Class A Biosolids

Terminal Island Treatment Plant

DRAFT

Startup Process and Protocols for Alternative 1, 40 CFR 503

July 2001

Terminal Island Treatment Plant and
Applied Research Group, WESD
Bureau of Sanitation, Public Works
City of Los Angeles

DATE: July 2, 2001

TO: Distribution

FROM: Adel Hagekhalil

SUBJECT: Protocol for Class 'A' Biosolids at Terminal Island Treatment Plant

This is the draft protocols developed for the subject based on Alternative 1, USEPA 40 CFR Part 503. Alternative 1 requires a plant mode of operation that satisfies the time-temperature specified in 40 CFR Part 503. This alternative is selected based on the suggestion by experts and efforts to save costs for monitoring and reporting.

These protocols have been prepared in full coordination with TITP operations, WESD, Applied Research Group, EMD staff, EED staff and consultants.

The plant has experimented full-scale thermophilic operation to produce Class A Biosolids based on Alternative 4 of 40 CFR 503; The experiments were done with a single digester from February 2000 to July 2000. Two stage digestion was done from July 2000 to April 2001. Reports distributed on the results have indicated that the operations so far has been highly successful.

As we have little time left before starting the work on July 9, we appreciate your comments to R. Iranpour/ M. Zermeno at (310)648-5280 or H. Kim/S. Oh at (310) 732-4715 by July 6.

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INTRODUCTION

If certain parameters are adjusted and changes in operating procedures are made, sludge digestion at TITP can produce biosolids meeting the USEPA Class A standard. ***This document presents a plan for a project to test operational methods for producing these high-quality biosolids according to Alternative 1 of the standard (40 CFR Part 503), for which the details are explained below.*** During previous one-stage (February 2000-July 2000) and two-stage digestion (July 2000-April 2001) tests that started in February, 2000, biosolids meeting the Class A standard according to Alternative 4 (also explained below) were produced, but certification was not obtained. As, Riverside County, where most of TITP's biosolids have been hauled for the past few years, recently changed its regulations to ban the land application of Class B Biosolids. This action led to our decision to obtain Class A certification at an earlier date than we formerly planned. We are following both the advice of experts in the field, our previous experience and our own cost considerations in shifting to using Alternative 1. This alternative eliminates the need to use the costly biological tests for enteric viruses and viable helminth ova.

BIOSOLIDS STANDARDS

This section summarizes the legal requirements. The statement of the six alternatives for the Class A pathogen standard constitutes §32 of 40 CFR 503 (USEPA, 1993, pp. 48-52). Since the sludge at TITP is less than 7% solids, the relevant subsection giving the time-temperature relationship is the fourth case in Alternative 1, §503.32 (a) (3) (ii) (D) (USEPA, 1993, p. 49). We list the conditions that are potentially relevant for TITP to produce biosolids in Class A, and hence suitable for unrestricted use.

1. Either the concentration of fecal coliforms is never to exceed 1,000 MPN (Most Probable Number) per gram of total dry solids or the concentration of *Salmonella* is never to exceed 3 MPN per 4 grams of total dry solids. This is item (i) for each of the six alternatives (*e. g.*, §503.32 (a) (3) (i) (USEPA, 1993, p. 49).

2. One of the following conditions must be met:

a. **(Alternative 1)** For a temperature T in degrees Centigrade that is at least 50°C, digestion time D in days is at least

$$D = 50{,}070{,}000/10^{0.14T} \qquad (1)$$

except that if T >67°C then D is always at least 30 minutes (§503.32 (a) (3) (ii) (D) (USEPA, 1993, p. 49)).

Note that for temperatures between 50°C and 67°C Equation 1 implies a five-fold reduction in time for each 5°C rise in temperature, as in the following table:

Table 1. Numerical Values for Temperature/Time Requirements, Eq. (1).

Temperature, °C	Time
50	5.0 days
55	1.0 day
60	4.8 hours
65	1.0 hour
67	30 minutes

Again we used alternative 4 between February 2000 to April 2000.

b. (Alternative 4) Microbiological testing verifies that enteric virus concentration is less than 1 plaque-forming unit (pfu) per 4 grams of total dry solids, and helminth ova concentration is less than 1 ovum per 4 grams of total dry solids (§503.32 (a) (6) (ii) and (iii) (USEPA, 1993, p. 51)).

For comparison, the Class B standard for biosolids is far less stringent, mandating a fecal coliform concentration below 2,000,000 MPN per gram total solids, or a Process to Substantially Reduce Pathogens (PSRP), such as anaerobic digestion for 15 days at 35°C, or a certified PSRP-equivalent process.

PROCESS MODIFICATIONS AT TITP

Although the results of early efforts to use thermophilic anaerobic digestion of sludge have given it some negative reputation in the United States, in recent times it has been developed in Europe into a highly reliable and effective process (Ahring, 1994, 1996). Recent US experience has also been highly successful, and this international effort has found values of pH, total volatile fatty acids (VFAs), alkalinity, etc. that indicate satisfactory operation of the process, so stable operation will be recognized by the attainment and maintenance of values close to the desired ones. Hence, the thermophilic digester will have to be carefully monitored for pH, alkalinity, VFA production, and the degree of VS destruction that actually occurs, to verify that the conditions are right for methane production to be maintained at a high level, without exceeding the pH tolerance or other metabolic limits of the methanogens. Some of the plants that have done this operation are and 2 stages at TITP have been highly successfully.

Feeding the thermophilic digester is to be performed in draw and fill mode, so that no incoming sludge enters the digester until all outgoing sludge has been removed. The digester is mixed by the recirculation and gas mixing systems, so a fraction of each new charge may be withdrawn at the next extraction, and hence the Part 503 requirement for pasteurization at the temperature of the thermo reactor must be met under the minimum residency conditions set by the draw and fill schedule.

Heat Transfer Considerations

The draw and fill operation requires temperatures around 55°C. The heat required to raise the incoming sludge to this temperature is in the range of 2.5-3 x 10^6 BTU/hr, depending on variations in the raw sludge temperature, the ambient air temperature, and the chosen final temperature. As the heat value of current digester gas production is around 4.0 x 10^6 BTU/hr, and the new process has produced more gas in the previous tests, this heat supply is probably sufficient to heat the incoming sludge in the absence of measures to recover heat from the thermophilically digested sludge.

As the liquid recirculation system on each side has two pumps, each with a rated capacity of 500 gpm. or 720,000 gpd, running the pump continuously (at it maximum duty cycle) and gas mixing should be sufficient to recirculate the contents of one digester about once per day.

Since we now expect permanent adoption of this process, we strongly recommend installation of a sludge-to-sludge heat exchanger. This will recover large amounts of heat and will ease the task of cooling the thermophilic solids for storage and dewatering. Cost estimates for the test and for purchase and installation of the sludge-to-sludge heat exchanger will be prepared.

MONITORING AND REPORTING

The following list of parameters is suggested for monitoring the chemical state of the digestion process, based on previous startups at other plants and consultation with various experts. Further experience may show that once operation is established some of the parameters may be eliminated entirely. All parameters are to be measured using the procedures in the latest edition of *Standard Methods*.

1. Temperature (^{o}C)
2. pH
3. Alkalinity (as mg $CaCO_3$ /L)
4. Total VFAs (as mg acetic acid/L)
5. Total solids (TS) (mg/L)
6. Total volatile solids (TVS) (mg/L)
7. CH_4 content of biogas (%)
8. CO_2 content of biogas (%)
9. Fecal coliforms (MPN/gm dry TS)
10. *Salmonella* (MPN/gm dry TS)
11. Heavy or toxic metals: As, Cd, Cr, Cu, Hg, Ni, Pb, Zn (mg/L)

Other important parameters cited in the references are: Oxidation/Reduction Potential (ORP) (volts); VFA composition: concentrations of acetic, butyric, propionic and pentanoic acids (as mg acetic/L); protein concentration (mg/L); total kjeldahl nitrogen (TKN) (mg/L); NH_3--N (mg/L); total organic carbon (TOC) (mg/L); biogas flowrate (L/hr); oil and grease (mg/L); biomass activity; sludge for microbiological analysis.

The suggested monitoring and reporting appear in Tables 2a, 2b, 2c, 2d and Figure 1.

Table 2a. Suggested Monitoring for EPA Certification.

Parameter	Frequency	Sampling Location	Testing Laboratory	Method	Sample Size	Sample Type
1. Temp	continuously	recirculation line	TITP control room	online		
2. pH	daily	digester withdraw line	TITP	SM-4500HB Electrometric	1000 ml	Grab
3. Alk	5 days/wk	digester withdraw line	TITP	SM-2320B Titration	1000 ml	Grab
4. Total VFAs	5 days/wk	digester withdraw line	TITP	SM-5560C Distillation and Titration	1000 ml	Grab
5. TS	daily	digester withdraw line	TITP	SM-2540B Gravimetric	1000 ml	Grab
6. VTS	daily	digester withdraw line	TITP	SM-2540E Gravimetric	1000 ml	Grab
7. CH4	3 days/wk (T,W, Th) for each digester	digester gas line	HTP air lab	EPA Method 18 gas chromatography	Tedler bag	Grab
8. CO2	3 days/wk (T,W, Th) for each digester	digester gas line	HTP air lab	EPA Method 18 gas chromatography	Tedler bag	Grab
9. Coliform	5 days/wk	digester withdraw line	HTP micro	SM-9221 E 2	500 ml sterilized bottle for each	Grab
10. Salmonella	2 days/wk (T and Th at 1:00 PM)	digester withdraw line	Biovir		500 ml sterilized bottle for each	Grab

Notes

* Parameters 2,3,4,5 and 6 require only one bottle of 1000 ml (sample will be collected at 7:00 AM).
* We are considering fecal coliform testing for raw sludge, digester feed sludge, dewatered biosolids.
* We are also considering checking the pathagen regrowth.
* Split samples for microbe analysis will be sent to outside laboratories.
* Parameters 5 and 10 will be collected at 1:00 PM from the digester withdraw line.

Table 2b. Sampling schedule for table

Date	Day	Digested Sludge Sample			
		Sampling Digester	Sampling time		
			* Fecal Coliforms	**Salmonella	**Total Solids
07/10/01	Tue.	1	7:00 AM	1:00 PM	1:00 PM
07/11/01	Wed.	2	7:00 AM	NS	NS
07/12/01	Thu.	3	7:00 AM	1:00 PM	1:00 PM
07/13/01	Fri.	1	7:00 AM	NS	NS
07/14/01	Sat.	2	NS	NS	NS
07/15/01	Sun.	3	NS	NS	Out
07/16/01	Mon.	1	7:00 AM	NS	NS
07/17/01	Tue.	2	7:00 AM	1:00 PM	1:00 PM
07/18/01	Wed.	3	7:00 AM	NS	NS
07/19/01	Thu.	1	7:00 AM	1:00 PM	1:00 PM
07/20/01	Fri.	2	7:00 AM	NS	NS
07/21/01	Sat.	3	NS	NS	NS
07/22/01	Sun.	1	NS	NS	NS
07/23/01	Mon.	2	7:00 AM	NS	NS
07/24/01	Tue.	3	7:00 AM	1:00 PM	1:00 PM
07/25/01	Wed.	1	7:00 AM	NS	NS
07/26/01	Thu.	2	7:00 AM	1:00 PM	1:00 PM
07/27/01	Fri.	3	7:00 AM	NS	NS
07/28/01	Sat.	1	NS	NS	NS
07/29/01	Sun.	2	NS	NS	NS
07/30/01	Mon.	3	7:00 AM	NS	NS
07/31/01	Tue.	1	7:00 AM	1:00 PM	1:00 PM

* These samples will be collected and delivered to the lab by TITP operation
** These samples will be collected and delivered to the lab by WESD engineers

Note: Please follow this schedule until there is a further notice.
If there is a situation that this schedule can not be followed,
please inform senior operators or/and Hi Sang/Seung.

NS = No Sample

Table 2c. Sampling Schedule.

Date	Day	Time		Digester No
9-Jul-01	Mon	7:00 AM		2
10-Jul-01	Tue	7:00 AM	1:00 PM	3
11-Jul-01	Wed	7:00 AM		2
12-Jul-01	Thu	7:00 AM	1:00 PM	3
13-Jul-01	Fri	7:00 AM		1
14-Jul-01	Sat	7:00 AM		2
15-Jul-01	Sun	7:00 AM		3
16-Jul-01	Mon	7:00 AM		1
17-Jul-01	Tue	7:00 AM	1:00 PM	2
18-Jul-01	Wed	7:00 AM		3
19-Jul-01	Thu	7:00 AM	1:00 PM	1
20-Jul-01	Fri	7:00 AM		2
21-Jul-01	Sat	7:00 AM		3
22-Jul-01	Sun	7:00 AM		1
23-Jul-01	Mon	7:00 AM		2
24-Jul-01	Tue	7:00 AM	1:00 PM	3
25-Jul-01	Wed	7:00 AM		1
26-Jul-01	Thu	7:00 AM	1:00 PM	2
27-Jul-01	Fri	7:00 AM		3
28-Jul-01	Sat	7:00 AM		1
29-Jul-01	Sun	7:00 AM		2
30-Jul-01	Mon	7:00 AM		3
31-Jul-01	Tue	7:00 AM	1:00 PM	1

Notes

* TITP responsible for sampling parameters 2,3,4,5,6, 9 and 10.

* WESD Applied Reseach responsible for sampling parameters 7 and 8.

Table 2d. Reporting Requirement Based on §503.16.

USA 40 CFR Part 503 Subsection 503.16, Table 1

Amount of Sludge (Tonnes per year)	Frequency per year
< 290	1
290 <= 1,500	4 (quarterly)
1,500 <= 15,000	6 (bimonthly
15,000 or more	12 (monthly)

Table 2e. Detail Responsibilities and Chain of Custody.

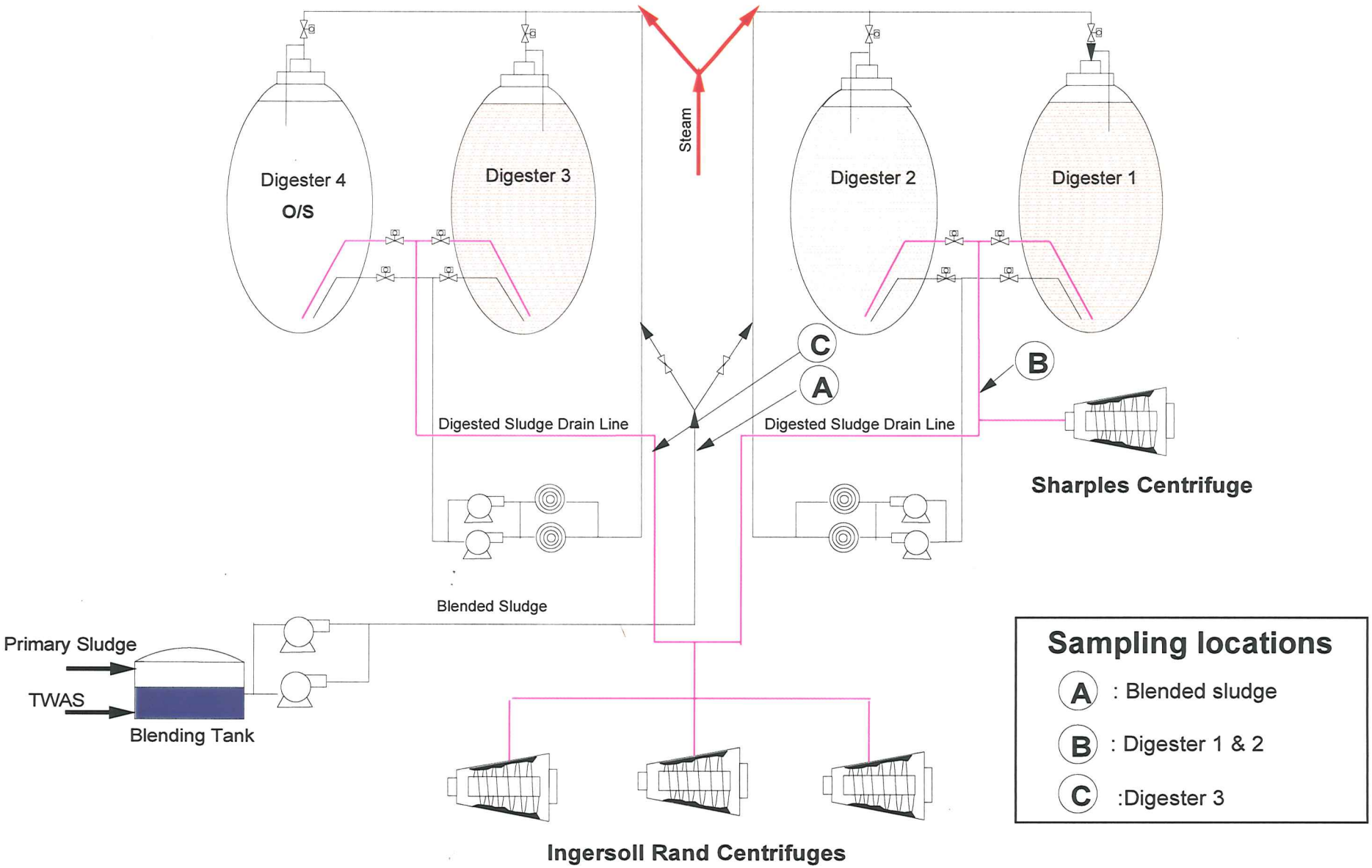
Name	Division	Telephone/pager	Responsibility
Ray Kearney	RAD	(310)648-5360	
Diane Gilbert	RAD	(310)648-5248	
Michael D. Williamson	TITP	(310) 548-7520	Physical Sampling and Chain of custody
Adonis Agben	TITP	(310) 732-4717	Coordinator
Ron Goodman	TITP	(310) 548-7520	Physical Sampling and Chain of custody
Shokoufe Marashi	EMD (TITP)	(310) 732-4713	Laboratory tests and send samples to outside labs
Ron Campbell	TITP	(310) 732-4735	Instrument Cal. Of Temp. Measurements
Y.J. Shao	TITP	(310) 732-4705	Plant Manager / Coordinator
Seung Oh	WESD	(310) 648-5094	Process coordinator
Reza Iranpour	WESD	(310) 648-5280	Protocol coordinator / liaison
Martin Ruiz	WESD	(310) 648-5002	Physical Sampling and Chain of custody
Miguel Zermeno	WESD	(310) 648-5440	Physical sampling and chain of custody
Dave Thomas	EMD	(310)648-5725	

Table 2f. Recommended Additional Testing (only for EPA certification).

Parameters	Process Cycle	Date	Time
Viable Helminth Ova			
Enteric Virus			

* During the digester withdraw mode the sample should be collected at 7:00 am by TITP staff.
* Samples will be collected every other day for a total of 7 samples (14 days sample collection) which then will be composited for analysis by Biovir Labs. Four duplicates will be analyzed.
* This test will be done by Biovir Laboratory located in San Francisco.
* Any additional testing should be requested by EPA through BOS-RAD .

Figure 1. TITP Digesters and Sampling Locations for Batch Mode.



SAMPLING AND TESTING NOTES

1. Until certification is achieved, pathogen testing will be much more frequent than is mandated in Table 1 of §503.16 (Table 2f). As described in the Operating Procedure section, fecal coliform (FC) measurements will be made five times a week, similar to what was done in the single-stage and two-stage phases of the project (Feb., 2000 to Apr., 2001). If possible, testing should also be done on wet cake samples obtained at the most convenient point between removal from the centrifuge and loading on the truck. Provisions will be made for rapid sample delivery to the laboratory, and for thorough sample chilling based on standards in case delivery is delayed. Re-sampling is to be done immediately on observation of a sample that exceeds the standard.

This decision is based on advice from discussions with experts at the June 26 Class A workshop at HTP arranged by EED at the Pregenson building and meeting at EED manager on June 28, 2001. These experts have discussed these subjects with EPA regulators and members of EPA's Pathogen Equivalency Committee. The intent of the rule is that low pathogen densities are to be demonstrated when the material is used or transferred, i.e, when it leaves the control of the producing agency. Some agencies have sampled both digested sludge and the final cake and found differences that may result either from contamination by biofilms in the piping or the centrifuge, or perhaps from colony-disrupting and growth-stimulating effects of the turbulence, shearing, and aeration that occur in the centrifuge. It is also possible that some of these results are artifacts resulting from growth in the cake samples after they were collected, since cooling cake samples is not easy, and several hours have sometimes elapsed between sample collection and delivery to the laboratory.

2. Proper sample handling is as important as maintaining the digester temperature, since the EPA requires that every sample must meet the Class A standard. The Agency wants an investigation of the reason for any exceedance, and immediate corrective action for any verified observation of excessive FC density. Keeping detailed records of temperature variations and retention times is essential to verify that the time-temperature requirement was always met.

3. The sampling as described in the Operating Procedure section is expected to produce representative samples, since the sludge is mixed well by the gas mixing and the recirculation during feeding.

4. Determining that the VS destruction factor is greater than 38% shows that Option 1 of the VAR standard is being met. Hence, maintaining the measurements of TS, VS, etc. as in the one-stage and two-stage phases is important to this aspect of public acceptability and our hopes for eventually going beyond Class A certification to Exceptional Quality.

5. Another consideration that is not part of Class A certification but is important for public acceptance is odor. The workshop participants urged odor testing with an olfactometer or odor panel at or very close to the plant to eliminate odor changes that might be caused by storing or transporting the dewatered cake.

6. As a point of perspective on the effort to meet Alternative 1, it may be worth noting that testing for viable helminth ova and enteric viruses during the previous phases of the study was primarily oriented toward meeting Alternative 4, which only specifies an absence of detectability of these pathogens in the final product, but the testing also indicated that much of the time these pathogens were undetectable in the raw sludge, which satisfies the easier option in Alternative 3. (Alternative 3 is very similar to Alternative 4 except for the sampling locations and measurement requirements to verify the absence of ova and viruses.) It would be possible to do biological testing that was sufficiently extensive to assess the prospects of meeting this alternative consistently, but this would cost a lot. Also, it is rare in the industry to use this alternative, suggesting that other agencies have not found it to be a desirable approach.

OPERATING PROCEDURES FOR ALTERNATIVE 1 FOR PLAN OPERATIONS

In order to meet the time-and-temperature requirement, a minimum of three digesters will be used. The time-and-temperature goal will be 24 hours (one day) and 131°F. There will be three cycles, in the order of feed, hold, and withdraw, that each of the three digesters go through every three days.

Table 3. General Operating Pattern

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
1st digester	Feed	Hold	Withdraw	Feed	Hold	Withdraw
2nd digester	Withdraw	Feed	Hold	Withdraw	Feed	Hold
3rd digester	Hold	Withdraw	Feed	Hold	Withdraw	Feed

Feed and Withdraw Cycles

Some of the important points are listed in the following sections. Digesters 1, 2, and 3 will be used. After Digester 4 is put in service, Digester 3 will be taken out of service. Then Digesters 1, 2, and 4 will be used.

Feed cycle

- During the feed cycle, all the digester feed, including the primary tank grease, will go to the feed digester for the day. Primary tank grease can only be fed to Digester 3 or 4. That means the grease can only be pumped out of the grease concentrator one day out of every three.

- At the beginning of the feed cycle for Digester 3 (or Digester 4 later on), turn on the grease pump by putting the manual off-auto switch to the auto position. At the end of the feed cycle for Digester 3, switch off the grease pump.
- Do not raise the level of the digester higher than 65 ft. Once this level is reached, stop the feed and resume with the next digester.
- The target temperature of the feed digester is 132-134°F. It is very important that the temperature stays within the range by the end of the feed cycle. If you expect that it will be difficult to achieve the temperature, secure the feed and continue heating to bring the temperature within the range.

Hold cycle

- The hold cycle is the most important cycle in terms of legality. During this period, we have to meet the time-and-temperature requirement.
- The hold cycle begins when the feed is complete and the desired temperature is reached. At the beginning of the hold cycle, record in the log book the exact start-time of the hold cycle for the digester.
- The hold cycle is complete when the sludge meets the time-and temperature requirement and is ready to be withdrawn for dewatering. Record, in the log book, the exact end-time of the hold cycle.

Withdrawal cycle

- During the withdrawal cycle, the biosolids are withdrawn to centrifuges for dewatering. By doing so, the level is lowered to receive the feed during the following (feed) cycle.
- By the end of the withdrawal cycle, the digester level should be brought down to 50 +/- 2 ft.
- The sludge samples will be taken during the withdrawal cycle every day at 0700 hours. Take the sample only if there has been flow going to a centrifuge for the past 30 minutes.

Other Notes

- To meet the time-and-temperature requirement, we should look at both the holding time and the temperature. If we do not meet the holding time of 24 hours, we can still meet the requirement by increasing the temperature, or vice versa. For example, we only need 21.5 hours of holding time if the holding temperature is 131.6°F. On other instances, you can gain on holding time by faster feeding and withdrawal to make up for a lower temperature. *The bottom line is meeting the requirement by working the two parameters.*
- Not all the three digesters must start and complete the three cycles at the same time. It is a good habit to start the cycle at noon and complete at the following noon. However, depending on the operational need, the timing of the cycles can be altered slightly.

PRECAUTIONS / SAFETY REQUIREMENTS

1. All participants in the project shall meet regularly to coordinate their activities.
2. All valves and gates leading to digesters not in service shall be closed and properly tagged.
3. The safety coordinator for the plant is to be consulted to ensure compliance with all other applicable safety procedures.

APPENDIX A

1. Notice and Necessary Information
   To be completed by Preparers of Class A Biosolids

Notice and Necessary Information

To be Completed by Preparers of Class A Biosolids

Facility Name: _____ **Monitoring Period** ___/___/___ **to** ___/___/___

1. Pollutant and Nitrogen concentrations (report results on 100% dry weight basis. Attach lab analyses).

	As	Cd	Cu	Pb	Hg	Mo	Ni	Se	Zn	Org-N	NH_4-N	% solids
Result												
Table 3	41	39	1500	300	17	na	420	100	2800	na	na	na
Table 1	75	85	4300	840	57	75	420	100	7500	na	na	na

Sampling date(s): _____

2. Class A Pathogen Reduction: (Check off and fill in applicable portions of requirement i AND requirement ii)

i) fecal coliform = _____**mpn/gram salmonella =** _____**mpn/4 grams**
Class A: fecal coliform < 1000 mpn/gram OR salmonella < 3 mpn/4 grams

ii) _____ **testing: enteric virus =** _____**pfu/4 grams, viable helminth ova =** _____**/4 grams**
Class A: enteric virus < 1 pfu/r grams, viable helminth ova < 1/4 grams
_____**composting: windrow:** _____ **days at** ____ **to** _____ **degrees F/C;** _____ **turns (attach logs of temps, turns)**
SAP; in vessel: _____ **days at** _____ **to** ____ **degrees F/C (attach logs of temps)**
Class A: windrow: > 15 days; > 55 degrees C, 5 turns. SAP, in vessel: > 3 days; > 55 degrees C
_____ **heat treatment:** _____ **minutes/hours/days;** _____ **degrees F/C;** ___ **% solids, heating method:** _____
Class A: (use appropriate equation and minimum time in 503.32(a) Alternative 1, A - D)
_____ **heat drying: temp:** _____ **degrees F/C; % solids =** _____
Class A: temp > 80 degrees C, % solids > 90 %
_____ **pasteurization: temp =** _____ **degrees C/F, time =** _____
Class A: temp > 70 degrees C, time > 30 min
_____ **alkali treatment: time pH above 12 =** _____ **(attach times measured); time temp > 52 degrees C =** _____
(attach times temp measured) ; % solids = _____
Class A: pH > 12 for > 72 hours, temp > 52 degrees C for 12 hours (while pH > 12); air dried until solids > 50%
_____**other: (describe parameters)**

3. Vector Attraction Reduction:
_____**Option 1: % VS_{lo} =** _____ **% VS_{red} =** _____ **% VSR =** _____
VAR: VSR > 38%
_____**Option 2/3: Bench scale test: % VSR =** _____ **after** ____ **days**
VAR: additional VSR < 17% after 40 days(anaerobic), < 15% after 30 days (aerobic)
____ **Option 4: SOUR =** _____
VAR: SOUR < 1.5 mg O_2/hr/gram (dry weight)
_____**Option 5: Composted** _____ **days at temps of** _____ **to** _____**degrees F/C (attach times/temps)**
VAR: temp > 40 degrees C for 14 days, w/5 days > 45 degrees C
____ **Option 6: time alkali added:** _____ **pH after 2 hours =** ___ **pH after 22 hours =** ___
VAR: pH ≥ 12 for 2 hours after alkali addition, ≥ 11.5 for additional 22 hrs
_____**Option 7: % solids =** _____ **Stabilization method:**
VAR: stabilized solids > 75%
_____ **Option 8: % solids =** _____
VAR: unstabilized solids > 90%
_____ **Option 9/10: Applier will incorporate in** _____ **hours**
VAR: inject in 1 hr, incorporate in 6 hrs, < 8 hours after treatment process

Certification: I certify, under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or the persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

me and Official Title: _____

Phone: (_____**)**_____ **E-mail:** _____**@**_____

Signature: _____ **Date:** _____

APPENDIX B

1. Chain of Custody

Air lab HTP
Chain of Custody Record
Gas Samples

				SAMPLERS (SIGNATURE)					
SAMPLE ID #	SAMPLING LOCATION	DATE	TIME	SAMPLE TYPE				# OF CONTAINERS	ANALYSIS REQUIRED
				WATER		SOLID			
				COMP	GRAB	COMP	GRAB		
	Digester #1								CH_4, CO_2
	Digester #2								CH_4, CO_2
	Digester #3								CH_4, CO_2
RELIQUIESHED BY:			RECEIVED BY:					DATE/TIME	
RELIQUIESHED BY:			RECEIVED BY:					DATE/TIME	
RELIQUIESHED BY:			RECEIVED FOR LABORATORY BY:					DATE/TIME	
METHOD OF SHIPMENT:									

City of Los Angeles
Department of Public Works
Bureau of Sanitation

FORM EMD-QA-010
Rev:7-01

TITP lab
Chain of Custody Record
Wastewater Samples

				SAMPLERS (SIGNATURE)						
SAMPLE ID #	SAMPLING LOCATION	DATE	TIME	SAMPLE TYPE				# OF CONTAINERS	ANALYSIS REQUIRED
				WATER		SOLID			
				COMP	GRAB	COMP	GRAB		
	Digester #1								TS,VS, ph VFA, Alk
	Digester #2								TS,VS, ph VFA, Alk
	Digester #3								TS,VS, ph VFA, Alk
RELIQUIESHED BY:			RECEIVED BY:					DATE/TIME	
RELIQUIESHED BY:			RECEIVED BY:					DATE/TIME	
RELIQUIESHED BY:			RECIVED FOR LABORATORY BY:					DATE/TIME	
METHOD OF SHIPMENT:									

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Microbiology Laboratory HTP
Chain of Custody Record
Wastewater Samples

				SAMPLERS (SIGNATURE)					
SAMPLE ID #	SAMPLING LOCATION	DATE	TIME	SAMPLE TYPE				# OF CONTAINERS	ANALYSIS REQUIRED
				WATER		SOLID			
				COMP	GRAB	COMP	GRAB		
	Digester #1								Coliform
	Digester #2								Coliform
	Digester #3								Coliform
RELIQUIESHED BY:			RECEIVED BY:					DATE/TIME	
RELIQUIESHED BY:			RECEIVED BY:					DATE/TIME	
RELIQUIESHED BY:			RECEIVED FOR LABORATORY BY:					DATE/TIME	
METHOD OF SHIPMENT:									

Biovir
Chain of Custody Record
Wastewater Samples

				SAMPLERS (SIGNATURE)						
SAMPLE ID #	SAMPLING LOCATION	DATE	TIME	SAMPLE TYPE				# OF CONTAINERS	ANALYSIS REQUIRED	
				WATER		SOLID				
				COMP	GRAB	COMP	GRAB			
	Digester #1								Salmonella	
	Digester #2								Salmonella	
	Digester #3								Salmonella	
RELIQUIESHED BY:			RECEIVED BY:					DATE/TIME		
RELIQUIESHED BY:			RECEIVED BY:					DATE/TIME		
RELIQUIESHED BY:			RECEIVED FOR LABORATORY BY:					DATE/TIME		
METHOD OF SHIPMENT:										

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