mix)
50 g (Total added 300 g)	Bread dough
50 g (Total added 350 g)	Bread dough
50 g (Total added 400 g)	Clay; stuff still one mass
50 g (Total added 450 g)	Clay, large balls or clay chunks
50 g (Total added 500 g)	large curd with dirt. Angular pieces.
50 g (Total added 550 g)	med. size curd with dirt.
50 g (Total added 600 g)	Small round moist ball like deer droppings
50 g (Total added 650 g)	same, small round moist balls, almost pellets
50 g (Total added 700 g)	Almost pellets
50 g (Total added 750 g)	Pellets, small round Hard balls. Able to break
50 g (Total added 800 g)	Balls with strong finger pressure.

Final Volume = 900 ml
Final Temp. = 64.5°F

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Work continued to Page

SIGNATURE Kenneth E. Lewis DATE 2/7/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PROJECT NO.

BOOK NO.

Work continued from Page

~~CLAC~~ PCTW w/ Lime, Flyash & Silica Flour

Mix #2

This test will evaluate the amount of flyash and fine silica flour (SSA-1) at a ratio of 5.67 : 1 is needed to be added to clarifier sludge with 5% lime by weight.

Mixture: 250 g PCTW "as received" Temp = 62.4°F Volume = 190 ml
12.5 g Hydrated lime, $Ca(OH)_2$ consisting of a cake icing.

Addition: Flyash and Silica flour (5.67 : 1 ratio) or in 45.4 g Flyash and 8 g Silica flour until a doable soil is achieved.

Flyash	Silica flour	Total	Observation
45.4	8	(45.4/8 = 53.4 g)	Cake icing to cookie dough.
45.4	8	(90.8/16 = 106.8 g)	Same
45.4	8	(136.2/24 = 160.2 g)	Very stiff icing to cookie dough
45.4	8	(181.6/32 = 213.6 g)	Balling up like bread dough, still sticky
45.4	8	(227/40 = 267 g)	Bread dough (mixing for 17 min)
45.4	8	(272.4/48 = 320.4 g)	Bread dough
45.4	8	(317.8/56 = 373.8 g)	Bread dough, begining to dry out.
45.4	8	(363.2/64 = 427.2 g)	Clay, begging to break up into balls of clay
45.4	8	(408.6/72 = 480.6 g)	large curd worm dirt, still clumps are sticking together
45.4	8	(454/80 = 534 g)	Med. curd worm dirt, more round balls, sticky
45.4	8	(499.4/88 = 587.4 g)	Med to small Round curd still sticky dew droplets
45.4	8	(544.8/96 = 640.8 g)	Small round worm dirt, same as above.
45.4	8	(590.2/104 = 694.2 g)	Same, small round ball, still moist, sticky
45.4	8	(635.6/112 = 747.6 g)	Almost pellets
45.4	8	(681/120 = 801 g)	Pellets, Hard round ball, Expelled pass out of mixer, Able to break pellets with finger pressure

Final Volume = 900 ml

Final Temp = 64.0 °F

Work continued to Page

SIGNATURE

DATE 2/7/85

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE

PCTW w/Lime, Cement, & Flyash

Mix #3

This test will evaluate the amount of flyash and cement, at a ratio of 2 to 1, is needed to be added to the PCTW with 5% Lime by weight.

mixture:

250 g PCTW "as recieved" Temp = 62.5 °F pH = 13.1 vol = 190 ml
12.5 g Hydrated Lime, $Ca(OH)_2$ pH = 13.3

Addition of Flyash & Cement at a 2:1 ratio in increments of 40 g flyash and 20 g cement until a friable soil is achieved.

Flyash	Cement	Total	Observation
40 g	20 g	(40/20 = 60 g)	Cake icing
40	20	(80/40 = 120 g)	very thick cake icing, very sticky
40	20	(120/60 = 180 g)	Cookie dough
40	20	(160/80 = 240 g)	Bread dough
40	20	(200/100 = 300 g)	Soft Bread dough one smooth ball.
40	20	(240/120 = 360 g)	Clumpy clay balls, drying out.
40	20	(280/140 = 420 g)	large curd worm dirt, large clay balls
40	20	(320/160 = 480 g)	med size curd worm dirt, med angular. Good moist top soil med clumps.
40	20	(360/180 = 540 g)	Small to medium size, round curd on balls.
40	20	(400/200 = 600 g)	no sceen or gloss. Round clean, close to pellets
40	20	(440/220 = 660 g)	Round, smooth, small uniform balls, still slight moist
40	20	(480/240 = 720 g)	Round Hard Pellets

Final Volume = 850 ml
Final Temp = 63.8 °F

Work continued to Page

DATE 2/7/95

WITNESS DATE

TITLE

PCTW with Hydrated Lime

Mix #4

This test will evaluate the amount of $Ca(OH)_2$, Hydrated lime, required to achieve a friable soil.

mixture: 250 g PCTW "as recieved" Temp = 62.5 °F
volume = 190 ml

addition will add 30 g increments of Hydrated Lime in Hobart on low until friable soil or desired consistency achieved.

Hydrated Lime	Observation
30 g (Total added 30 g)	Cake icing
30 g (Total added 60 g)	Cookie dough, pulling off sides slightly.
30 g (Total added 90 g)	One ball, still slight, sticky almost Bread dough
30 g (Total added 120 g)	Sticky Bread dough
30 g (Total added 150 g)	Hard, still clay. Sticky to beater.
30 g (Total added 180 g)	Worm Dirt, med curd
30 g (Total added 210 g)	Small round curd worm dirt
30 g (Total added 240)	Small round pellets

Final Volume = 650 ml
Final Temp = 60.8 °F

Work continued to Page

SIGNATURE [signature] DATE 2/7/95

DISCLOSURE AND UNDERSTOOD DATE WITNESS DATE

TITLE Rocky FLAT

PROJECT NO

BOOK NO

Work continued from Page

ADDITIONAL PRE-WAL TEST

PROCESS TRAIN TESTING

This test will evaluate the addition of Lime at 5% by weight two ways:

1) Pre-mix Lime w/ waste for 5 min to allow reaction.
2) Add dry products & Lime and add directly into mix with no addition separate mixing

Will test 207A/B at the 3X3 mid-point
~ @20% solids @ 0.25 w/p ratio

mix: 100 g 207 A/B sludge "as received"
194 ml 207 A/B water
14.7 g Lime, Hydrated
627 g Flyash, Type C
313 g Cement, Type I/II

#1 Pre mix Lime 5 min	#2 No Pre mix
5 sec powder & moist balls flying around	SAME
1 min clumps moist some	same
2 min 30 sec Clumpy worm dirt good mix	SAME

Note Mixed for 10 min. It was observed that the two products acted very close to identical. If anything the pre mix lime was lagging the No mix by 10-20 sec. (moister) But for all practical purposes the two mixes appeared to be identical.

Work continued to Page

SIGNATURE [signature] DATE 2/9/95

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

LABORATORY LOG BOOK

P032-95

ROCKY FLATS

TREATABILITY STUDY

- PCTW WAC
- PCM PRE-WAC
- 207C & PCM WAC

2/8/95 Thru 2/21/95

PO32-95
Rocky Flats Treatability Study
2-7-95

ROCKY FLATS WAC

PONDCRETE TRIWALLS WAC TESTING

These Waste Acceptance Criteria mixes will test a variety of additives determined in the Pre-WAC tests at varying % solids waste stream and varied W/P ratio.

The "as recieved" material is at 34.8% solids. The mixes will be performed at 15%, 25%, and as recieved percent solids at W/P ratios of 0.28, 0.34, and 0.40

SPECIFIC GRAVITY = 1.32

15% solids mix

$$\frac{(X)(34.8\%)}{X+Y} = 15\%$$

$$(X)(348) = .15x + .15y$$

$$.348X - .15x = .15y$$

$$\frac{.198X}{.15} = Y$$

$$y = 1.32x \quad \text{or} \quad X = \frac{0.15}{.198}y$$

$$x = 0.758y$$

$x + y = 400$

$x = 172.4$ g PCTW "as recieved"

$y = 227.6$ ml 207 A/B water

25% solids

$$\frac{X(.348)}{X+Y} = .25$$

$$\frac{X(.348 - .25)}{.25} = Y$$

$y = 0.392$

$x + y = 400$

$1.392x = 400$

$x = 287$ g

$y = 113$ ml

2/8/95

Copied from:
LAB BOOK P174-94

48 hour UCS TEST of PONDCRETE TRIWALLS made 2/8/95
(Lime, cement, flyash)

BATCH ID	WT(g)	LB_f	PSI	% solids
1A	412.6	>2000	>637	15%
2A	399.2	>2000	>637	15%
3A	387.9	>2000	>637	15%
4A	415.9	>2000	>637	25%
5A	402.6	>2000	>637	25%
6A	391.0	>2000	>637	25%
7A	≈ 325	*		*
8A	365.1	1240	395	34.8%
9A	393.3	>2000	>637	34.8% (made on 2/9/95)

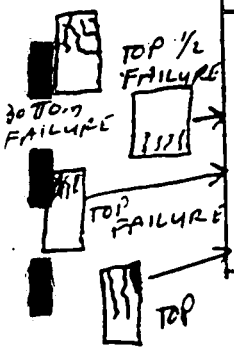
PSI calc. = $\frac{LB_f}{area}$ area = 3.14

* - cylinder failure occured during removal from mold.

- drawings and discriptions on page 78

mixed on 2/10/95

BATCH ID	WT(g)	LB_f	PSI	% solids
10A	310.8	282	89.8	
11A	292.5	196	62.4	
12A	294.3	271	86.3	
13A	292.6	231	73.6	34.8%



TOP SLIGHTLY ROUNDED
TOP BROKEN BEFOR UCS, APPROX 4" HT.

ALL CYLINDERS WERE SOLID, DRY WITH FEW AIR VOIDS

2/10/95

PCTW w/ Lime, Cement, & Flyash

Mix #1A PCTW @ 15% solids @ 0.28 w/p

mixture:
- 172 g PCTW "as received"
- 228 ml 207 A/P water
- 20 g Hydrated Lime, $Ca(OH)_2$
- 405 g cement, Type I/II (from Colorado)
- 810 g Flyash

mix observation: PCTW and 207 A/P @ 15% solids resembled colored water Temp = 58.7 °F
addition of Lime pH = 12.8 Temp = 58.5 °F 30 ml

Addition of pozolans:
- mixing 5 sec → Powder w/ some balls flyash around
- 30 sec → Clay or moist bread dough
- 1 min 30 sec → Cake icing
- 2 min 30 sec → cake icing

Volume, packed volume = 850 ml

LABEL: 020895-1A-PCTW

2/8/95

78 Copied from LAB Book P174-94

BATCH I.D	ILLUSTRATION	TYPE of Failure	Description of Cylinder Consistancy
1A		SOLID — NO CHIPPING	Very slight chipping on out side. No Failure
2A		SOLID — LIKE A ROCK	No chipping, solid as a rock.
3A		SOLID NO CHIPPING	No chipping
4A		SOLID NO CHIPPING	No chipping
5A		SOLID NO CHIPPING	No Chipping
6A		SOLID VERY SMALL CHIPPING @ TOP	No Chipping
7A		TOP & BOTTOM CRUMBLED UPON REMOVAL FROM MOLD	Failure on top, mushrooms out, No visable cracks. mushroomed on top.
8A		VERY POROUS SOME CRUMBLING	
9A		Solid no chipping	No Failure

Mix #2A — PCTW @ 15% solids @ 0.34 w/p ratio

mixture:

172 g	PCTW "as received"
228 ml	207 A/B water
20 g	Hydrated Lime, $Ca(OH)_2$
333 g	Cement, Type I/II
667 g	Flyash, Type C

mix observations: PCTW and 207 A/B @ 15% solids is a fluid, water like paste. Addition of Lime Initial Temp = 58.2°F addition Temp = 57.9°F pH = 12.9

Addition of Aggregates

mix 5 min → Clay Balls

10 sec → Cake icing

2 min 10 sec → moist cake icing.

volume, packed only 750 ml

Labs: 020895-2A – PCTW

02/08/95

6

NOTE: Rob S. Had to leave after 1st & 2nd mixes. Tom M. continued with directing the personnel.

mix #3A — PCTW @ 15% solids @ 0.40 w/p Ratio

Mixture :

172g	PCTW, as rec'd
228ml	207A/B water
20g	Hydrated Lime, $Ca(OH)_2$
283g	Cement, Type I/II
567g	Flyash, Type C

Mixing observations : PCTW @ 15% solids is a fluid liquid Temp = 59.3°F
Addition of Lime. Temp = 59.0°F pH = 12.9

Addition of Pozzolans

Packed Volume = 700 ml
Final Temp = 64.3°F

LABEL: 020895-3A-PCTW

2/8/95

Mix #4A PCTW @ 25% Solids @ 0.28 w/p ratio

Mixture:

287g	PCTW, as rec'd
113ml	207A/B water
20g	Hydrated Lime
357g	Cement, Type I/II
714g	Flyash, Type C

Init. Vol = 330 ml

mixing observation: Initial Temp = 59.8°F. Added Lime which made a material which was still pourable. pH = 12.9 and temp = 59.8°F. Addition of portion made Cake Icky see Vidio Tape. Could only do a final packed volume because a clay like material.

Final Volume (Packed) = 850 ml

LABLE: 020895-4A-PCTW

P300817
P300818 (TCLP)

2/8/95

Mix #5A PCTW @ 25% solids @ 0.34 W/P Ratio

mixture:

287 g	PCTW "as received"
113 ml	207 A/O water
20 g	Hydrated lime, $Ca(OH)_2$
294 g	Cement, Type I/II
588 g	Flyash, Type C

Initial Volume = 330 ml

Mixing observations: Initial temp. = 61.0 °F. Addition of lime creates a pasty mixture w/ pH = 12.8 and temp = 61.3 °F. Additional additives created → see video tape. Final temp = 66.9 °F. Could only do a packed volume because a clay like material.

Final Volume (packed) = 700 ml

LABLE: 020895-5A-PCTW P300819

2/9/15

NOTE: Rob not in lab

Mix 6A — PCTW @ 25% solids @ 0.40 w/p ratio

mixture:

287 g	PCTW "as received"
113 ml	207 A/B water
20 g	Hydrated Lime, $Ca(OH)_2$
250 g	Cement, Type I/II
500 g	Flyash, Type C

Initial Volume = 770

mixing observations: Initial Temp = 61.0 °F. Addition of lime for 5 min mix. pH = 13.1 and Temp = 61.1 °F Addition of pozzolans see video Tape Final Temp. 66.7 °F Mix resembled clay like material so could only do packed volume.

Final Volume (Packed) = 650 ml

LABLE: 020895-6A-PCTW

P300820
P300821 (TCLP)

RS

2/8/95

Mix #7A PCTW @ 34.8% solids @ 0.28 w/p Ratio

mixture:

400 g	PCTW "as received"
20 g	Hydrated Lime, $Ca(OH)_2$
311 g	Cement, Type I/II
621 g	Flyash, Type C
1.14 g	STERGO additive

mixing observations: Initial PCTW Temp = 60.7°F & Volume = 303 ml
Addition of the lime in Hobart for 5 min produced consistency of ~~a sandy/frosty~~ cake icing. pH = 12.9 and a temp = 59.7°F
The additive addition SEE Video TAPE Final Temp = 66.9°F

Final Loose Volume = 1400 ml
Final Packed Volume = 1050 ml

LABLE: 020895-7A-PCTW

P300822
P300823 (TCLP)

2/8/95

Mix #8A — PCTW @ 34.8% solids @ 0.34 w/p ratio

mixture:

400 g	PCTW "as received"
20 g	Hydrated Lime, $Ca(OH)_2$
256 g	Cement, Type I/II
512 g	Flyash, Type C
1.14 g	STERGO® additive

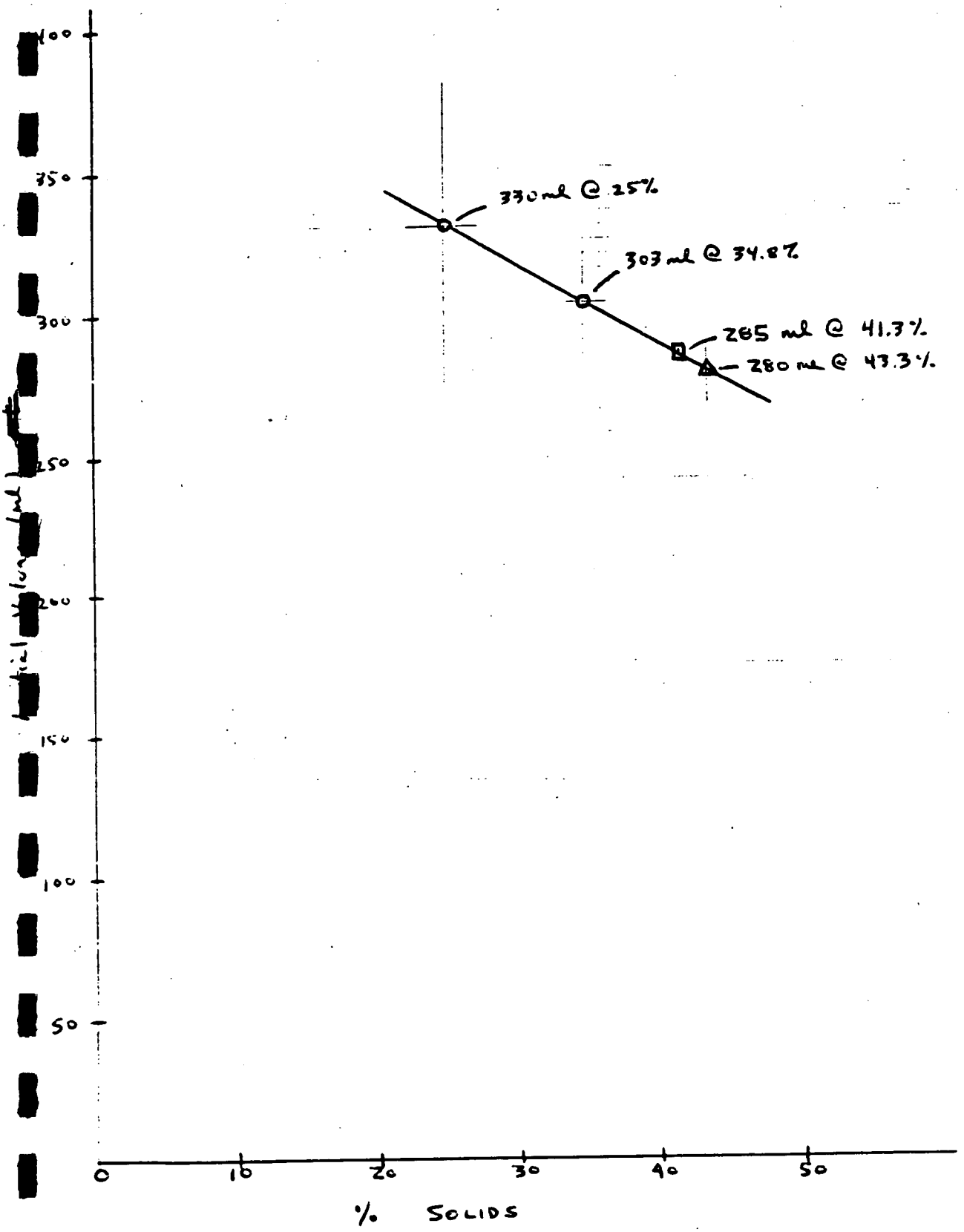
mixing observations: The temp. of the initial PCTW was 60.9°F (a pudding consistency) Addition of the lime, Small mix on Low for 4 min. resulted in a cake icing of pH = 12.9 and temp = 59.2°F
Addition of the additive resulted in a final temp = 66.7°F
SEE VIDIO TAPE

Final Loose volume = 1300 ml
Final packed volume = 975 ml

LABLE: 020895-8A-PCTW P300824

2/8/95

18 LINEAR ESTIMATE OF INITIAL VOLUME AT 41.3% SOLIDS FOR FOR RUNS 10A thru 13A



mix #9A PCTW @ 34.8% solids @ 0.40 w/p ratio

mixture: 400 g PCTW "as received"
20 g Hydrated Lime, $Ca(OH)_2$
218 g Cement, Type I/II
435 g Flyash, Type C
1.14 g STERGO additive

mix observation: PCTW as received is a thick material like pudding.
Initial Temp. = 60.6°F Volume = 303 ml
S.G. = 1.32
Addition of lime made an cake icing consistency which sticks to sides of bowl.
pH = 13.0 Temp. = 60.8 °F

Addition of flyash
15 sec → powder & most clumps flying around bowl
30 sec → Packing to sides
1 min → large clay clumps in center of bowl, hand soil pack on sides
2 min → Cookies dough picking up side material.
2 min 30 sec → Bread dough or stiff clay holding in one piece.

Volume Final, packed only = 600 ml
Final Temp = 70.0°F

Label: 020995-9A-PCTW P301003
P301004 (TCLP)

2/9/95

Rocky FLATS

mix # 10A PCTW @ 41.3 % Solids @ 0.20 w/p Ratio

mixture:

400g	PCTW "dried out"
20g	Hydrated lime, $Ca(OH)_2$
391g	Cement, Type I/II
782g	Flyash, Type C
1.14g	STERGO addition

mixing observations: Dried PCTW is consistency of thick pudding. Non pourable. All dry addition added at once. Then mixed in Hobart on speed #2.

15 sec mixing → Powder flying around in bowl

30 sec → Powder w/ round moist balls in Powder.

1 min → Powder, moist, some clumps.

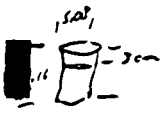
2 min 30 sec → Slight sticking to sides of bowl, Moist powder. Can squeeze in ball of Dirt, but breaks with little pressure.

Final Loose Volume = 2050 ml

Final Packed Volume = 1417 ml

LABLE: 021095-10A-PCTW P301068
P301069 (TCLP)

4 hour cure = Powder



$\frac{5.08^2}{4}\pi(7.10) =$

$\frac{145}{210} = \frac{x}{2050}$

RL 2/10/95

$1\frac{1}{2} = \frac{(.508)^2}{4} \pi (6.3)(1)$

$\frac{128}{210} = .61$

Mix #11A PCTW @ 41.3 % Solids @ 0.25 W/P ratio

mixture:

400 g	PCTW "dried out"
20 g	Hydrated Lime, $Ca(OH)_2$
313 g	Cement, Type I/II
626 g	Fly ash, Type C
1.14 g	STERGO additive

mixing observation: Dried PCTW and dried product additives mixed in Hobart.

5 sec → Powder flying around bowl
15 sec → Powder w/ some moist balls or clumps
30 sec → Same
1 min → Powder & some moist clumps.
2 min 30 sec → Some sides of bowl pack, powder in center w/ some moist clumps. Able to squeeze a moist dirt ball which breaks easily with little pressure

Final Loose Volume = 1800 ml
Final packed Volume = 1096 ml

Label: 021095-11A-PCTW P301070

4 hour cure = Powder

2/10/95

$\frac{128}{200} = \frac{x}{150}$

Mix # 12A PCTW @ 41.3% solids @ 0.30 w/p ratio

mixture:

400 g	PCTW "dried out"
20 g	Hydrated Lime, $Ca(OH)_2$
261 g	Cement
522 g	Flyash
1.14 g	STERGO

mix observation: Dried PCTW and dry powder additives mixed in Hobart on speed #2.
15 sec → Powder & moist powder flying around bowl
1 min → Powder and some moist clumps
2 min 10 sec → Some soils will pack, moist powder able to squeeze a soil ball in hand which barely carry

Loose volume = 1500 ml
Packed volume = 914 ml

LABEL: 021095-12A-PCTW P301071
P301072 (TCLP)

4 hour cure = Powder

2/10/95

Mix #13A — PCTW @ 34.8% Solids @ 0.20 w/p ratio

mixture

400 g	PCTW "as received"
20 g	Hydrated Lime, $Ca(OH)_2$
435 g	Cement, Type I/II
870 g	Flyash, Type C
1.14 g	STERCO additive

mixing observations: PCTW dumped out and additives added in Hobart on speed #2.

15 sec → Powder & some soil clumps flying around in bowl.

1 min → Moist soil, clumps & some stuck on side of bowl.

2 min 30 sec → moist powder, able to squeeze in hand to form moist dust which Bounds up little effort.

Loose volume = 2100 ml
Packed volume = 1410 ml

LADLE: 021095-13A-PCTW P301073
P301074 (TCLP)

4 hour cure = Powder

2/10/95

Copied from Lab Book p174-94

48 hour UCS TEST of PONOCAESE TRIWALLS
(Lime, Flyash, silica flour)

BATCH ID	Wt (g)	LB_f	PSI	% solids	DATE mixed
1B	315.2	160	51	25	2/9/95
2B	368.1	630	201	25	2/9/95
3B	399.6	>2000	>637	25	2/9/95
4B	287.8	123	39	34.8	2/9/95
5B				34.8	2/9/95
6B	289.6	283	90	34.8	2/9/95
7B			*		2/10/95
8B	302.7	397	126	[illegible]	2/10/95
9B			*		2/10/95

PSI Calc = lb_f/area area = 3.14

* - cylinder failure occured during removal from mold

- drawings and descriptions on page 80

Mix #1B PCTW @ 25% solids @ 0.20 w/p Retro

mixture:
- 287 g PCTW "as received"
- 113 ml 207A/B water
- 20 g Hydrated Lime, $Ca(OH)_2$
- 1275 g Flyash, Type C
- 225 g Silica Flour, SSA-1
- 1.14 g STERGO

mix observation: The PCTW & 207A/B water made a smooth, pourable, fluid, consistency of pea-soup.
All dry products (lime, stergo, flyash, silica) mixed together and added as one bulk addition.

- 15 sec → Powder & some moist balls flying around bowl.
- 30 sec → same
- 1 min → Moist powder w/ some balls. Beginning to pack to side of bowl
- 2 min → Hard dirt/powder pack on sides of bowl. Moist powder.
- 2 min 30 sec → Moist powder.

Final Loose Volume = 2050 ml
Final Packed Volume = 1256 ml

LABLE: 020995-1B-PCTW

P301005
P301006 (TCLP)

6.35
1/2" 129/210 = x/200

2/9/95

Copied from Lab Book P174-94

Batch ID	Illustration	Discription of Cylinder consistancy	Discriptions of UCS preformed
1B		loose at top solid otherwise	buckled at top
2B		clumps ~~loose~~ at top solid otherwise	shatter at top
3B		Solid	no failure
4B		Chipped at top solid otherwise	fissures at top
5B		broken in half	
6B		broken at top solid otherwise	some buckling + fissures at top
7B	—	—	—
8B		SLIGHTLY CHIPPED AT TOP SOLID	FAILURE AT BOTTOM
9B	—	—	—

MIX #2B PCTW @ 25% solids @ 0.25 w/p ratio

mixture: 287 g PCTW "as recieved"
113 ml 207 A/B water
20 g Hydrated Lime, Ca(OH)₂
1020 g Flyash, Type C
180 g Silica Flour, SSA-1
1.14 g STERGO

mix observations: The PCTW & 207 A/B water pea-soup consistency. All pozzolans added in bulk addition.

15 sec → Powder & some small moist soil bulls.
30 sec → Hard pack on sides of bowl
1 min → Center clay clumps large and side well packed
2 min → Center Worm Dirt or med curd friable soil. Hard pack on bowl.
2 min 30 sec → Very hard side bowl pack, center Dry clay bulls.

Final Loose Volume = 1700 ml
Final Packed Volume = 886 ml

P301007
~~[illegible]~~

LABLE: 020995-2B-PCTW

$1\frac{7}{8}" = 2.125 = 5.3975$
$V = \frac{(5.05)^2}{4} = 5.3975$
$\frac{109}{210} = \frac{X}{1700} = 0.86$

[signature] 2/9/95

Mix #3B PCTW @ 25% solids @ 0.30 w/p ratio

mixture:

287 g	PCTW "as received"
113 ml	207 A/B water
20 g	Hydrated Lime, $Ca(OH)_2$
850 g	Flyash, Type C
150 g	Silica flour, SSA-1
1.14 g	STERGO

mix observations:

The PCTW of 207 A/B water is a fluid, liquid, pourable, water-like.

The bulk addition of powders:

15 sec → Sticking to sides of bowl, Powder & clumps of mostly powder.

30 sec → Clay clump in center with hard soil pack on sides of bowl.

1 min → Bread dough or cookie dough

1 min 30 sec → Begging to pull off sides of bowl.

2 min 30 sec → Stiff clay, semi-sticky

Volume, packed only = 750 ml

Labels: 020995-3B-PCTW

P301008
P301009 (TCLP)

2/9/95

mix #4B PCTW @ 34.8% solids @ 0.20 w/p Ratio

mixture:

400 g PCTW "as received"
20 g Hydrated Lime, $Ca(OH)_2$
1109 g Flyash, Type C
196 g Silica Flour, SSA-1
1.14 g STERGO

mix observation:

The PCTW as received is a thick, non-pourable, consistency of pudding. Addition of other additions in bulk and mixed in Hobart on speed #2.

5 sec → All power w/ some soil clumps
30 sec → Moist powder w/ some clumps.
1 min → Same
1 min 30 sec → Clumps and soil, moist
2 min 30 sec → Moist powder, can squeeze in hand to form ball which breaks apart easily w/ little pressure.

Loose Volume = 2000 ml
Packed Volume = 1103 ml

P301010
P301011 (TCLP)

LABLE: 020995-4B-PCTW

1¾ 2.25

$\frac{116}{210}$ → 5.715

2/9/95

Mix # 5B PCTW @ 34.8% solids @ 0.25 w/p ratio

mixture:

400 g PCTW "as recieved"
20 g Hydrated lime, Ca(OH)2
887 g Flyash, Type C
157 g Silica Flour, SSA-1
1.14 g STERGO

mix observation:

The PCTW "as recieved" is the consistency of pudding. The pozzolans will be added ~~at~~ in Bulk.

15 sec → Powder w/ some moist balls
30 sec → Powder, begging to pack on side of bowl.
1 min → Like moist powder with pack on side of bowl.
2 min → Heavy pack on walls.
2 min 30 sec → Moist powder, able to form ball w/ hand that breaks up with little pressure. Would probably blow in wind.

Final Loose Volume = 1700 ml

Final Packed Volume = 1146 ml

LABLE: 020995-5B-PCTW P301012 ~~P301013~~

1.25 ~ 2.75
141/200 = 1/1000

[illegible] 2/9/95

Mix #6B PCTW @ 34.8% solids @ 0.30 w/p ratio

Mixture:

400 g PCTW "as recieved"
20 g Hydrated Lime, $Ca(OH)_2$
740 g Flyash, type C
130 g Silica flour, SSA-1
1.14 g STERGO

mix observations.

The PCTW as delivered is a paddy consistency. Addition of dry products in Bulk single addition.

15 sec → Powder w/ moist soil balls flying around bowl
30 sec → same
1 min → smooth round balls very small moist in moist powder.
2 min 30 sec → Powder, moist able to form soil ball by squeezing in hand.

Final Loose volume = 1300 ml

Final Packed volume = 898 ml

Lable: 020995-6B-PCTW

P301013
P301014 (TCLP)

$\frac{(5.08)^2}{4}\pi 7.16$

$\frac{145}{210} = 1300$

TCL

2/9/95

ROCKY FLATS

Mix #7B PCTW @ 41.3 % solids @ 0.20 w/p ratio

mixture:

400 g PCTW "dried out"
20 g Hydrated Lime, $Ca(OH)_2$
998 g Flyash, Type C
176 g Silica flour, SSA-1
1.14 g STERGO ® additive

mix observations: PCTW dried out is the consistency of thick pudding. The dry addition will be added in one bulk addition mixed in Hobart speed #2

15 sec → Powder flying around bowl
30 sec → some moist clumps & Powder
1 min 30 sec → moist soil some dry clumps of moist balls.
2 min 30 sec → moist powder or Dirt. Able to squeeze in hand to form ball which breaks easily under pressure.

Loose volume = 2200 ml
Packed Volume = 1213 ml

LABLE: 021095-7B-PCTW

P301075
P301076 (TCLP)

9hr cure = Powder

TCL

2/10/95

12

$\frac{216}{210} = \frac{1750}{}$

Mix #8B PCTW @ 41.3 % solids @ 0.25 w/l ratio

mixture:

400 g	PCTW "dried out"
20 g	Hydrated Lime, $Ca(OH)_2$
798 g	Flyash, Type C
141 g	Silica flour, SSA-1
1.14 g	STERGO additive

mix observations: Dried PCTW and dry additives were in Hobart for 2.5 min on speed # 2.

15 sec → Powder flying around bowl
30 sec → Powder and some soil a powder clumps
1 min → moist soil
2 min 30 sec → moist soil able to squeeze in hand to form ball which breaks easily with little pressure

Loose volume → 1750 ml
packed volume → 965 ml

Label: 021095-8B-PCTW

P301077

4 hour cure = Powder

02/10/95

Mix #9B PCTW @ 41.3 % solids @ 0.30 w/p ratio

mixture:

400 g	PCTW "dried out"
20 g	Hydrated Lime, $Ca(OH)_2$
665 g	Flyash, Type C
117 g	Silica flour, SSA-1
1.14 g	STERGO additive

mix observations: PCTW dried out is a thick pudding consistency. The dry additives are added in one bulk addition in Hobart speed #2.

15 sec → Powder flying around Bowl
30 sec → Powder and moist powder clumps
1 min → Small uniform dry clumps of moist powder
2 min 30 sec → Moist powder, round clumps mixed in powder. Can squeeze in hand to form ball which breaks up easily.

Final Loose Pack = 1500 ml
Final Pack volume = 1011 ml

LABLE: 021095-9B-PCTW

P301078
P301079 (TCLP)

4 hour cure = Powder

2/10/95

Copied from Lab book P174-94

48 hour UCS Test of Pondcrete Triwalls (Lime, Flyash)

Batch ID	Wt (g)	LB_f	PSI	% Solids	Date Mixed
1C	331.7	217	69	25	2/9/95
2C	396.0	1610	513	25	2/9/95
3C	378.8	> 2000	> 637	25	
★ 4C	284.0	114	36.3	34.8	
5C	319.1	522	166.2	34.8	2-13-95
6C	345.2	486	155	34.8	2-13-95
7C-1		*		43.3	2-13-95
8C		*		43.3	2-13-95
9C	301.3 ~~305.0~~	243	77.4	43.3	2-13-95
7C-2	305.0	347	111	43.3	2-13-95

PSI Calc. = lb_f/area area = 3.14

* – Cylinder failure occurred during removal from mold

– drawings and description on pg 82

★ TOP PORTION BROKE OFF PRIOR TO UCS. TOP WAS ROUNDED OFF. APPROX 4" AT HIGHEST POINT.

Rocky Flats

Mix # 1C — PCTW @ 25% solids @ 0.20 w/p Ratio

mixture:
- 287 g PCTW "as received"
- 113 ml 20% A/B water
- 20 g Hydrated Lime, $Ca(OH)_2$
- 1500 g Flyash, Type C
- 1.14 g STERGO

mix observations: The PCTW and 20% A/B water is a fluid water like consistency. The material was added in bulk.

- 15 sec → powder with small moist chunks.
- 30 sec → powdery with some dirt or packed dust on sides of bowl
- 1 min 30 sec → moist soil
- 2 min 30 sec → moist powder, formed a soil ball when squeezed in hand, breaks with only little pressure.

Final Loose Volume = 1950 ml

Final Packed Volume = 1309 ml

Label = 020995-1C-PCTW

P301015
P301016 (TCLP)

$\frac{1441}{200} = \frac{+}{1951}$

2/9/95

Lab Book P114-44

Batch ID	Illustration	Description of cylinder consistency	Description of UCS performed
1C		chipped at top solid otherwise	top bulged + fissured
2C		voids at top solid otherwise	buckled suddenly
3C		VOIDS IN MIDDLE & BOTTOM	NO FAILURE
4C		ROUNDED AT TOP. SOLID OTHERWISE	FAILURE AT BOTTOM
5C		SLIGHTLY CHIPPED AT TOP NO AIR VOIDS	TOP FAILURE
6C		almost a fully PD 3-15 cylinder many small voids generally small grain size	top bulged & fissured
7C 1		very dry, gritty, sandy very small grain size	cracked in half during removal from mold
7C 2		chipped at top mostly solid, some voids	internal failure
8C		very dry, gritty, sandy very small grain size	cracked in half during removal from mold
9C		very dry, gritty, sandy very small grain size top & bottom slightly chipped	top bulged & fissured

Mix #2C PCTW @ 25% solids @ 0.25 l/p ratio

mixture: 287 g PCTW "as received"
113 ml 207 A/B water
20 g Hydrated Lime, $Ca(OH)_2$
1200 g Flyash, Type C
1.14 g STERGO

mix observation: The PCTW and 207 A/B water is a fluid water like consistency. Material add in bulk.
15 sec → powder and very round moist Balls flying around bowl.
30 sec → Clay clumps with side bowl packing
1 min 30 sec → Cookie dough
2 min 30 sec → Like Bread dough. Able to squeeze clumps into a friable soil.
Because broke clumps with hand able to do a loose pack
looks like worm Dirt.

Final loose pack → 1550 ml

Final Packed volume → 775 ml

Label → 020995 - 2C - PCTW P301017

[signature] 2/9/95

p 175 mm

$1\frac{1}{4} \sim 2.75 = 6.785$

$\frac{5.08^2}{4}\pi(6.985) = \frac{1911}{210} = 150.$

Mix #3C PCTW @ 25% solids @ 0.30 w/p ratio

mixture:
- 287 g PCTW "as received"
- 113 ml 207 A/B water
- 20 g Hydrated Lime, $Ca(OH)_2$
- 1000 g Fly ash, Type C
- 1.14 g STERGO

mix observation: ~~and~~ PCTW and 207 A/B water mixed together. Additives mixed together and added in one Bulk addition. Mixed in Hobart for 2.5 min on speed #2.

- 15 sec → Powder and clumpy soil/powder
- 30 sec → Good Worm Dirt. Clumpy soil about 1" dia. Friable soil.
- 1 min → Bread dough.
- 1 min 30 → Cookie dough
- 2 min 30 sec → Cake icing. smooth, stocky or Stiff Clay. Pasty.

Final Packed Volume → 800 ml

Logs: 021095-3C-PCTW P301080 P301081 (TCLP)

4 hour cure = Hard monolithic block. Able to break with hands.

2/10/95

mix #4C PCTW @ 34.8% solids @ 0.20 w/p Ratio

mixture: 400 g PCTW "as received"
20 g Hydrated Lime, $Ca(OH)_2$
1305 g Flyash, Type C
1.14 g STERGO

mixing observation: PCTW as delivered is a ~~thin~~ pumpable consistency of a Wendy's frosty or thick milkshake. The admixtures are added in one bulk addition in Hobart for 2.5 min

15 sec → Powder flying around bowl.
30 sec → Powder & moist clumps small and round. Dry powder
1 min 30 sec → stone
2 min 30 sec → Moist powder, can squeeze in hand to form ball which breaks easily with little pressure.

Final Loose Volume → 2150 ml
Final Packed Volume → 1186 ml

Lable: 021095-4C-PCTW

P301082
P301087 (TCLP)

4 hour cure = Powder

2/10/95

Mix #5C PCTW @ 34.8% Solids @ 0.25 w/p ratio

mixture: 400 g PCTW "as received"
20 g Hydrated Lime, $Ca(OH)_2$
1044 g Flyash, Type C
1.14 g STERGO

mix observation: PCTW as received is a non pourable consistency of a wendy's frosty or thick milkshake. The powders are added in one bulk addition in the bowl on speed #2
5 sec → Powder flying around bowl
30 sec → Clumps flying around bowl
1 min 30 sec → Powder
2 min 30 sec → most Powder, able to form ball by squeezing in hand and then it easily broken w/ little pressure.

Final Loose Volume = 1600 ml
Final Packed Volume = 980 ml

P301084

LABNE: 021095-5C-PCTW

4 hour cure = Powder

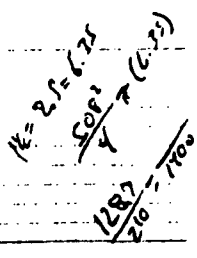
DL

2/10/95

$1k = 2.5 = 6.25$

$\frac{508^2}{4} \rightarrow (6.35)$

$\frac{1287}{210} = 1400$



Mix #6C PCTW @ 34.8% solids @ 0.30 w/p ratio

mixture: 400 g PCTW "as received"
20 g Hydrated Lime, $Ca(OH)_2$
870 g Flyash, Type C
1.14 g STERGO

mix observation: The PCTW "as received" is a thick watery consistency. The additives are added in one bulk addition in Hobart on speed #2.

5 sec → Powder flying around in bowl.
30 sec → moist powder
1 min 30 sec → Pack on side of bowl and moist powder in center of bowl.
2 min 30 sec → Hard side of bowl pack. Moist powder powder.

Final Loose volume → 1400 ml
Final Packed volume → 858 ml

P301147
P301148 (TCLP)

LABEL: 021395-6C-PCTW

2/9/95

NOTE: It appeared to be a miss weighing on page 59 because final weight was less than weight of flyash, But the final product looked Great! So did the below mixes:

7C1 400g PCTW dried out @ 43.3% solids
20g Lime
1134g Flyash
1.14g STERGO
5 sec → Powder flaps around bowl
1 min 30 sec → Moist powder some clumps of loose fines
2 min 30 sec → moist to dry powder. Able to squeeze to form ball which breaks easily.

Loose Volume = 2000 ml
Packed Volume = 1226 ml
Lable: 021395-7C1-PCTW

P301147
P301150 (TLLP)

2.5" = 6.35
$\frac{(5.08)^2}{4}$? (4)
$\frac{129}{210}$ = $\frac{}{2010}$

Ran out of PCTW dried out

7C2 300g PCTW dried out @ 43.3% solids
20g Lime
134g Flyash
1.14g Stergo
5 sec → large clay chunks
30 sec → Cake Icing.
1 min 30 sec → Hard packed Icing.
2 min 30 sec → Friable soil, moist clay. Flat warm dirt. Looks like mix 7C!

Loose Volume = 750 ml
Packed Volume = 375 ml
Lable = 021395-7C2-PCTW

P301151
P301152 (TLLP)

Mix #7C PCTW @ 43.3 % solids @ 0.20 w/p ratio

mixture: 400 g PCTW "dried out"
20 g Hydrated Lime, $Ca(OH)_2$
1134 g Flyash, Type C
1.14 g STERCO® additive

mix observations: The PCTW "dried out" is consisting of pudding. Bulk additional mixed in Hobart on #2 speed for 2.5 min.

5 sec → large clay balls or clumps
30 sec → Cookie dough / packed on sides
1 min 30 sec → Dry cake Icing.
2 min 30 sec → Dry clay or Friable soil. Hard soil pack on walls at bowl. When out looked like flat chunks.

NOTE This mix observation most like remainder mix #7C2

Final Loose volume = 750 ml
Final Packed Volume = 775 ml

LABLE: 021395 - 7C - PCTW

The mix for 7C-2 and what we got from 7C look very close and would be an excellent friable soil. So due to limited quantity will mix together and just call Mix 7C-2 and submit for TCLP ~~[illegible]~~ along with Mix #7C-1.

700 g PCTW {@ 43.3%} W = 397 g, S = 303 g
~268 g Flyash

w/p = 1.48 → change amount of additive actual w/p = 1.12

[signature]

2/13/95

Mix #8C PCTW @ 43.3 % solids @ 0.25 w/p ratio

mixture:

400 g	PCTW "dried out"
20 g	Hydrated Lime, $Ca(OH)_2$
907 g	Flyash, Type C
1.14 g	STERGO @ additive

mix observations: PCTW and Bulk addition of dry products in Hobart on speed #2 for 2½ min.

5 sec. → Dry powder flying around bowl.
30 sec → moist powder and some small moist mixture balls flying and bowl.
1 min 30 sec → same
2 min 30 sec → Moist powder, dry, powder

Loose Volume Found → 1700 ml
Final Packed Powder → 938 ml

P301153

Label = 021395-8C-PCTW

2/13/95

$2.5 = 6.35$

$\frac{\cos^2}{4} = 6.11$

$\frac{129}{210} = \frac{x}{1450}$

Mix #9C — PCTW @ 43.3 % Solids @ 0.30 w/p ratio

mixture:

400 g	PCTW "dried out"
20 g	Hydrated Lime, $Ca(OH)_2$
756 g	Flyash, Type C
1.14 g	STERGO® additive

mix observations: Dried out is pudding consistency added bulk additives.

5 sec → Dry powder flying around bowl.

30 sec → Dry powder and sand balls flying around bowl.

1 min 30 sec → Mostly dry powder and some moist balls flying around bowl.

2 min 30 sec → Powder, moist powder. Able to squeeze in hand to form ball which breaks easily with slight pressure.

Final loose volume = 1450 ml

Final packed volume = 889 ml

LABNE = 021395-9C-PCTW

PO301154

PO301155 (TCLP)

Robert Smith

2/13/95

ROCKY FLATS

PONDCRETE METALS (PCM)

Waste Acceptance Criteria Pre-Test

PRE-WAC

Pre-mix

% solids from Baseline = 38.8 % pH = 13.0

PCM as received is consistency of pudding. Non pourable. Has quarter size chunks of hard cement like material. ~~Able to mix~~

For WAC

In Back Region Lab

pH = 13.1

% solids = 45.2 % solids 61.2% moisture

MUD Balance = ~~[illegible]~~ 1.37 S.G.

NOTE: Will do calcs on 45.2% solids because the material may have dried slightly since it was delivered.

[signature]

DATE 2/13/95

5

Mixing Contained

1

Flyash	w/p	observation
25g (Total added 550g)		Same, slightly drier (48 mm)
25g (Total added 575g)	.43	Almost worm Dirt, Med sine clay chunks.
25g (Total added 600g)		Worm Dirt, large to medium curved
25g (Total added 625g)		Small curved to med curved worm Dirt Deer droppings
25g (Total added 650g)	.38	round, smooth worm dirt close to pellets
25g (Total added 675g)	.36	round sampling, cleaner. Still slightly sticky to each other, but close to moist pellets (58 mm)
25g (Total added 700g)	.35	Very round, sticky together close to pellets
25g (Total added 725g)	.34	same
25g (Total added 750g)	.33	Very close to pellets
25g (Total added 775g)	.32	Hard round dry pellets.

Final Volume = 1100 ml

TITLE

FLYASH

PRE-WAC MIXES

Mix #1

400 g PCM "as recieved" ~290 ml

38.8% solids
155 g solids
245 g H_2O

20 g Hydrated Lime

1.14 g STERGO® additive

? Flyash, Type C

Flyash will be added in 25 g increments until the desired consistency is achieved. The consistency of Lime, Stergo and first addition of Flyash is

Flyash added	w/p	observation
First addition		Cake Icing, packing on sides of bowl
25g (Total added 50g)		Dryish Cake Icing.
25g (Total add 75g)		Cookie dough, sticking to sides, scraped sides
25g (Total added 100g)		Smooth cake icing, hard bowl pack
25g (Total added 125g)		Cake Icing
25g (Total added 150g)		Same
25g (Total added 175g)		Drish Cake icing again. still sticking to sides
25g (Total added 200g)		Same
25g (Total added 225g)		Beginning to pull off sides, dryish cake dough.
25g (Total added 250g)		Same
25g (Total added 275g)		Hanging on beater blade, stuck still
25g (Total added 300g)		Same (Now mixing for 23 min)
25g (Total added 325g)		Begging to form bread dough
25g (Total added 350g)		Bread dough
25g (Total added 375g)		Bread dough sticking to beater
25g (Total added 400g)		Same
25g (Total added 425g)		Bread dough clinging onto mixer blade
25g (Total added 450g)		Same (37 min mixing)
25g (Total added 475g)		No stick to sides. Bread dough.
25g (Total added 500g)	.49	Bread dough
25g (Total added 525g)		Clay med. size clumps.

CONTINUED Page 66

Work continued to Page

SIG. [signature] DATE 2/13/95

DIST. DATE

Mixing Content

Flyash	Cement	Total	Observations
10g	20g	(220/440 ≠ 660g)	Same, slightly drier (48 mm)
10g	20g	(230/460 = 690g)	Small core warm dirt. Drier
10g	20g	(240/480 = 720g)	Deer droppings, Small core warm dirt Round moist pellets
10g	20g	(250/500 = 750g)	Same slightly more Round & Drier.
10g	20g	(260/520 = 780g)	Very close to pellets.
10g	20g	(270/540 = 810g)	Smooth, Round, clean moist pellets Barely stick together (58 mm)
10g	20g	(280/560 = 840g)	Almost dry pellets, Still color of moist, but not sticky together
10g	20g	(290/580 = 870g)	Same (1 hour 3 min mixing time)
10g	20g	(300/600 = 900g)	Pellets of round dry and hard

Final volume = 1125 ml

Mix #2

400 g	PCM : as recieved
20 g	Hydrated Lime, $Ca(OH)_2$
1.17 g	STERGO ® Additive.
?	Flyash, Type C
?	Cement, Type I/II

The Flyash and Cement will be added in a 2:1 ratio or 10g Cement and 20g Flyash Increments.

Flyash	Cement	Total	observation
10g	20g	(10/20 = 30g)	Cake Icing, Packed on sides of bowl
10g	20g	(20/40 = 60g)	Dryish Cake Icing.
10g	20g	(30/60 = 90g)	Cookie dough, Stricking on sides
10g	20g	(40/80 = 120g)	Hanging on mixer blade. Clay.
10g	20g	(50/100 = 150g)	Dry clay clumps. Still slight stick to sides
10g	20g	(60/120 = 180g)	Same
10g	20g	(70/140 = 210g)	Pulling off sides of bowl. Cookie dough
10g	20g	(80/160 = 240g)	Same
10g	20g	(90/180 = 270g)	Bread dough, Balling up
10g	20g	(100/200 = 300g)	Same, started to stick to sides again
10g	20g	(110/220 = 330g)	Bread dough, Stuff.
10g	20g	(120/240 = 360g)	Same (now mixing for 23 min)
10g	20g	(130/260 = 390g)	Same.
10g	20g	(140/280 = 420g)	Hard Clay, clumpy to Bread dough.
10g	20g	(150/300 = 450g)	Dry clay medium size clumps.
10g	20g	(160/320 = 480g)	Same
10g	20g	(170/340 = 510g)	Dryish Clay, med. Chunks
10g	20g	(180/360 = 540g)	Same (37 min mixing)
10g	20g	(190/380 = 570g)	Dryish Clay med. size chunks
10g	20g	(200/400 = 600g	Smaller & Drier Chunks
10g	20g	(210/420 = 630g	Warm dirt, med curd chunks

[signature]

2/13/95

Mix #3

400 g	PCM "as Received"
20 g	Hydrated Lime
1.14 g	STERGO® additive
?	Silica flour }
?	Flyash }

The flyash and fine Silica flour is added at a ratio of 5.67 to 1 or in increments of 45.4 g flyash, 8 g SSA-1. until the desired product is achieved

FLYASH	Silica Flour	Total	Observation
45.4	8	(45.4/8 = 57.4 g)	Dry Cake Icing, Packed to Sides of Bowl.
45.4	8	(90.8/16 = 106.8 g)	Cookie dough, trying to pull off sides of bowl.
45.4	8	(136.2/24 = 160.2 g)	Rolling onto beater, same slightly thicker
45.4	8	(181.6/32 = 213.6 g)	Wet rolling clay, stiff, still sticky.
45.4	8	(227/40 = 267 g)	Same
45.4	8	(272.4/48 = 320.4 g)	Bread dough, but holding on beater, dry like clay
45.4	8	(317.8/56 = 373.8 g)	Close to clay, same.
45.4	8	(363.2/64 = 427.2 g)	Med size clay chops, Breaking up.
45.4	8	(408.6/72 = 480.6 g)	medium curd worm Dirt.
45.4	8	(454/80 = 534.4 g)	small curd worm dirt. Like deer droppings
45.4	8	(499.4/88 = 587.4 g)	small curd worm dirt, slightly sticky still angular
45.4	8	(544.8/96 = 640.8 g)	small round worm dirt. Still slightly sticky
45.4	8	(590.2/104 = 694.2 g)	Cleaning up to very round smooth but still many
45.4	8	(635.6/112 = 747.6 g)	worm dirt, round
45.4	8	(681/120 = 801 g)	Same
45.4	8	(726.4/128 = 854.4 g)	Round, balls, smooth, Like Pellets, slight rock look
45.4	8	(771.8/136 = 907.8 g)	Same
45.4	8	(817.2/144 = 961.2 g)	Round, smooth, Pellets almost completely Hard
45.4	8	(862.6/152 = 1014.6 g)	Pellets

Volume = 1250 ml

2/15/95

207C WAC Mixes

Waste Acceptance Criteria Mixes

These mixes will test 207C natural at three waste loadings as discribed by the Specific Gravity. The loadings will be: S.G. = 1.98 (as-recieved)
S.G. = 1.75
S.G = 1.50

Based on the Pre-wac testing it was determined that a wide range of W/P is needed to cover the desired consistancy of the material. The W/P ratio range selected is 0.1, 0.2, and 0.3 W/P

The

DATE

Copied from LAD Book: P174-94

P176-94

48 HR UCS TEST OF 207C MIXED 2-14-95 2-16-95

BATCH ID	WT, g	LBf	PSI	% SOLIDS	DATE MIXED
1A	— —	— — —	*	— — —	— —
2A	435.5	108	34.4		2-14-95
3A	422.3	62	19.7		↓
4A	329.5	59	18.8		
5A	438.1	559	178		
6A	418.1	260	82.8		
7A	— —	— — —	*	— — —	— — — —
8M	349.6	63	20.1		2-14-95
9A	429.1	355	113		↓

PSI CALCULATIONS : LBf / AREA AREA = 3.14

* - CYLINDER FAILURE DURING REMOVAL FROM MOLD.

NOTE: DRAWINGS & DESCRIPTIONS ON PG 86

6.35

$\frac{129}{210} = \frac{4}{163}$

Mix #1 A 207C @ ~~1.48~~ 1.5 S.G or ~~52.5~~ 54.3 % solids @ 0.10 w/l ratio

mixture:

200 g crystals, 207C
97 ml 207 A/B water
15 g Hydrated Lime, $Ca(OH)_2$
~~1298~~ 1298 g Flyash, Type C.

mix observations: 207C crystals and 207 A/B water consistency of water, pourable fluid. The pH = 10.0. We will add the lime to check the pH on this mix only.
pH = 12.9 Initial volume = 2000 ml

5 sec → Powder flying around in bowl.
30 sec → Some moist clumps & powder flying around bowl.
1 min → Heavy pack of moist powder on side of bowl. Powder flying around bowl.
2 min 30 sec → Powder, moist to dry. Able to form powder ball by squeezing in hand.

Final volume Loose → 1800 ml
Final Packed Volume → 1106 ml

P301173
P301174 (TCLP)

LABLE: 021495-1A-207C

24 hr cure → Powder

2/14/95

86 Copied from LAB Book: 174-94

BATCH ID	ILLUSTRATION	DESCRIPTION OF CYLINDER CONSISTENCY	DESCRIPTION OF FAILURE
1A		BROKE DURING REMOVAL FROM MOLD DRY CHIPPED AT TOP	BROKE IN REMOVAL FROM MOLD
2A		MOIST BUT SOLID VERY FEW AIR VOIDS	SOME COMPRESSION OF CYLINDER. FAILURE IN MIDDLE, NO CRACKS. COMPRESSION FAILURE, NO FISSURES
3A		MOIST – SOLID COUPLE OF AIR SM. VOIDS	COMPRESSION FAILURE, NO FISSURES.
4A		DRY - SOLID NO AIR VOIDS	VERTICLE FAILURE
5A		SOLID – MANY SMALL VOIDS	VERTICLE FAILURE
6A		SOLID - MANY SMALL VOIDS - SOME LARGER VOIDS SOME SM. CRYSTALS VISABLE	ANGULAR FAILURE
7A		DRY - BROKE IN MOLD NO VOIDS	BROKE DURING EXTRACTION FROM MOLD
8A		DRY - CHIPPED AT TOP. VERY FEW SMALL VOIDS	VERTICLE FAILURE FROM TOP
9A		SOLID - MANY SMALL VOIDS CRYSTALS VISABLE	NO VISIBLE CRACKS

Mix #2A 207C @ 1.5 S.G or 56.3% solids @ 0.20 w/p ratio

mixture:

300 g 207C crystals
145 ml 207 A/B water
22 g Lime
~~1253~~ g Flyash, Type C
972

297 ml

mix observation: same initial as mix 1A. Mix in bulk addition and mixed in Hobart on speed #2.

5 sec → Cake icing
30 sec → wet cake icing
1 min → slopy, striking to sides of bowl
2 min 30 sec → pudding consistency, or thick wendy's frosty.

Final Packed Volume = 700 ml.

LABLE = 02~~0~~495-2A-207C

24 hour cure → Clay, melting, still soft, not fully cured.

P301175

[signature]

2/14/95

Mix #3A 207C @ 1.5 S.G. ~ 56.37% solids @ 0.30 w/p Ratio

mixture:

300 g	crystal, 207C
145 ml	207A/B water
22 g	Lime, Hydrated
648 g	Flyash, Type C

mix observations: Initial consistency same as mix #1A
Bulk mix in of flyash & Lime
5 sec → Cookie dough
30 sec → Cake Icing, wet.
1 min → Wendy's Frosty, wet & sloppy
2 min 30 min → Semi-pourable, Milkshake Consistency.

Final Packed Volume → 550 ml

LABLE → 021495-3A-207C

24 hour cure → Very soft clay. Not hard cure, still Moldable

P301176
P301177 (TCLP)

JCS

2/14/95

$1\frac{3}{4}$"

5 mls

$\frac{115.6}{210} = \frac{x}{200}$

Mix # 4A — 207C @ 1.75 ~ 70.8% solids @ 0.10 w/p ratio

mixture:

400 g	207C crystals
62 ml	207 A/B water
23 g	Lime, Hydrated
1349 g	Flyash, type C

mixture observation: 207C crystals and 207A/B water @ SG 1.75 is a fluid, water like consistency with settled solids on bottom. pH = 10.3

To this mix we add the lime seperately to check the change in pH. pH = 12.8 to 13.0

The remain addition, Flyash, was added in one bulk addition.

5 sec → Powder flying around in bowl.
30 sec → moist powder balls and powder flying around bowl.
1 min → moist fluffy powder
2 min 30 sec → moist powder, able to squeeze in hand to form ball which breaks easily under pressure.

Final Loose volume = 2050 ml
Final Packed volume = 1131 ml

P301178
P301179 (TCLP)

Label: 021495-4A-207C

24 hour cure → Powder

2/14/95

mix #5A 207C @ 1.75 or 70.8% solids @ 0.20 w/p ratio

mixture:

400 g 207C Crystals
62 ml 207A/B Water
23 g Hydrated Lime
675 g Flyash, Type C

mix observation: Material is fluid, water like with lots of settled solids. Addition of Lime makes a pea-soup consistency.

5 sec → small rounds balls & powder flying around bowl

30 sec → Round moist warm Dirt. Good warm dirt.

1 min → large curd warm dirt. Heavy sticking to bottom of bowl.

1 min 30 sec → large clay balls

2 min → Clay chunks to bread dough

2 min 30 sec → Heavy clay ball. Dense molding clay.

Final Packed volume → 650 ml

Lable: 021495-5A-207C

24 hour cure → Solid, breaks with hand pressure, a monolith which breaks easily.

P 301180

[signature] 2/14/95

Mix # 6A 207C @ 1.75 or 70.8% solids @ 0.30 w/p Ratio

mixture:

400 g	207C Crystals
62 ml	207A/B water
23 g	Hydrated Lime
450 g	Flyash, Type C

mix observation: See mix #4A for initial observations. Bulk addition of Lime & Flyash.

5 sec → Cookie dough
30 sec → Thin Cake Icing
1 min → Wendy's frosty
1 min 30 sec → same
2 min → same
2 min 30 sec → Thin frosty to Thick milkshake

Final Packed Volume → 450 ml

LABLE: 021495-6A-207C

24 hour cure → a monolith which breaks apart easily with only hand pressure.

NOTE: John noted when breaking the cylinders there was visible grains of white salt like crystals.

P301181
P301182 (TCLP)

2/17/95

5

$2.5 = \text{[illegible]}$

$$\frac{129}{210} = \frac{x}{1300}$$

Mix # 7A 207C @ 1.98 S.G. or 82.5% solids @ 0.10 w/p ratio

mixture:

400g	207C crystals
20g	Hydrated Lime
700	Flyash, type C

Initial mixture 208-1

mix observation: The crystals as received are almost all crystals with only some water. Initial pH = 10.8. The addition of lime created a pasty, chunky, matted material. Non pumpable pH = 13.0 Bulk addition of materials.

5 sec → Powder flying around bowl.
30 sec → Same
1 min → Round balls & powder flying around bowl.
2 min 30 sec → Some hard pack on bottom, dry powder.

Final Loose Volume → 1300 ml
Final Packed Volume → 797 ml

Labels: 021495-7A-207C

P301183
P301184 (TCLP)

24 hour cure → Powder

JCL

2/14/95

$\frac{1.84}{210} \times \frac{7.67}{950}$

mix # 8A 207C @ 1.98 S.G. or 82.5% solids @ 0.20 w/p ratio

Mixture:

500 g 207C Crystal
25 g Hydrated Lime
437.5 g Flyash, Type C

mix observation: See mix 7A for initial observations
Bulk mix of additives
35 sec → Round, looks hard, may be pellets
1 min → Powder & round balls
2 min 30 sec → Powder, loose. Dry powder

Final loose volume → 950 ml
Final packed volume → 699 ml

Lable: 021495-8A-207C

24 hour cure → Powder P301185

2/14/95
DATE

mix #9A 207C @ 1.985G. or 82.5% solids @ 0.30 w/p ratio

mixture:

700 g 207C Crystals
35 g Hydrated Lime
408 g Flyash, Type C

mix observation: see mix #7A for initial observations. Bulk addition.

5 sec → Balls & Chunks Dry in ~~powder~~ very small amount of powder. Looks like pellets.
30 sec → Worm Dirt, small curd
1 min → Packed worm dirt or starting to become bread dough
1 min 30 sec → Bread dough
2 min → Bread dough or clay
2 min 30 sec → Molding Clay. Easily breaks apart. Friable clay.

Final Loose Volume → 1100 ml
Final Packed Volume → 550 ml

LABEL: 021495-9A-207C

24 hour cure → good mix, worm dirt consistency, hard but friable pieces.

P 301186
P 301187 (TCLP)

[signature]

2/14/95

P176-94

Copied from LAO Book: P174-94

2-17-95

48 hour UCS test of 207C mixes made 2-15-95

batch ID	wt (g)	LBF	PSI	% solids
1B	436.2	265	84.4	56.3
2B	------	*	------	56.3
3B	431.5	118	37.6	56.3
4B	------	*	------	70.8
5B	444.4	398	127	70.8
6B	432.9	327	104	70.8
7B	------	*	------	82.5
8B	------	*	------	82.5
9B	------	*	------	82.5

PSI calc. = LBF/area area = 3.14

* : cylinder failure during removal from mold

drawings and descriptions on pg. 88

Rocky FLATS

Flyash, Cement, and Lime

Mix #1B 207C @ 1.5 S.G. or 56.3% solids @ 0.15 w/p Ratio

Mixture:

200 g	Crystals, 207C
97 ml	207 A/B water
15 g	Hydrated Lime
288 g	Cement, Type III
577 g	Flyash, Type C

200 ml

mix observation: Initial 207C crystals and 207 A/B water is water-like, pourable fluid. See initial 207C mixes for pH and other observations.

5 sec mix → Pea size round balls with beginnings of side of bowl pack.

30 sec mix → Small to very small round worm dirt and heavy side bowl pack.

1 min → Moist powder in center alot of side bowl pack.

2 min 30 sec → Side bowl pack, Pushed sides in which then look like an excellent friable soil consisting.

Final Loose Volume: 1100 ml
Final Packed Volume: 550 ml
Lab 6: 021595-1B-207C

NOTE: when bounced to pack cylinder for pack volume the top became shiny with moisture.

24 hour cure = Powder, still moist looking, some pea-size chunks

P301231
P301232 (TCLP)

[signature]

2/15/95

Copied from LAB BOOK: P174-94

batch ID	illustration	description of cylinder consistency	description of failure
1B		very solid and cementlike many small air voids moist appearance	internal failure
2B		very solid and cementlike not many air voids, some large top chipped during removal from mold	during removal from mold
3B		very solid and cementlike air voids rare moist appearance	top bulged vertical cracks
4B		very gritty and sandy very small air voids approx. 1/2 of cylinder crushed during removal	during removal from mold
5B		very solid and cementlike many small air voids moist appearance	hairline cracks at top
6B		very solid and cementlike many small air voids moist appearance	chipping and cracking on top surface
7B		dry, gritty, somewhat sandy air voids rare > 1/2 of cylinder crushed during removal	during removal from mold
8B		dry, gritty, somewhat sandy air voids rare > 1/2 of cylinder crushed during removal	during removal from mold
9B		gritty and cementlike many small air voids top and bottom chipped during removal	during removal from mold

Mix #2B — 207C @ 1.5 S.G @ 56.32 solids @ 0.20 w/p ratio

mixture:

300 g	207C crystals
145 ml	207A/B water
22 g	Hydrated Lime, $Ca(OH)_2$
324 g	Cement, Type I/II
648 g	Flyash, Type C

mix observation: See pg 75 for pH's. This mix all additives (Lime, cement, Flyash) are added in on bulk addition.

- 5 sec → Clay clumps
- 30 sec → Bread dough
- 1 min → Cookie dough
- 2 min → Cake Icing
- 2 min 10 sec → Thick pudding or moist molding clay consistency.

Packed Final Volume → ~~750 ml~~ 700 ml

Label: 021595-2B-207C

24 hour cure → moist molding clay, still moldable, but will break in chunks.

P 301233

2/15/95

Mix #3B 207C @ 1.50 S.G. w 56.3% solids @ 0.25 w/p ratio

Mixture:

400 g	207C cryBalls
194 ml	207A/B water
30 g	Hydrated Lime
346 g	Cement, Type I/II
692 g	Flyash, Type C

Mix observations: The additives are added to the liquid in one bulk addition and mixed on speed #2 for 2.5 min.

- 5 sec → Bread dough
- 30 sec → Cookie dough to cake icing
- 1 min → Wet cake icing
- 2 min → Wendy's frosty
- 2 min 30 sec → Thick milkshake, semi-pourable will slow pour into beaker. Seems to be setting quickly.

Packed Final Volume → 825 ml

Label = 021595-3B-207C

24 hr cure → Moist ~~not~~ to wet molding clay. Dense bit will crush first ½ inch. Can break into chunks.

P301234
P301235 (TCLP)

2/15/95

1.5'

Mix #4B 207C @ 1.75 S.G. or 70.8% solids @ 0.15 w/p ratio

Mixture:

400 g 207C Crystals
62 ml 207A/B water
23 g Hydrated Lime
300 g Cement, type I/II
600 g Flyash, type C

765 ml

Mix Observation: The 207C at 70.8% solids is a liquid with settled solids to bottom. Mixed as with other for ~5 min on low speed on Hobart. See pg 81 for pH readings
Additives added in one bulk addition.

5 sec → Pea size balls or clumps
30 sec → seems like pellets flying around bowl
1 min → Crushed the round balls to form a moist powder or very small packed clumps.
2 min → moist fluffy powder
2 min 30 sec → Moist powder. Able to squeeze in hand to form ball which crushes with little pressure

Final loose volume = 1250 ml
Final Packed Volume =

P 301236
P 301237 (TCLP)

Label = 021595-4B-207C

24 hour cure → Fine powder, still moist looking, powder consistency.

2/15/95

Mix #5B 207C @ 1.75 S.G or 70.8% solids @ 0.20 w/p Ratio

Mixture:

400 g	207C crystals
62 ml	207 A/B water
23 g	Hydrated Lime
225 g	Cement, Type I/II
450 g	Flyash, Type C

mix observations: Material add in one bulk addition.

5 sec → Round pellets or balls (pea-size) flying around bowl

30 sec → Worm Dirt, large curd

1 min → Worm Dirt, small curd

1 min 30 sec → Medium clay balls

2 min 30 sec → Moist molding clay

Final Packed Volume → 650 ml

Sample = 021595-5B-207C

24 hour cure → Chunks of dry clay. Easy to break up.

P 301238

[signature]

2/15/95

Mix #6B 207C @ 1.75 5.6 -- 70.8 % solids @ 0.25 W/P ratio

Mixture:

600 g	207C crystals
93 ml	207 A/B Water
35 g	Hydrated Lime
270 g	Cement, Type ~~III~~ I
540 g	Flyash, Type C

mix observations: Bulk addition of additives.

10 sec → Bread dough Ball
30 sec → Cookie dough
1 min → Cake Icing
1 min 30 sec → Wet cake icing
2 min 30 sec → Chunky cake icing or peanut butter not pourable.

Final placed volume = 750 ml

Lab #: 021595-6B-207C

NOTE: John notices while breaking the sample for TCLP, small white crystals (Like salt crystals) were spread throughout the sample.

24 hour cure → Powder still looks moist.

P 301239
P 301240 (TCLP)

2/15/95

13/4

$\frac{176}{210} = \frac{88}{105}$

Mix #7B 207C @ 1.98 S.G. or 82.5% solids @ 0.15 W/P Ratio

mixture:

400 g	207C crystals
20 g	Hydrated Lime
155 g	Cement, Type I/II
311 g	Flyash, Type C

mix observation: As delivered crystals are mainly all crystal chunks with some free liquid. The additives are added in one bulk addition.

5 sec → Powder flying around bowl.
30 sec → Powder & some moist ball flying around bowl.
1 min → Powder and some packed powder on side of bowl.
2 min 30 sec → Moist powder. Made moist puck ball by squeezing in hand and able to break with slight finger pressure

Final Loose volume = 950 ml
Final Packed volume = 524 ml

Comments: 021595-7B-207C

24 hour cure → Powder

P30 1241
P30 1242 (TCLP)

2/15/95

$$\frac{1.5}{\frac{129}{210} = \frac{x}{650}}$$

Mix #8B 207C @ 1.98 SG -- 82.5% solids @ 0.20 w/p ratio

mixture:

500 g	207C Crystals
25 g	Hydrated Lime, $Ca(OH)_2$
146 g	Cement, Type I/II
292 g	Flyash, Type C

mix observation: As defined crystals and both additives

5 sec → Powder with some moist balls flying around bowl

30 sec → Round balls or pellets flying around bowl.

1 min → Round balls very small and moist powder.

2 min 30 sec → Moist powder able to squeeze into ball which breaks with slight pressure.

Final Loose volume → 850 ml
Final Packed Volume → 521 ml

Label: 021595 - 8B - 207C

P301243

24 hour cure → Powder

2/15/95

1" =

$\frac{154.4}{210} = \overline{1150}$

Mix # 9B 207C @ 1.98 S.G or 82.5% solids @ 0.25 w/p ratio

mixture:

700 g	207C crystals
35 g	Hydrated lime
163 g	Cement, Type I/II
327 g	Flyash, Type C

mix observations: As delivered crystals and silt

5 sec → Powder and round balls flying around bowl.
30 sec → Pellets, hard round balls flying around bowl.
1 min → Pellets begging to break down
1 min 30 sec → Packing to sides of bowl and center moist powder and pellets.
2 min 30 sec → Heavy pack on sides of bowl and moist powder in center. Pushed sides in created a hole with powder packed.

Final Loose volume → 1150 ml
Final Packed volume → 846 ml

LABEL: 021595-9B-207C

P301244
P301245 (TCLP)

24 hour cure → Powder still looking moist

2/15/95

P176-94

Copied from LAB Book: P174-94 2-18-95

48 Hour UCS TEST OF 207C MIXES MADE 2-16-95

BATCH ID	WT. (g)	LB.F	PSI	% SOLIDS
1C	428.1	180	57	56.3 ~~53.6~~ 58
2C	431.8	136	43	56.3
3C	422.5	81	26	56.3
4C	*		*	70.8
5C	423.6	465	148	70.8
6C	426.6	333	106	70.8
7C	*		*	82.5
8C	*		*	82.5
9C	343.5	59	19	82.5

PSI CALC. = LB.F/AREA AREA = 3.14

* CYLINDER CRUMBLED DURING REMOVAL FROM MOLD

DRAWINGS & DESCRIPTIONS ON PAGE 90

1.71
2.25
(5.713)
$\frac{116}{206} = \frac{x}{1500}$

Rocky FLATS

Lime, Flyash, SSA-1

Mix #1C 207C @ 1.5 S.G. = 56.3% solids @ 0.15 w/p ratio

Mixture:

300 g Crystals, 207C
145 ml 207A/B water
22 g Lime, Hydrated
194 g Silica flour, SSA-1
1102 g Flyash, Type C

mix observation: 207C @ 1.5 S.G. is a watery slurry w/ some settled solids. The other observations are same as pg 75. The additions are added in one bulk addition in Hobart on speed #2 for 2.5 min.

@ 5 sec → Powder and round balls flying around in bowl.
30 sec → Round balls flying around bowl, some powder.
1 min → Some pack on sides of bowl w/ powder in center bowl
1 min 30 sec → Moist powder some packing
2 min 30 sec → Very moist powder. Squeeze into tight ball, but break apart easily.

Final Loose Volume → 1900 ml
Final Packed Volume → 1070 ml

P301299
P301300 (TCLP)

Label: 021695-1C-207C

3hr cure: Moist granular powder or soil

Robert F. Spence 2/16/95

112
90

Copied from LAB BOOK: P174-94

BATCH ID	ILLUSTRATION	DESCRIPTION OF CYLINDER CONSISTENCY	DESCRIPTION OF FAILURE
1C		SOLID WITH MANY SMALL AIR VOIDS MOIST APPEARANCE	VERTICAL HAIRLINE CRACKS
2C		SMOOTH SOLID WITH LONG AIR VOIDS MOIST APPEARANCE	NUMEROUS HORIZONTAL HAIRLINE BULGES SOME VERTICAL CRACKS
3C		SMOOTH SOLID WITH VERY FEW AIR VOIDS MOIST APPEARANCE	NUMEROUS HORIZONTAL HAIRLINE BULGE AND MANY VERTICAL CRACKS
4C		SOFT CRUMBLY VERY FEW AIR VOIDS MOIST APPEARANCE	TOP HALF OF CYLINDER CRUMBLED DURING REMOVAL FROM MOLD.
5C		SMOOTH SOLID WITH MANY SMALL AIR VOIDS MOIST APPEARANCE	HORIZONTAL HAIRLINE CRACKS
6C		SMOOTH SOLID WITH MANY SMALL AIR VOIDS MOIST APPEARANCE	NUMEROUS VERTICAL HAIRLINE CRACKS
7C		GRITTY BUT SMOOTH SOLID WITH VERY FEW AIR VOIDS MOIST APPEARANCE	TOP QUARTER OF CYLINDER CRUMBLED DURING REMOVAL FROM MOLD.
8C		GRITTY BUT SMOOTH SOLID WITH MANY SMALL AIR VOIDS MOIST APPEARANCE	CYLINDER BULGE IN HALF AND TOP QUARTER CRUMBLED DURING REMOVAL FROM MOLD
9C		PACKED SAND APPEARANCE TOP CRUMBLED VERY SLIGHTLY MOIST APPEARANCE	BULGING & BREAKING AT TOP

Mix #2C — 207C @ 1.5 5.6 -- 56.3% solids @ 0.20 W/P ratio

Mixture:

400 g 207C Crystals
194 ml 207A/B water
30 g Lime
194 g Silica Flour
1103 g Flyash

Mix observation: Initial 207C has bulk additions added.

5 sec → Clay chunks
30 sec → Bread dough
1 min → Cookie dough
1 min 30 sec → Some
2 min 30 sec → Consistency of creamy peanut butter

Packed Volume → 950 ml

LABELS: 02.1695-2C-207C P301301

3 hour cure → moist clay, monolith

2/16/95

Mix #3C — 207C @ 1.55.6 -- 56.37% solids @ 0.25 w/p ratio

mixture:

600 g	207C crystals
291 ml	207 A/B water
84 g	Lime
283 g	Silicon flour
1324 g	Flyash

mix observation: Addition of Bulk additives to 207C mixture

5 sec → Cookie dough
30 sec → Wet cake icing
1 min 30 sec → Creamy wendy's frosty
2 min 30 sec → Semi-pourable, consisting of a Wendy's frosty or Thick milkshake. Like soft ice cream.

Packed Volume = 1250 ml

LABEL: 021695-3C-207C

3 hour cure = Moulith, clay soft, but one block

P301302
P301303 CTCLP

2/16/95

1.25

$\frac{141.6}{206} = 950$

mix #4C — 207C @ 1.75 S.G. or 70.8% solids @ 0.15 w/p ratio

mixture:

300 g Crystals
46 ml 207A/B water
17 g Lime
101 g Silica flour
572 g Flyash, Type C

mix observations: 207C mixture prepared to 1.75 S.G. and additives added in one bulk addition.

5 sec → Pellets or pea-size ball flying around bowl.

30 sec → Same, ball or pellets becoming smaller

2 min 30 sec → Breaking down to powder. Fine moist powder. Able to form packed ball by squeezing in hand, breaks with slight pressure.

Final Loose Volume = 950 ml
Final Pack Volume = 653 ml

Labels: 021695 - 4C - 207C

3 mm cm: moist granular sand or powder

P301304
P301305 (TCLP)

JCP

2/16/95

Mix #5C 207C @ 1.75 S.G or 90.8% solids @ 0.20 w/p ratio

Mixture:

500 g	207C Crystals
62[illegible] ml	207 A/B Water
23[illegible] g	Hydrated Lime
101 g	Silica Flour, SSA-1
573 g	Flyash, Type C

Mix observation: The additions are added in Bulk to the 207C material

5 sec → Balls and powder flying around bowl.

30 sec → Medium curd worm Dirt

1 min → Bread dough

1 min 30 sec → Sticky Bread dough or dense clay.

2 min 30 sec → Molding Clay, soft

Final Packed volume = 600 ml

Label: 021695-5C-207C

hr cure: Moist Clay chucks ~ 1" to 2" dia

P301306

2/16/95

Mix #6C 207C @ 1.75 S.G. w/ 70.8% solids @ 0.25 w/p ratio

mixture:

500 g	207C Crystalline
77 ml	207A/B Water
29 g	Hydrated Lime
101 g	Silica flour, SSA-1
573 g	Flyash, Type C

mix observation: Bulk addition of additives to the 207C

5 sec → Clay clumps
30 sec → Cookie dough
1 min → Cookie dough, sticky, very thick cake icing
2 min 30 sec → Fudge, gritty, thick sticky cookie dough

Final Packed Volume → 600 ml

LABEL = 021695-6C-207C

3 hr cure → Moist Hard clay character

P301307
P301308 (TCLP)

2/16/95

mix #7C 207C @ 1.98 S.G. or 82.5% solids @ 0.15 w/p ratio

mixture:

400g 207C crystals
20g Hydrated lime
70g Silica flour, SSA-1
396g Flyash, Type C

mix observation: To the as recieved crystals added materials in one bulk addition in Hobart on Speed #2 for 2.5 min.

5 sec → Powder flying around bowl
30 sec → Ball or pellets with some powder flying around bowl
1 min Begging to break down ball and slight dirt pack on side of bowl.
1 min 30 sec mostly powder
2 min 30 sec Moist powder to just powder. Able to squeeze in hand to form a ball without break easily under slight pressure.

Final Loose volume → 1000 ml
Final Packed Volume → 562 ml

Lable: 021695 - 7C - 207C

P301309
P301310 (TCIP)

3 hr one: Moist powder. Fine texture.

2/16/95

8,255

$\frac{167}{200} = 850$

Mix #8C 207C @ 1.98 5.6 : 82.5% solids @ 0.20 w/p Ratio

Mixture:

600g	207C crystals
30g	Hydrated lime
79g	Silica flour, SSA-1
446g	Flyash, Type C

Mix observation: To the as received crystals the additives were added in one bulk addition.

5 sec → Powder w/ some balls flying around bowl.

30 sec → Pellets flying around bowl.

1 min → Round balls and powder

2 min 30 sec → Moist powder.

Loose volume → 850 ml

Packed volume → 689 ml

Label: 021695-8C-207C

3 min cure → At mix dry powder

P 301311

2/16/95

Mix # 9C 207C @ 1.98 S.G. or 82.5% solids @ 0.25 w/p ratio

mixture:

800 g 207C Crystals
40 g Hydrated Lime
84 g Silica flour, SSA-1
476 g Flyash, Type C

mix observation: To the as received material the materials are added in one bulk addition.

5 sec → Powder and round balls flying around bowl.
30 sec → Pellets or small balls flying around bowl.
1 min → Pellets begging to break down
1 min 30 sec → Begging to pack on sides of bowl.
2 min 20 sec → Heavy pack on sides of bowl. Good granular soil in center.

Final loose volume → 1150 ml
Final packed volume → 862 ml

Label 021695-9C-207C

3 hr cure → moist small curd warm dirt consistency.

P301312
P301313 (TCLP)

[signature] 2/16/95

2/16/95

Submitted samples of additives for TCLP and Bulk Density Analysis:

Flyash, Type C → P0301396
P0301397 (TCLP)

Fine Silica flour → P0301398
P0301399 (TCLP)

Lime, $Ca(OH)_2$ → P0301400
P0301401 (TCLP)

CEMENT, Type I/II → P0301402
P0301403 (TCLP)

Rocky FLATS

EXTRA MIXES

Field Duplicates Mixes

Field duplicate mixes need to be submitted for 1 out of every 10 TCLP analysis.

There are five waste streams, 3 formulas, 3 % solids, and 3 w/p ratios. (NOTE: PCM will only preform a 2x3 or 2x2 matrix due to limited quantity of material) this produces a total of 84 mixes submitted for TCLP analysis (only 6 of 9 mixes "The Ends" are submitted for TCLP).

The field Dups were selected to cover the range of mixes preformed

LABLE: The field Dups will be labled with the original sample Lable and Dup. as well as the new lable and given it own Laboratory Tracking P#.

The Dup. samples are as follows:

① 013095-4-207A/B Dup.

100g 207 A/B "as recieved"
194 ml 207 A/B Water
100 g Hydrated lime
900 g Flyash, Type C

LABLE: 021795-1 DUP-207A/B

Observation: Heavy pack on side of bowl. Powder in center. Final mix a moist powder.

P301413

[signature] 2/17/95

② 013195 - 4A - 207 A/B Dup.

100 g 207 A/B "as received"
194 ml 207 A/B Water
14.7 g Hydrated Lime
999 g Flyash, Type C
176 g Silica Flour.

LABEL: 021795 - 2 DUP - 207 A/B

observation: All a moist powder.

P0301414

③ 020195 - 4B - 207 A/B Dup.

100 g 207 A/B "as received"
194 ml 207 A/B water
14.7 g Hydrated lime
783 g Flyash, Type C
392 g Cement, Type I/II

LABEL: 021795 - 3 DUP - 207 A/B

observation: Heavy side of bowl packed with moist powder in center. Moist Powder

P0301415

2/17/95

④ 020395 - 9A - CLAR Dup.

400 g CLARIFIER "as received"
20 g Hydrated Lime
729 g Flyash, Type C

label: 021795 - 4Dup - CLAR PO 301416

Observation: Bread dough to cookie dough, Monolithic dry blk.

⑤ 020795 - 9B - CLAR DUP.

400 g Clarifier "as received"
20 g Hydrated Lime
703 g Flyash, Type C
124 g Silica flour

Label: 021795 - 5 Dup - CLAR PO 301417

observation: Dry clay or Arable packed soil.

⑥ 020995 - 4B - PCTW

400 g PCTW "as received"
20 g Hydrated Lime
1109 g Flyash, Type C
196 g Silica flour
1.14 g STERGO® Additive

Label: 02179 - 6 Dup. - PCTW PO 301418

observation: Moist powder.

Robert F Smith 2/17/95

⑦ 021095-4C-PCTW

400 g PCTW "as received"
20 g Hydrated Lime
1305 g Flyash, Type C
1.19 g STERGO® Additive

LABLE: 021795-7DUP-PCTW PO 301419
observation: moist soil

⑧ 021495-7A-207C

400 g 207C Crystals
20 g Hydrated Lime
700 g Flyash, Type C

LABLE: 021795-8DUP-207C PO 301420
observation: moist soil

⑨ 021595-7B-207C

400 g 207C Crystals
20 g Hydrated Lime
155 g Cement type I/II
311 g Flyash, Type C

LABLE: 021795-9DUP-207C PO 301421
observation: moist soil

Robert F. Smith 2/17/95

Rocky FLATS

PCM WAC

137

PONDCRETE METALS (PCM)

PCM WAC TESTING

*SEE PAGE 65 THIS BOOK FOR PRE-WAC *

A portion of the PCM was dried out by blowing a fan over the material.

[signature]

2/20/95

Copied from LAB Book: P174-94

48 hour UCS test of PCM mixes made 2-20-95

batch ID	wt(g)	LBF	PSI	% solids
1A	319.0	356	113	38.8
2A	300.5	433	138	38.8
3A	298.3	229	73	38.8
4A				48.6
5A **	349.9	1078	343	48.6
6A				48.6

PSI calc. = LBF/area area = 3.14

* - cylinder crumbled during removal from mold

drawings and descriptions on pg. 92

** - cylinder 5A UCS test done after 24 hours, on 2-21-95.

Ca(OH)2 / MIXES

PCM

Mix # 1A PCM @ 38.8% solids @ 0.25 w/p ratio

mixture:

400 g PCM "as recieved"
20 g Hydrated Lime, $Ca(OH)_2$
979 ~~822~~ g Flyash, Type C

mix observation: The consistency of the as recieve PCM is like choc. pudding. Thick, non-pourable, Holds up spoon easily. INITIAL pH = 13.0 The Flyash and Lime are mixed together and added in one bulk addition and mixed in Hobart on speed #2 for 2.5 min. Initial volume = 290 ml

5 sec → Powder and powder chunks flying around in bowl.

30 sec → Pea size chunks, fluffy looking in bowl. powder

1 min 30 sec → Moist powder.

2 min 30 sec → Brown sugar consistency: Moist Powder. Able to form a ball in hand by squeezing. Breaks apart easily

NOTE pre-mixed Lime w/ As-recieved pH = 12.7 *

Final Loose Volume = 1700 ml
Final Packed Volume = ~~1075~~ 1062 ml (37% reduction in volume)

LABLE: 022095-1A-PCM

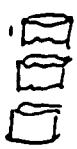
P301505
P301506 (TCLP)

* The consistency of the material after Lime addition is a very thick cake icing, smooth and stiff. Difficult to get accurate pH using the probe used in Treat. Room.

[signature]

2/20/95

92 Copied from LAB Book: P174-94

batch ID	illustration	description of cylinder consistency	type of failure
1A		smooth & solid some chipping at top sandy appearance	large vertical faults
2A		smooth & solid sandy appearance	large vertical fault buckling at top
3A		grainy & solid chipping at top sandy appearance	vertical cracks
4A		sandy appearance crumbly	failed during removal from mold
5A		very smooth and solid small air pocket voids small grain size	large chipping and cracking on bottom half
6A		sandy appearance grainy	failed during removal from mold

Mix # 2A PCM @ 38.8% solids @ 0.30 w/p ratio

mixture:

400 g PCM "as received"
20 g Hydrated Lime, $Ca(OH)_2$
816 g Flyash, Type C

mix observation: The as delivered PCM is a pudding consistency. Bulk addition of Flyash and Lime.

5 sec → Powder and powder mix clings to flying around bowl.

30 sec → Pea-size chunks, Looks fluffy flyash around bowl. Powder

2 min 30 sec → Moist Powder. Able to squeeze in hand Ram moist ball of Packed powder w/ breaks easily.

Final Loose volume → 1300 ml
Final Packed volume → 975 ml (25% reduction in volume)

LABLE: 022095-2A-PCM P301507

2/20/95

Mix #3A PCM @ 38.8% solids @ 0.35 w/p Ratio

mixture:

400 g PCM - "as received"
20 g Hydrated Lime, $Ca(OH)_2$
699 g Flyash, Type C

mix observations: To the as received PCM a little addition of Lime & Flyash was added as in the previous mixes.

5 sec → Pea-size clumps. Mostly moist powder b/w flyash and sand.
30 sec → Heavy side of bowl packs. Powder in center.
1 min 30 → Mixture rolls well packs and moist powder in center.
2 min 30 sec → Moist powder able to squeeze to form a ball w/ breaks easily with little pressure.

Loose volume → 1150 ml
Packed volume → 862 ml (25% reduction in volume)

Labels: 022095-3A-PCM

P301508
P301509 (TCLP)

2/20/85

Mix 4A PCM @ 48.6% solids @ 0.25 w/p ratio

mixture:

400 g PCM "dry out"
20 g Hydrated Lime, $Ca(OH)_2$
822 g Flyash, Type C

Initial vol = 280

mix observation: The dried material is the consistency of a dry molding clay. A friable clay, but still moist. The initial pH = 12.4 *
The Lime is added and allowed to mix on low speed.
The consistency of the material is stiff clay. pH = 12.7
Added the Flyash and mixed on speed #2.

5 sec → Side wall pack and loose moist powder flying around center of bowl.

30 sec → pea size moist powder clumps and powder flying around in bowl.

1 min 30 sec → Heavy side bowl pack center moist powder

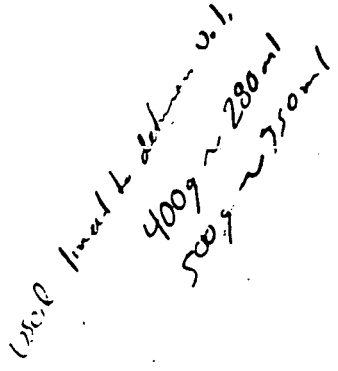
2 min 30 sec → Moist powder, able to squeeze a moist powder ball which breaches with each pressure.

Final Loose volume = 1350 ml
Final Packed volume = 928 ml (31% reduction in volume)

LABLE: 022095 - 4A - PCM P301510

*NOTE The dried material is very difficult to get an accurate pH using disposable probes in Trial Lab.

[signature] 2/20/95


400g ~ 280ml
500g ~ 350ml

mix 5A PCM @ 48.6% solids @ ~~0.30~~ 1.0 w/p ratio

mixture:

500g ~~600~~g PCM "dried out"
25g ~~20~~g Hydrated Lime, $Ca(OH)_2$
257g ~~308~~ ~~500~~g Flyash, Type C

mix observation = Due to the material mixes being so dry we will change to a higher w/p ratio. The Flyash and Lime added in one bulk addition.

5 sec → Large clay dry clumps 2" dia flying around bowl.
30 sec → Warm Dirt med sine chunks
1min ~~30 sec~~ → Cookie dough or bread dough
1min 30 secs Cake icing sticky. Cling on ends of bowl.
2min 30 sec → Cake icing. moist or wet clay.

Packed volume = 600 ml

Lable = 022095-5A-PCM

P301511
P301512 (TCLP)

[signature]

2/20/95

Mix 6A PCM @ 48.6% solids @ w/p = 0.35 ratio

mixture:

400g PCM "dried out"
20g Hydrated Lime, $Ca(OH)_2$
587g Flyash, Type C

mix observations: Addition of material.

5 sec → Powder and pea size clumps flying around bowl.
30 sec → pea size clumps. Dry: powdery
1 min 30 sec → some small pucks.
2 min 30 sec → Powder, able to squeeze in hand to form ball with hands with slight pressure.

Final Loose Volume → 1000 ml
Final puck Volume → 750 ml (25% reduction in volume)

Lab #: 02095-6A-PCM P301513
P301514 (TCLP)

2/20/95

NOTE: Adjusted the ~~w/p~~ ratio Based on the observations of previous mixes

Copied from LAB Book: P174-94

48 hour UCS test of PCH mixes made 2-20-95

batch ID	wt (g)	LBF	PSI	% solids
1B	333.6	550 TM 2-22-95	175	38.8
2B	353.6	~~175~~ >200	>637	38.8
3B	321.9	1031	328	38.8
4B				~~48.6~~ TM 2-22-95 48.6
5B	294.9	203	65	48.6
6B	NSQ			48.6

PSI calc. = LBF/area, area = 3.14

* - cylinder crumbled during removal from mold

drawings and descriptions on pg. 94

Mix #1B PCM @ 38.8% solids @ 0.35 w/p ratio

Mixture:

400 g	PCM "as received"
20 g	Hydrated Lime, $Ca(OH)_2$
595 g ~~852 g~~	Fly ash, Type C
105 g ~~147 g~~	Fine Silica flour, SSA-1

Mix observations: The 'as received' material is a pudding consistency. The additives are added in one bulk addition.

5 sec → Powder flying around bowl
30 sec → Powder balls and powder flying around bowl.
1 min → Powder & balls flying around
1 min 30 sec → Packing on scale, it must powder with some pound clumps or balls.
2 min 30 sec → Powder, moist

Final Loose Volume → 1250 ml
Final Packed Volume → 781 ml

Labels: 022095-1B-PCM

PJ01515
PJ01516 (TCLP)

4/20/95

94 copied from LAB BOOK: PP74-94

batch ID	illustration	description of cylinder consistency	type of failure
1B		solid + grainy sandy appearance horizontal faults	vertical cracks bulging at top
2B		smooth + solid minor air-voids monolith	did not fail
3B		smooth + solid monolith	bulging at bottom
4B		grainy + solid top crumbled sandy appearance	failed during removal from mold
5B		grainy + solid chipping at top sandy appearance	crumbled at top
6B		NSQ - non-sufficient quantity	

Mix #2B PCM @ 38.8% solids @ ~~0.30~~ 0.65 w/p ratio

mixture:

400 g PCM "as recieved"
20 g Hydrated Lime, $Ca(OH)_2$
320 g ~~694~~ g Fly ash, Type C
56 g ~~128~~ g Fine silica flour, SSA-1

mix observation: To the PCM a bulk addition of the additions is added in Hobart on speed #2.

5 sec → Moist powder & powder clumps flying around bowl.
30 sec → Worm dirt
1 min → Bread dough or Clay
1 min 30 sec → Cake Icing
2 min 30 sec → Clay. Like molding clay.

Final Packed volume = 500 ml

LABLE: 022095 - 2B - ~~[illegible]~~ PCM P301517

[signature] 2/20/95

Mix # 3B PCM @ 38.8% solids @ 1.0 w/p Ratio

Mixture:

600g	PCM 'as received'
30g	Hydrated Lime, $Ca(OH)_2$
208g	Flyash, Type C
37g	Fine Silica flour, SSA-1

vol ~ 475 400 ~ 270 60

mix observations: Bulk addition of solids

5 sec → Coarse dough

30 sec → Brittle cake icing

1 min 30 sec → Cake Icing

2 min 30 sec → Modeling clay

Final Packed Volume = 600 ml

Lab: 022095-3B-PCM

P301518

P301519 (TCLP)

2/20/95

Mix #4B PCM @ 48.6% solids @ 0.35 w/p ratio

Mixture:

400 g	PCM "dried out"
20 g	Hydrated Lime $Ca(OH)_2$
500 g	Flyash, Type C
88 g	Fine Silica Flour, SSA-1

mix observations: To the PCM which is a dry clay consisting of molding clay a bulk addition of the material is added.

5 sec → ~~Cookie dough~~ Balls & powder flying around bowl
30 sec → ~~Cake icing, sticky~~. Powder
1 min 30 sec → ~~wet cake icing~~. Moist powder, Pea-size chunks
2 min 30 sec → ~~After stopped mixing and placed in jar the material resembled molding clay~~. Moist powder.

Loose Volume = 1200
Packed volume = 756 ml (reduced volume by 37%)

Lab 022095-4B-PCM

P301520
P301521 (TCLP)

[signature]

2/20/95

Mix #5B PCM @ 48.6% solids @ 0.65 w/p ratio

mixture:

400 g PCM "dried out"
20 g Hydrated Lime, $Ca(OH)_2$
269 g Flyash, Type C
47 g Fine Silica Flour

mix observation: To the dried PCM a bulk addition of additives is added and mixed in Hobart

5 sec → Dry powder flying around bowl. A few large powder chunks.
30 sec → Round moist powder balls and powder flying around bowl.
1 min → Beginning to pack on sides of bowl.
2 min 30 sec → Powder, moist. Powder

Final Loose Pack → 1150 ml
Final Packed volume → 724 ml (37% reduction in volume)

Lable: 022095-5B-PCM P301522

[signature] 2/20/95

Mix # 6B PCM @ 48.67. solids @ 1.0 w/p ratio

Mixture:

500g	PCM "dried out"
25g	Hydrated Lime, $Ca(OH)_2$
218g	Flyash, Type C
39g	Fine Silica flour, SFS-1

Total vol 750 ml

mix observation: To the PCM a bulk addition of the additives was mixed on speed #2.

5 sec → Large Clay Chunks 2" dia
30 sec → Worm dirt, med. curd.
1 min → Cookie dough
1 min 30 sec → Sticky bread dough
2 min 30 sec → Dry, Sticky, Moldy Clay. Soft.

Final Packed Volume = 500 ml

Labb: 022095-6B-PCM

P301523
P302028 (TCLP)

2/20/95

Copied from LAB Book: P174-94

48 hour UCS test of PCM mixes made 2-21-95

batch ID	wt(g)	LBF	PSI	%solids
1C				
2C	362.2	>2000	>637	38.8
3C	336.4	>2000	>637	38.8
4C	273.9	86	27	48.6
5C	363.8	1120	357	48.6
6C				

PSI calc. = LBF/area, area = 3.14

* - cylinder broke during removal from mold

drawings and descriptors on pg. 96

Mix # 1C PCM @ 38.8% solids @ 0.35 w/p Ratio

Mixture:

400 g	PCM "as received"
20 g	Hydrated Lime, $Ca(OH)_2$
233 g	Cement, Type I/II
466 g	Flyash, Type C

mix observation: Hit hard clump and material in mixer bowl flew out. Also sloped mix. Would have re-mixed two batches, but all mixers there broke trying to do other mixes.

NO TEST

2/21/95

96 copied from L&B Book: P174-94

batch ID	illustration	description of cylinder consistency	type of failure
1C		did not mix	
2C		solid + smooth some air voids monolith	did not fail
3C		solid + smooth some air voids monolith	did not fail
4C		grainy + solid some chipping at top horizontal faults sandy appearance	vertical cracks
5C		solid + smooth some air voids some chipping at top monolith	bulging on side
6C		did not mix	

Mix #2C PCM @ 38.8% solids @ 0.65 w/p ratio

mixture:

400g PCM "as recieved"
20g Hydrated Lime, $Ca(OH)_2$
126g Cement, Type I/II
251g Flyash, Type C

mix observation: To the "as recieved" material a bulk addition is added

5 sec → Powder & BAlls flying around bowl.
15 sec → Worm Dirt
30 sec → Bread dough
1 min 30 sec → Cake Icing
2 min 30 sec → Clay material, consistency of molding

Final Packed Volume = 500 ml

Label = 022195-2C-PCM

P0302030 TCLP

[signature]

2/21/95

Mix # 3C PCM @ 38.8% solids @ 1.0 w/s ratio

Mixture:

600g PCM "as received"
30g Hydrated lime, $Ca(OH)_2$
122g Cement, Type I/II
245g Flyash, Type C

Jar 1-1 475 ml

Mix observation: To the as received material a bulk addition of water is made

15 sec → Clay chunks, balled clay upon 1" to 2" dia.
30 sec → Cake icing
1 min 30 sec → moist cake icing, sticky puck on side of bowl.
2 min 30 sec → moist molding clay, stiff.

Final Packed Volume → 600 ml

LABLE: 022195-3C-PCM

PO 302030
PO 302031 (CEL)

2/21/95

Mix #4C PCM @ 48.6% solids @ 0.35 w/p ratio

Mixture:

400g	PCM: dried out"
20g	Lime
196g	Cement, Type I/II
392g	Flyash, Type C

mix observations: To the dried mixture a bulk addition is made
- 15 sec → round balls and powder
- 30 sec → round balls, like pellets flying around bowl. Some powder
- 1 min 30 sec → same w/ some rods will pack
- 2 min 30 sec → Powder

Final Loose volume → 1200 ml
Final Packed Volume → 900 ml (25% deduction in volume)

LABLE: 0221-4C-PCM

PO 302034
PO 302035 (TLH)

[signature]

2/21/85

Mix #5C PCM @ 48.6% solids @ 0.65 w/p ratio

Mixture:

374 ~~400~~ g	PCM "dried out"
19 ~~20~~ g	Hydrated Lime, $Ca(OH)_2$
98 ~~105~~ g	Cement, Type I/II
197 ~~211~~ g	Flyash, Type C

Mix observation: To the dried material a bulk addition of pozzolan is added.

5 sec → Large Hard Chunks in the powder

30 sec → Hard round ball (pea-size) in moist powder.

1 min → Starting to form a worm dirt

1 min 30 sec → Medium size curd worm dirt

2 min → Large curd worm dirt

2 min ~~30 sec~~ → Clumpy clay, stiff melby clay

Loose volume = 800 ml

Packed Volume = 450 ml (44% reduction in volume)

Label: 022195-5C-PCM PO 302036

2/21/95

Mix #6C PCM @ 48.6 % solids @ 1.0 w/p ratio

Mixture:

500 g	PCM "dried out"
25 g	Hydrated Lime, $Ca(OH)_2$
86 g	Cement, Type I/II
171 g	Flyash, Type C

Mix observation:

Broke two Hobart mixers due to clumps in Dried undersd. Clumps were Rock hard material which was found in as delivered material also.

NO TEST

2/21/95

Pug Mill Study:

Purpose: This study is to examine the operation of the pug mill and determine any considerations for future mixes.

Materials: To simulate a waste stream, commercial potting soil was diluted to 20% solids with DI water. Mixes were performed with flyash as the only additive.
- The potting soil was found to have 52.2% solids, by weight.

Note: Videotape was taken of the following mixes.

Recipe: 200g soil
322ml water
2088g flyash ⟶ This gives W/P = 0.20.

The following results were determined:

(See table on page 177.)

T. E. Mahoney

3-3-95
DATE

Mix	Time	Mass Input	Mass Yield	% Yield	Total Mass Input	Total Mass Yield	Total % Yield
1	—	2610g	*	*	2610g	—	—
2	—	2610g	*	*	5220g	—	—
3	—	2610g	*	*	7830g	—	—
4	—	2610g	*	*	10440g	3628g	34.8
5	—	2610g	1254g	48.0	13050g	4882g	37.4
6	—	2610g	1700g	65.1	15660g	6582g	42.0
7	1:40	2610g	1892g	72.5	18270g	8474g	46.4
8	1:35	2610g	2090g	80.1	20880g	10564g	50.6
9	1:45	2610g	1217g	46.6	23490g	11781g	50.2
	~10:00		2360	90.4		14141g	60.2
10	1:45	2610g	5331	204	26100g	19472g	74.6
11	**	2610g	1676	64.2	28710g	21148g	73.7

Notes: "Time" is the time that yield ceased, with time=0 being the time when mix ingredients were added. "Time" is in minutes. "Time" was only measured for the final 5 mixes.

* - Yield was collected for the first four mixes and weighed as an accumulation.

** - Mix 11 was done at a slower mix speed to examine residence time and yield. Mixes 1-10 began product yield ~15 sec after addition of ingredients. Mix 11 began product yield at 29 sec. Mix 11 ceased product yield ~3 min.

T. E. Mullaney

3-3-95

LABORATORY LOG BOOK

P050-95

ROCKY FLATS

TREATABILITY STUDY

CURING TIME & pH STUDY

WAC PHASE II MIXES

- POND 207 A/B
- POND 207C
- 207C & CLARIFIER
- CLARIFIER
- PCTW

3/8/95 - 3/22/95

BOOK: P050-95

FOR: ROCKY FLATS

TREATABILITY

DATE: 3-8-95

Curing Time + Lime Addition Study

The purpose of this study is to examine the effects of curing time and lime loading on final leachate pH.

4 sets of 3 mixes will be prepared and TCLP leaches will be extracted at curing times of 24 hr, 48 hr, 72 hr, and 7 days.

The 4 sets will be 207 A/B with lime and flyash; 207 A/B with lime, flyash, and cement; 207 C with lime and flyash; 207 C with lime, flyash, and cement.

The 3 mixes in each set will increase the lime loading from 5% to 15% by weight of the waste material.

Mix 030895-A-207AB: 20% solids, W/P = 0.23, 5% lime

100g 207 A/B
194ml A/B water
14.7g Lime
1023g Flyash

Mix ID's:

24 hr cure:	030895-24A-207AB	P302868
48 hr cure:	030895-48A-207AB	P302869
72 hr cure:	030895-72A-207AB	P302870
7 day cure:	030895-~~7~~7dA-207AB	P302871

Mix time 1110

T. E. Mullaney

3-8-95

Analytical Results for 030895-A-207AB

24 hr cure : Final Leachate pH 9.9
Cd
Be
Total Alkalinity

48 hr cure : Final Leachate pH
Cd
Be
Total Alkalinity

72 hr cure : Final Leachate pH
Cd
Be
Total Alkalinity

7 day cure : Final Leachate pH
Cd
Be
Total Alkalinity

Mix 030895-B-207AB: 20% solids, W/P = 0.23, 10% lime

100g 207 A/B
194ml A/B water
29.4g Lime
1023g Flyash

Mix ID's:		
24 hr cure:	030895-24B-207AB	P302872
48 hr cure:	030895-48B-207AB	P302873
72 hr cure:	030895-72B-207AB	P302874
7 day cure:	030895-7dB-207AB	P302875

Mix time 1110

Mix 030895-C-207AB: 20% solids, W/P = 0.23, 15% lime

100g 207 A/B
194ml A/B water
44.1g Lime
1023g Flyash

Mix ID's:		
24 hr cure:	030895-24C-207AB	P302876
48 hr cure:	030895-48C-207AB	P302877
72 hr cure:	030895-72C-207AB	P302878
7 day cure:	030895-7dC-207AB	P302879

Mix time 1110

T. E. Mullaney

3-8-95

Analytical Results for 030895-B-207AB

24 hr cure: Final Leachate pH 10.0
Cd
Be
Total Alkalinity

48 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

72 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

7 day cure: Final Leachate pH
Cd
Be
Total Alkalinity

Analytical Results for 030895-C-207AB

24 hr cure: Final Leachate pH 10.4
Cd
Be
Total Alkalinity

48 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

72 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

7 day cure: Final Leachate pH
Cd
Be
Total Alkalinity

Mix 030895-D-207AB : 20% solids, W/P = 0.23, 5% lime

100g 207 A/B
194ml A/B water
14.7g Lime
341g Cement
682g Flyash

Mix ID's :	24 hr cure :	030895-24D-207AB	P302880
	48 hr cure :	030895-48D-207AB	P302881
	72 hr cure :	030896-72D-207AB	P302882
	7 day cure :	030895-7dD-207AB	P302883

Mix time 1135

Mix 030895-E-207AB : 20% solids, W/P = 0.23, 10% lime

100g 207 A/B
194ml A/B water
29.4g Lime
341g Cement
682g Flyash

Mix ID's :	24 hr cure :	030895-24E-207AB	P302884
	48 hr cure :	030895-48E-207AB	P302885
	72 hr cure :	030895-72E-207AB	P302886
	7 day cure :	030895-7dE-207AB	P302887

Mix time 1135

T. E. Mullaney

3-8-95

Analytical Results for 030895-D-207AB

24 hr cure: Final Leachate pH 11.5
Cd
Be
Total Alkalinity

48 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

72 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

7 day cure: Final Leachate pH
Cd
Be
Total Alkalinity

Analytical Results for 030895-E-207A/B

24 hr cure: Final Leachate pH 11.4
Cd
Be
Total Alkalinity

48 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

72 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

7 day cure: Final Leachate pH
Cd
Be
Total Alkalinity

Mix 030895-F-207AB : 20% solids, W/P = 0.23, 15% lime

100g 207A/B
194ml A/B water
44.1g Lime
341g Cement
682g Flyash

Mix ID's : 24 hr cure : 030895-24F-207AB P302888
48 hr cure : 030895-48F-207AB P302889
72 hr cure : 030895-72F-207AB P302890
7 day cure : 030895-7dF-207AB P302891

Mix time 1148

T. E. Mullaney

3-8-95

Analytical Results For 030895-F-207AB

24 hr cure: Final Leachate pH 11.6
Cd
Be
Total Alkalinity

48 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

72 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

7 day cure: Final Leachate pH
Cd
Be
Total Alkalinity

~~Analytical Results For~~

Continuation of Curing Time / Lime Addition Study

Mix 030995-A-207C : 70.8% solids, W/P = 0.23, 5% Lime

400g 207C
66ml A/B water
23.3g Lime
592g Flyash

Mix ID's :		
24 hr cure:	030995-24A-207C	P302909
48 hr cure:	030995-48A-207C	P302910
72 hr cure:	030995-72A-207C	P302911
7 day cure:	030995-7dA-207C	P302912

Mix Time 1105

Mix 030995-B-207C : 70.8% solids, W/P = 0.23, 10% Lime

400g 207C
66ml A/B water
46.6g Lime
592g Flyash

Mix ID's :		
24 hr cure:	030995-24B-207C	P302913
48 hr cure:	030995-48B-207C	P302914
72 hr cure:	030995-72B-207C	P302915
7 day cure:	030995-7d-207C	P302916

Mix Time 1105

T. E. Mullaney

3-9-95

Analytical Results for 030995-A-207C

24 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

48 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

72 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

7 day cure: Final Leachate pH
Cd
Be
Total Alkalinity

Analytical Results for 030995-B-207C

24 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

48 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

72 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

7 day cure: Final Leachate pH
Cd
Be
Total Alkalinity

Mix 030995-C-207C: 70.8% solids, W/P = 0.23, 15% Lime

400g 207C
66ml A/B water
69.9g Lime
592g Flyash

Mix ID's:		
24 hr cure:	030995-24C-207C	P302917
48 hr cure:	030995-48C-207C	P302918
72 hr cure:	030995-72C-207C	P302919
7 day cure:	030995-7dC-207C	P302920

Mix Time 1128

Mix 030995-D-207C: 70.8% solids, W/P = 0.23, 5% Lime

400g 207C
66ml A/B water
23.3g Lime
197g Cement
394g Flyash

Mix ID's:		
24 hr cure:	030995-24D-207C	P302921
48 hr cure:	030995-48D-207C	P302922
72 hr cure:	030995-72D-207C	P302923
7 day cure:	030995-7dD-207C	P302924

Mix Time 1128

D. E. McKinney 3-9-95

Analytical Results for 030995-C-207C

24 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

48 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

72 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

7 day cure: Final Leachate pH
Cd
Be
Total Alkalinity

Analytical Results for 030995-D-207C

24 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

48 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

72 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

7 day cure: Final Leachate pH
Cd
Be
Total Alkalinity

Mix 030995-E-207C : 70.8% solids, W/P = 0.23, 10% Lime

400g 207C
66 ml A/B water
46.6g Lime
197g Cement
394g Flyash

Mix ID's : 24 hr cure : 030995-24E-207C P302925
48 hr cure : 030995-48E-207C P302926
72 hr cure : 030995-72E-207C P302927
7 day cure : 030995-7dE-207C P303562

Mix Time 1143

Mix 030995-F-207C : 70.8% solids, W/P = 0.23, 15% Lime

400g 207C
66ml A/B water
69.9g Lime
197g Cement
394g Flyash

Mix ID's : 24 hr cure : 030995-24F-207C P303563
48 hr cure : 030995-48F-207C P303564
72 hr cure : 030995-72F-207C P303565
7day cure : 030995-7dF-207C P303566

Mix Time 1143

T. E. Mullaney

3-9-95

Analytical Results for 030995-E-207C

24 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

48 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

72 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

7 day cure: Final Leachate pH
Cd
Be
Total Alkalinity

Analytical Results for 030995-F-207C

24 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

48 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

72 hr cure: Final Leachate pH
Cd
Be
Total Alkalinity

7 day cure: Final Leachate pH
Cd
Be
Total Alkalinity

WAC, Phase II, Mixes

Pond 207C Sludge Mixes

Mix #1: 56.3% solids, w/p = 0.15, 7.5% Lime

200g	207C
97ml	A/B water
22.3g	Lime, hydrated
577g	Flyash, Type C
288g	Cement, Type I/II

Mix ID: 032095-1-207C

P304213
P304214

Mix #2: 56.3% solids, w/p = 0.35, 7.5% Lime

400g	207C
194ml	A/B water
44.5g	Lime, hydrated
494g	Flyash, Type C
247g	Cement, Type I/II

Mix observations: 30 sec - wet, pudding consistency
1 min - slightly wetter, runny milkshake
2 min - runny milkshake
2.5 min - very wet, runny milkshake

Volume - loose n/a
packed 650ml

Mix ID: 032095-2-207C

P304215
P304216

D. E. Mullaney

3-20-95

Mix #3: 82.5% solids, W/p = 0.15, 7.5% Lime

~~700~~100g	207 C
0 ml	A/B water
30.0g	Lime, hydrated
311g	Flyash
156g	Cement

Mix ID: 032095-3-207C

P304217
P304218

Mix #4 82.5% solids, W/p = 0.35, 5% Lime

700g	207 C
0 ml	A/B water
35.0g	Lime, hydrated
233g	Flyash
117g	Cement

} pH = not possible due to dry nature of material

Mix observations: 30 sec - dry, many small clumps, pebbles
1 min - moist, friable dirt - good
2 min - moist, clumping, wet sand
2.5 min - moist, clumping, wet sand

Volume - loose 1100 ml
packed ~750 ml

Mix ID: 032095-4-207C

P304219
P304220

T. E. Mullaney

3-20-95

Mix #5: 82.5% solids, W/P = 0.35, 7.5% Lime

700g	207C	pH = not possible due to dry nature of material
0 ml	A/B water	
52.5g	Lime, hydrated	
233g	Flyash	
117g	Cement	

Mix observations: 30 sec - dry, many small clumps, pebbles
1 min - moist, friable soil - good
2 min - moist, packing soil
2.5 min - moist, packin soil, friable soil

Volume - loose 1150 ml
packed ~790 ml

Mix ID: 032095-5-207C

P304221
P304222

Mix #6: 82.5% solids, W/P = 0.35, 10% Lime

700g	207C	pH = not possible due to dry nature of material
0 ml	A/B water	
70.0g	Lime, hydrated	
233g	Flyash	
117g	Cement	

Mix observations: 30 sec - dry, many small clumps, pebbles
1 min - dry, pebbles
2 min - dry, powder-like
2.5 min - dry, powder-like soil

Volume - loose 1000 ml
packed ~~~700 ml~~ ~720 ml

Mix ID: 032095-6-207C

P304223
P304224

L. E. Mullaney

3-20-95

Pond 207 A/B Sludge mixes

Mix #1: 10% solids, w/p = 0.20, 7.5% Lime

50g	207 A/B
244ml	A/B water
22.1g	Lime, hydrated
882g	Flyash, Type C
441g	Cement, Type I/II

Mix ID: 032095-1-A/B

P304225
P304226

Mix #2: 10% solids, w/p = 0.30, 7.5% Lime

50g	207A/B
244ml	A/B water
22.1g	Lime, hydrated
588g	Flyash
294g	Cement

Mix ID: 032095-2-A/B

P304227
P304228

Mix #3: 30% solids, w/p = 0.20, 7.5% Lime

150g	207 A/B
144ml	A/B water
22.1g	Lime
686g	Flyash
343g	Cement

Mix ID: 032095-3-A/B

P304229
P304230

T. E. Mallamy

3-20-95

Mix #4 : 30% solids, w/p = 0.30, 5% Lime

150g 207 A/B
144g A/B water
14.7g Lime
457g Flyash
229g Cement

Mix ID: 032095-4-A/B

P304231
P304232

T. E. Williams

3-20-95

Pond 207 A/B Sludge Mixes, continued

Mix #5 : 30% solids, W/p = 0.30, 7.5% Lime

150g	207 A/B
144ml	A/B water
22.1g	Lime, hydrated
457g	Flyash, Type C
229g	Cement, Type I/II

Mix ID: 032195-5-A/B P304309
P304310

Mix #6 : 30% solids, W/p = 0.30, 10% Lime

150g	207 A/B
144ml	A/B water
29.4g	Lime
457g	Flyash
229g	Cement

Mix ID: 032195-6-A/B P304311
P304312

~~Mix~~

T. E. Mullaney

3-21-95

Poundcrete Triwall Mixes

Mix #1: 25% solids, W/P = 0.20, 7.5% Lime

287g	PCTW	
113ml	A/B water	
30.0g	Lime, hydrated	
999g	Flyash, Type C	
499g	Cement, Type I/II	
1.19g	Stergo® Absorbent	P304313
Mix ID: 032195-1-PCTW		P304314

Mix #2: 25% solids, W/P = 0.30, 7.5% Lime

287g	PCTW	
113ml	A/B water	
30.0g	Lime	
666g	Flyash	
333g	Cement	
1.14g	Stergo®	P304315
Mix ID: 032195-2-PCTW		P304316

Mix #3: 40% solids, W/P = 0.20, 7.5% Lime

300g	PCTW	
0ml	A/B water	
22.5g	Lime	
600g	Flyash	
300g	Cement	
0.86g	Stergo®	P304317
Mix ID: 032195-3-PCTW		P304318

D. E. Mullaney

3-21-95

Mix #4 : 40% solids, W/P = 0.30, 5% Lime

300g	PCTW
0 ml	A/B water
15.0g	Lime
400g	Flyash
200g	Cement
0.86g	Stergo®

Mix ID: 032195-4-PCTW — P304319, P304320

Mix #5 : 40% solids, W/P = 0.30, 7.5% Lime

300g	PCTW
0 ml	A/B water
22.5g	Lime
400g	Flyash
200g	Cement
0.86g	Stergo®

Mix ID: 032195-5-PCTW — P304321, P304322

Mix #6 : 40% solids, W/P = 0.30, 10% Lime

300g	PCTW
0 ml	A/B water
30.0g	Lime
400g	Flyash
200g	Cement
0.86g	Stergo®

Mix ID: 032195-6-PCTW — P304323, P304324

D. E. Mallarney

3-21-95

Clarifier Sludge Mixes

Mix #1 : 20% solids, W/P = 0.20, 7.5% Lime

210g	Clarifier
190ml	A/B water
30.0g	Lime, hydrated
1067g	Flyash, Type C
533g	Cement, Type I/II

Mix ID: 032195-1-Clar P304325
P304326

Mix #2 : 20% solids, W/P = 0.30, 7.5% Lime

210g	Clarifier
190ml	A/B water
30.0g	Lime
711g	Flyash
356g	Cement

Mix ID: 032195-2-Clar P304327
P304328

T. E. Mullaney

3-21-95

Clarifier Sludge Mixes, continued

Mix #3: 38.1% solids, W/P = 0.20, 7.5% Lime

400g Clarifier
0ml A/B water
30.0g Lime, hydrated
825g Flyash, Type C
413g Cement, Type I/II

Mix ID: 032295-3-Clar

P304978
P304979

Mix #4: 38.1% solids, W/P = 0.30, 5% Lime

400g Clarifier
0ml A/B water
20.0g Lime
550g Flyash
275g Cement

Mix ID: 032295-4-Clar

P304980
P304981

Thomas P. Mullaney

3-22-95

Mix #5: 38.1% solids, W/P = 0.30, 7.5% Lime

400g Clarisier
0.ml A/B water
30.0g Lime
550g Flyash
275g Cement

P304982
P304983

Mix ID: 032295-5-Clar

Mix #6: 38.1% solids, W/P = 0.30, 10% Lime

400g Clarisier
0.ml A/B water
40.0g Lime
550g Flyash
275g Cement

P304984
P304985

Mix ID: 032295-6-Clar

Thomas C. Mullaney

3-22-95

Pond 207C + Clarifier Sludge Mixes

These mixes will begin with a waste material that is 20% Clarifier and 80% 207C, by weight. This will explore the possible dilution of the Clarifier with 207C pond sludge.

Mix #1: 49.0% solids, w/p = 0.16, 7.5% Lime

160g	207C
40g	Clarifier
100ml	A/B water
22.5g	Lime, hydrated
638g	Flyash, Type C
319g	Cement, Type I/II

Mix observations: 30 sec - loose dirt, some small clumps
1 min - loose, moist dirt
2 min - moist dirt, few clumps
2.5 min - dry, powdery dirt, will clump if squeezed

Volume - loose 1400 ml
packed ~ 790 ml

Mix ID: 032295-1-C/Clar P304986
P304987

Donna E. Mullaney

3-22-95

Mix #2: 49.0% solids, W/P = 0.30, 7.5% ~~solids~~ Lime

160g	20%
40g	Clarisier
100ml	A/B water
22.5g	Lime
339g	Flyash
170g	Cement

Mix observations: 30 sec - wet, cake icing
1 min - thick cake icing
2 min - wet, milkshake
2.5 min - wet, soft ice cream or thick milkshake

Volume loose ~~40~~ n/a
packed 400 ml

Mix ID: 032295-2-C/Clar

P304988
P304989

Mix #3: 73.6% solids, W/P = 0.16, 7.5% ~~solids~~ Lime

320g	20%
80g	Clarisier
0ml	A/B water
30.0g	Lime
440g	Flyash
220g	Cement

Mix observations: 30 sec - small ~~pebbles~~ pebbles, gravel-like
1 min - dry dirt with small pebbles
2 min - dry dirt with some clumps
2.5 min - dry loose soil, some small clumps

Volume - loose 1000 ml
packed ~625 ml

Mix ID: 032295-3-C/Clar

P304990
P304991

Thomas E. McKinney

3-22-95

Mix #4: ~~49.0%~~ 73.6% solids, W/P = 0.30, 5% Lime

320g 20°C
80g Clarifier
0ml A/B water
20.0g Lime
234g Flyash
117g Cement

Mix observations: 30 sec - dry, small pebbles
1 min - dry dirt with small pebbles
2 min - moist clumping soil
2.5 min - moist friable soil - good mix

Volume - loose 750ml
packed ~400ml

Mix ID: 032295-4-C/Clar

P304992
P304993

Mix #5: 73.6% solids, W/P = 0.30, 7.5% Lime

320g 20°C
80g Clarifier
0ml A/B water
30.0g Lime
234g Flyash
117g Cement

Mix observations: 30 sec - dry with some small pebbles
1 min - soil with some clumps
2 min - dry, clumping soil
2.5 min - moist, friable soil

Volume - loose 800ml
packed ~500ml

Mix ID: 032295-5-C/Clar

~~P304994~~ P304996
~~P304995~~ P304997

Thomas B. Mullaney

3-22-95

Mix #6: 73.6% solids, w/p = 0.30, 10% Lime

320g	207C
80g	Clarifier
0 ml	A/B water
40.0g	Lime
234g	F-Flyash
117g	Cement

Mix observations: 30 sec - dry soil with pebbles
1 min - soil, packing on sides
2 min - dry, clumping soil
2.5 min - moist, fine, loose soil

Volume - loose 800 ml
packed ~ 550 ml

Mix ID: 032295-6-C/Clar

P304998
P304999

Thomas C. Mullaney

3-22-95

ient: Rocky Flats
eport/Invoice Address:
Same
tn:
:

☐ Check if new Client

Phone:

Date/Time Sample Receipt: 3-9 1115
Air Bill No.: N/A
No. Coolers Received: N/A
Custody Seals: Yes / (No)
Intact: Yes / No / (NA)
Custody Seals No. N/A
Chain-of-Custody Record: Yes / (No)
Sample Tags: Yes / (No)

ondition of Samples Upon Receipt:
- Cooler temperature(s): _____ NA ____; Thermometer ID: _____
- Headspace in VOA vials: Yes / No / NA - Containers intact: Yes / No

g-In Date:	Client No.:	Job No.	SIC	Proj No./ PMS Code:

ice Date:	____ Discount (%) ____ List ____ Premium (%)	PO No.:	Vendor No.:	Work Order No.:

isk lo.	Lab Sample No.	Matrix	Sample Identification	Date Sampled	Bottles
=	P302868		030895-24A - 207 AIJ TCLP		
	69		- 48A -		
	70		- 72A -		
	71		- 76A -		
	3028 72		- 24B -		
	73		- 48B -		
	74		- 72B -		
	75		- 76B -		
	302876		- 24C -		
	77		- 48C -		
	78		- 72C -		
	79		- 76C -		
	302880		- 24D -		
	81		- 48D -		
	82		- 72D -		
	P302883		- 76D -		

ecial Instructions:

Special Requirements:
___ CLP
X Lab Tracking
___ Labor
___ MSIS
___ QC Report
___ Add. Deliv.

Project Manager:
Written up by: JC
Logged-in by:
Reviewed by:

☐ See CAR No.:

09/94

[redacted]nt: Rocky Flats

[redacted]p[redacted]/Invoice Address: Same

[redacted]n: [redacted]

[redacted]: [redacted]

☐ Check if ~~new Client~~

Phone: _____

Date/Time Sample Receipt: 3-9 1115
Air Bill No.: N/A
No. Coolers Received: N/A
Custody Seals: Yes / (No)
Intact: Yes / No / (NA)
Custody Seals No. N/A
Chain-of-Custody Record: Yes / ~~No~~
Sample Tags: Yes / (No)

[redacted]on of Samples Upon Receipt:
Cooler temperature(s): _____ NA ____; Thermometer ID: _____
Headspace in VOA vials: Yes / No / NA • Containers intact: Yes / No

[redacted]-[redacted] Date:	Client No.:	Job No.	SIC	Proj No./ PMS Code:

[redacted]e[redacted]ate:	____ Discount (%) ____ List ____ Premium (%)	PO No.:	Vendor No.:	Work Order No.:

[redacted]sk [redacted].	Lab Sample No.	Matrix	Sample Identification	Date Sampled	Bottles
	P307884		C30895-24E-207AB TCLP		
	85		- 48E -		
	86		- 72E -		
	87		- 96E -		
	307885		- 24F -		
	84		- 48F -		
	90		- 72F -		
	P307891		- 96F -		

[redacted]cial Instructions: _____

Special Requirements:
___ CLP
X Lab Tracking
___ Labor
___ MSIS
___ QC Report
___ Add. Deliv.

Project Manager: _____
Written up by: JG
Logged-in by: _____
Reviewed by: _____

☐ See CAR No.: _____

09/94

Page ____ of ____

Client: Rocky Flats
Report/Invoice Address: Same

☐ Check if new Client

Attn: ____ Phone: ____
CC: ____

Date/Time Sample Receipt: 3-9 1500
Air Bill No.: N/A
No. Coolers Received: N/A
Custody Seals: Yes / (No)
Intact: Yes / No / (NA)
Custody Seals No. N/A
Chain-of-Custody Record: Yes / (No)
Sample Tags: Yes / (No)

Condition of Samples Upon Receipt:
- Cooler temperature(s): ____ NA ____; Thermometer ID: ____
- Headspace in VOA vials: Yes / No / NA
- Containers intact: Yes / No

Log-In Date: 3/9	Client No.: 1431	Job No. 10	SIC	Proj No./ PMS Code:
Price Date:	____ Discount (%) ____ List ____ Premium (%)	PO No.:	Vendor No.:	Work Order No.:

Task No.	Lab Sample No.	Matrix	Sample Identification	Date Sampled	Bottles
1	P302409		030995-24A-27C TCLP	3-9	
	10		- 45A -		
	11		- 72A -		
	12		- 72A -		
	13		- 24B -		
	14		- 48B -		
	15		- 72B -		
	16		- 72B -		
	17		- 24C -		
	18		- 48C -		
	19		- 72C -		
	20		- 72C -		
	21		- 24D -		
	22		- 48D -		
	23		- 72D -		
	P302424		- 72D -		

Special Instructions: ____

Special Requirements:
- ___ CLP
- X Lab Tracking
- ___ Labor
- ___ MSIS
- ___ QC Report
- ___ Add. Deliv.

Project Manager: ____
Written up by: JA
Logged-in by: TW
Reviewed by: ____

☐ See CAR No.: ____

09/94

Page ___ of ___

Client: Rocky Flats

Report/Invoice Address: Same

Attn:

CC:

☐ Check if new Client

Phone:

Date/Time Sample Receipt: 3-4 1500

Air Bill No.: N/A

No. Coolers Received: N/A

Custody Seals: Yes / No

Intact: Yes / No / NA

Custody Seals No. N/A

Chain-of-Custody Record: Yes / No

Sample Tags: Yes / No

Condition of Samples Upon Receipt:

- Cooler temperature(s): ____ NA ____; Thermometer ID: ____
- Headspace in VOA vials: Yes / No / NA
- Containers intact: Yes / No

Log-In Date:	Client No.: 1431	Job No. 10	SIC	Proj No./ PMS Code:
Price Date:	____ Discount (%) ____ List ____ Premium (%)	PO No.:	Vendor No.:	Work Order No.:

Task No.	Lab Sample No.	Matrix	Sample Identification	Date Sampled	Bottles
1	P302925		030995 - 24E - 207C TCLP	3-9	
	P302926		- 48E -		
	P302927		- 72E -		
	P303562		- 72E -		
	563		- 24F -		
	564		- 48F -		
	565		- 72F -		
	P303566		- 72F -		

Special Instructions:

Special Requirements:
- ___ CLP
- > Lab Tracking
- ___ Labor
- ___ MSIS
- ___ QC Report
- ___ Add. Deliv.

Project Manager:

Written up by: JG

Logged-in by:

Reviewed by:

☐ See CAR No.:

09/94

LABORATORY LOG BOOK

P005-95

BACTERIOLOGICAL LAB

LIME STUDY

pH &
BACTERIOLOGICAL ANALYSIS

1/5/95 Thru 1/11/95

TITLE Stn. Plate Counts, Rocky Flats 1-5-95 Jun EPA 600/A

PROJECT NO.

BOOK NO.

1

Work continued from Page

Sample ID	grams ~~Jun~~ Sample per 100 mL	~~Dilu~~ Factor Dilution Factor	mL sample used	# of colonies ~~/mL~~	Final Col/gram Result
Blank	—	—	—	Jun <1	<1
↓	—	—	—	<1	<1
A/B #1	1.01	X100	0.1	<1 Ø Jun	<100,000
			0.1	<1 Ø Jun	↓
			1.0	1	10,000
	↓	↓	1.0	<1	<10,000
A/B #2	1.03	X100	0.1	<1 Ø Jun	<100,000
			0.1	<1 Ø Jun	<100,000
			1.0	<1	<10,000
	↓	↓	1.0	<1	↓
A/B #3	1.02	X100	0.1	<1 Ø Jun	<100,000
			0.1	<1 Ø Jun	↓
			1.0	1	10,000
	↓	↓	1.0	1	↓
A/B #4	1.04	X100	0.1	<1 Ø Jun	<100,000
			0.1	<1 Ø Jun	↓
			1.0	1	10,000
	↓	↓	1.0	1	↓
A/B #5	1.01	X100	0.1	<1 Ø Jun	<100,000
			0.1	<1 Ø Jun	↓
			1.0	1	10,000
	↓	↓	1.0	1	↓
A/B #6	1.02	X100	0.1	<1 Ø Jun	<100,000
			0.1	<1 Ø Jun	↓
			1.0	<1	<10,000
	↓	↓	1.0	<1	↓
A ~~A/B~~ #7	1.02	X100	0.1	<1 Ø Jun	<100,000
			0.1	<1 Ø Jun	↓
			1.0	4	40,000
	↓	↓	1.0	7	70,000

... PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE | DATE

DISCLOSED TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE STD. PLT. Count 1-5-95 JWL EPA 600/A

PROJECT NO.

BOOK NO.

Continued from Page 1

Sample ID	Grams Sample per 100 mL	Dilution factor	mL Sample Used	# of Colonies	Final Result Col/Gram
1A ~~A/B~~ 8	1.03	X100	0.1	<10 JWL	<100,000
			0.1	<10 JWL	↓
			1.0	1	10,000
			1.0	<1	<10,000
1A J.C. ~~A/B~~ 9	1.05	X100	0.1	<10 JWL	<100,000
			0.1	<10 JWL	↓
			1.0	<1	<10,000
			1.0	<1	↓
1A ~~A/B~~ 10	1.05	X100	0.1	<10 JWL	<100,000
			0.1	10 JWL	100,000
			1.0	4	40,000
J.C. A			1.0	2	20,000
1A ~~A/B~~ 11	1.05	X100	0.1	<10 JWL	<100,000
			0.1	<10 JWL	↓
			1.0	<1	<10,000
			1.0	<1	↓
1A JWL ~~A/B~~ 12	1.03	X100	0.1	<10 JWL	<100,000
			0.1	<10 JWL	↓
			1.0	1	10,000
			1.0	<1	<10,000

In Incubator at 14:45 1-5-95 JWL
Read 10:45 1-7-95 JWL

Dilution water - Lot # 4JP3 Fisher Scientific

Pipet - Fisher Lot # 40248

Petri Dishes - Fisher Lot # QC 409 or 4338 4

Work continued to Page

DATE

... TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

Work continued from Page

Sample ID	g. Sample per 100 mL	mL Sample	# of colonies	Final Result colonies/gram
Blank	—	—	<1	<1000
	—	—	<1	<1000
13	1.05	0.1	<1	<1000
↓			1	1000
14	1.00		2	2000
↓			1	1000
15	1.01		1	1000
↓			<1 ~~2~~ Jun	<1000
16	1.01		<1	<1000
↓			<1	<1000
17	1.04		<1	<1000
↓			<1	<1000
18	2.99		<1	<1000
↓			<1	<1000
19	1.04		1	1000
↓			<1	<1000
20	1.01		<1	<1000
↓			<1	<1000
21	1.05		1	1000
↓			<1	<1000
22	1.00		<1	<1000
↓			<1	<1000
23	1.02		<1	<1000
↓			<1	<1000
24	1.03		1	1000
↓			1	1000
			<1	<1000

Plate Pour 15:00 1-9-95 Jun
Read 13:20 1-11-95 Jun

BINDERY PRODUCTIONS CHICAGO 60605 MADE IN USA

Work continued to Page

SIGNATURE

DATE

...ED TO AND UNDERSTOOD BY

DATE

WITNESS

DATE

TITLE STd. Plate Counts 1-10-95 EPA 600 1A

PROJECT NO.

BOOK NO.

Work continued from Page

Sample ID	g Sample per 100 mL	mL Sample	# of colonies	Final Result colonies/gram
Blank	—	—	<1	<1
	—	—	<1	<1
25	1.10	0.1	<1	<1000
↓		0.1	<1	<1000
26	1.08	0.1	<1	<1000
↓		0.1	<1	<1000
27	1.02	0.1	<1	<1000
↓		0.1	<1	<1000
28	1.03	0.1	<1	<1000
↓		0.1	<1	<1000
29	1.02	0.1	<1	<1000
↓		0.1	<1	<1000
30	1.02	0.1	<1	<1000
↓		0.1	<1	<1000
31	1.02	0.1	<1	<1000
↓		0.1	<1	<1000

Plates Downed 13:00 1-10-95 [illegible]

Read 13:20 1-12-95 [illegible]

Work continued to Page

DATE

TO AND UNDERSTOOD BY | DATE | WITNESS | DATE

TITLE STD. PLATE COUNT
1-11-95

BOOK NO.

Work continued from Page

Sample ID	% Sample per 100 mL	mL Sample	# of Colonies	Final Result CFU/gram
BLANK	—	—	<1	<1
	—	—	<1	<1
Drinking Water	—	1.0	12	12 CFU/mL
	—	1.0	10	10 ↓
	—	0.1	3	30 ~~3000~~ per CFU/mL
	—	0.1	1	10 ~~1000~~ on ↓
32	1:12	0.1	<1	<1000
↓	↓	0.1	<1	<1000
33	1:02	0.1	2	2000
↓	↓	0.1	<1	<1000
34	1:05	0.1	<1	<1000
↓	↓	0.1	<1	<1000
35	1:02	0.1	<1	<1000
↓	↓	0.1	<1	<1000
36	1:00	0.1	<1	<1000
↓	↓	0.1	<1	<1000
Sample on:	14:30	1-11-95	JMC	
Read on:	14:30	1-13-95	JMC	

Work continued to Page

PRODUCTIONS CHICAGO 60605 MADE IN USA

SIGNATURE DATE

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