651.1370 Appendix 13C—Operation, Maintenance, and Safety Guidelines

Appendix 13C Operation, Maintenance, and Safety Inspection Guidelines

Production Function

Element to check	How to check	Recommended action
Nutrients produced	Compare feed ration, number of animals, and weights of animals assumed in design.	Make appropriate adjustments to the nutrient management plan if nutrients are significantly different from those assumed.
Volume produced	Compare actual number of animals, weights of animals, bedding used, areas producing polluted runoff, and other sources of wastewater to those assumed in design.	If actual volume produced is greater and will result in early filling of storage/ treatment facilities, see the Trouble-shooting Guide for recommended action.
Clean water exclusion	See that clean water exclusion practices, such as diversion channels, roof gutters and downspouts, and curbs, are functional and in good condition.	Maintenance should be performed to correct deficiencies found.

Collection Function

Element to check	How to check	Recommended action
Alley scrape	Observe that alleys are relatively clean after being scraped and that animals are not being interfered with during scraping. Note areas that are not being cleaned during scraping. Observe that mechanical scrapers are operating properly.	Evaluate consequences, such as odor, that may result because of lack of cleanliness. Make suggestion on how to achieve more cleanliness if consequence for not doing so would be significant. Tractor scrapers and other related equipment needed should be available, maintained, and equipped with adequate safety devices, such as roll over bars and shields. Equipment that is not properly equipped with safety devices should not be used until it has been so equipped.
Alley flush	See that alleys are relatively clean after being flushed, particularly along curbs and at the end of alleys.	Adjust flow rate and/or duration of flush as necessary to achieve necessary cleanliness. See that safety precautions are taken in use of flush tanks that tip or otherwise present a hazard.
Gutter scrap	Observe cleanliness after scraping.	Suggest adjusting travel speed of scraping mechanism if satisfactory cleanliness is not being achieved.
Reception hoppers	See that dry material is not being placed in hopper. Observe whether ice is forming in hopper.	Blend wet material with dry material before placing in hopper. Hopper should be protected from freezing.
Slatted floors	See that ventilation is provided beneath slatted floors. Check structural integrity of slats.	Provide ventilation if not found.

Storage Function

Element to check	How to check	Recommended action
Waste storage pond		
Rate of filling	Observe availability and readability of staff gage in pond with marks or cross-bars at intervals that will permit calculation of volume of waste added per unit of time, i.e., month. Use gage readings in conjunction with pond's stage-storage relationships to determine rate of filling.	A staff gage should be installed if one is not present. If rate of filling will result in an early filling of storage facilities, see Troubleshooting Guide for recommended action.
	Determine waste and wastewater contribution.	Examine records kept of how often and what amounts of waste are added to the pond.
	Determine precipitation contribution to filling. Examine onsite or nearby weather station rain/snow gage readings. Compare with precipitation assumed in design.	If determined that precipitation has been excessive, reduce waste production to offset excess precipitation in storage or do emergency pumping to allow for future storm events.
	Determine amount of evaporation. Examine onsite or nearby weather station evaporation records. Compare actual evaporation with the amount assumed in design. Recognize that crusts formed on pond surfaces may reduce evaporation.	Reduce amount of waste produced or make adjustment in pumping schedule if evaporation is less than assumed in design.
Agitation	Observe that pond contents are agitated properly.	Assure that agitation is according to the agitation equipment manufacturer owner's manual recommendation for time and spacing.
	Observe that bank protection at agitation points is adequate.	If erosion is present, install bank protection or make adjustment of agitation point so erosion will not occur.

Storage Function—Continued

Element to check	How to check	Recommended action
Waste storage pond (Continued)		
Pump intake	Observe that intake is located at a depth that will minimize intake of solids material that will clog land application equipment, such as nozzles and orifices.	Make appropriate revision to pump intake to minimize clogging of land application equipment. Check adequacy of agitation equipment.
	Observe that sides and bottom are protected or intake is far enough away to avoid erosion during pumping.	Install protection or move pump intake if erosion is occurring.
	Observe that intake screens with appropriate size opening are in place. Observe frequency of clogging of screens and method for cleaning screens.	Make adjustments to minimize clogging.
Safety measures	Observe that fences and gates are maintained and that warning signs are visible and in good condition.	
	Assure that access ramps have appropriate guard rails and safety curbs in place and cleaned so traction surfaces are exposed.	
	Ascertain that a life ring, life line, or pole is readily available in case of an emergency.	
Waste storage structure—tank		
Rate of filling	Use established method for determining depth of waste in the tank that will permit determination of volume of waste and allow calculation of volume per unit of time, e.g., cubic feet per month. This rate can be compared to rate of filling assumed in design. The rate can also be used as a basis for planning/design of subsequent AWMS's.	Make adjustment to reduce filling rate if it exceeds assumed rate.

Storage Function—Continued

Element to check	How to check	Recommended action
Waste storage structure—tank (Continued)		
Agitation	During agitation observe that dry crusts that may have formed on the surface and heavy solids that may have settled to the tank are put into suspension.	Improve methods used in agitation if it is inadequate.
Emptying	Confirm that tank is pumped out in accordance with established utilization plan and that records are kept of when and how much is removed from the tank.	
Structural integrity	For reinforced concrete structures, inspect for excessive cracking and concrete deterioration.	Consult with concrete repair specialist for recommended repairs.
	For steel tanks check for corrosion around bolts and deterioration of protective coatings.	Repair, if found.
	Observe differential or excessive settlement.	If found, consult an engineer for action needed.
Water table control drains	See that drains are properly functioning to maintain water table to level required for structure loadings assumed in design.	
Safety measure	Assure that warning signs are visible and in good condition, and that protective grates and covers are in place. Confirm that an emergency action plan is in place to deal with accidental tank entry or other crisis.	Assist in development of a plan if one has not been developed.

Storage Function—Continued

Element to check	How to check	Recommended action
Waste storage structure—Stacking facility		
Rate of filling	Make an estimate of volume based on measurement of stack. Divide the volume estimate by the number of days waste has been stored in the facility. Compare actual daily rate with that assumed in design.	If found to be excessive, make adjustments to reduce the daily volume of waste produced, such as using less bedding.
Structural integrity	For reinforced concrete structures, inspect for excessive cracking and concrete deterioration.	Consult with concrete repair specialist for recommended repairs.
	Check wood portions of structure for damage.	Replace as appropriate.
Roofing	Check trusses and rafters for damage.	Repair as necessary. Repair roofing if leaks are noted. See that fasteners are tight and in good repair.

Treatment Function

Element to check	How to check	Recommended action
Waste treatment lagoon		
Operating depth/treatment depth	Observe availability and readability of staff gage in lagoon marked to show minimum depth; maximum depth (depth above which insufficient storage remains for the 24-hour, 25-year storm event); and elevation of top of embankment or spillway.	Install staff gage if one is not present.
Loading rate	Compare wastewater sources being discharged in lagoon with those assumed in design.	If loading rates exceed those in design, suggest ways to reduce loading rates or changes in operation of the lagoon to accommodate the additional loading.
	Take wastewater samples, have them tested for VS or BOD_5 and compare results with the values assumed in design.	If loading rates exceed those in design, suggest ways to reduce loading rates or changes in operation of the lagoon to accommodate the additional loading.
Performance in reducing pollutants	Test lagoon contents periodically to determine changes in ammonia (NH_3), total phosphorus (TP), total nitrogen (TN), total dissolved solids (TDS), and bacteria.	Excessive ammonia and TDS (salts) can effect lagoon function. High TP and TN concentrations can create land application problems. If above parameters are suspected of being excessive, dilution, reduction in loading rates, increase in residence time, or some other appropriate measure should be considered to improve the lagoon's performance.
Agitation	Observe that lagoon contents are agitated properly.	Assure that agitation is according to agitation equipment manufacturer owner's manual recommendation for time and spacing.
	Observe that bank protection at agitation points is adequate.	If erosion is present, install bank protection or make adjustment of agitation point so erosion will not occur.

Treatment Function—Continued

Element to check	How to check	Recommended action
Waste treatment lagoon (Continued)		
Bottom sludge	Determine depth of the bottom sludge and compare the depth with that reserved for its acclamation in design.	If it exceeds the amount assumed in design, it will infringe on the minimum treatment volume and, as such, it should be removed from the lagoon. Consistency of the sludge determines how its thickness is measured and how it may be removed. If the bottom sludge has a solid consistency, determine top elevation of sludge and compare with "as built" lagoon bottom elevation to determine its thickness. Generally, some sort of excavating equipment must be used to remove solid sludge. If the bottom sludge has a liquid consistency, its thickness and total solids must also be determined. The depth is used to determine if the sludge volume infringes on the minimum design volume and total solids is used to decide if the sludge can be pumped. A light and light sensor apparatus can be used to determine the depth. A rigid translucent pipe driven into bottom of lagoon and retrieved with a soil plug can be used to obtain a sample for determining total solids. Generally, wastewater with less than 5% solids can be pumped. If the sludge has total solids of more than 5%, it may be necessary to agitate the bottom sludge before pumping.
Aeration	Assure that operation of aeration equipment is consistent with recommendations in manufacturer owner's manual(s) and conforms to design requirements.	If undesirable odor is present, take sample of lagoon contents from within the top 2 feet of lagoon water surface and test for dissolved oxygen at the detectable level, 0.1 mg/L. If aeration operation needs to be changed, a manufacture representative should be consulted.
	Observe that none to very few organic solids are present on the lagoon surface.	A few solids on the surface for a newly installed aeration system does not necessarily indicate a problem.

Treatment Function—Continued

Element to check	How to check	Recommended action
Waste treatment lagoon (Continued)		
Safety measures	Inspect fence and gates to see that they are in good repair. See that warning signs are visible and in good condition.	Correct deficiencies as appropriate.
Mechanical separation		
Volume of solids separated	Compare the volume of solids being separated with the volume assumed to be separated in planning/design.	If not to expectations, check that total solids of the wastewater is within the range recommended by the manufacturer.
	Make sure wastewater is agitated so that all solids are in suspension prior to separation. Check flow rate to see that it does not exceed manufacturer's recommendation.	Reduce flow rate if found to be excessive.
Safety measures	Check to see that moving parts are guarded. See that warning signs, ladders, and handrails are in good condition. Also see that access to separation equipment towers and pits is denied to unauthorized people.	Safety deficiencies must be repaired or installed if hazards are found.
Settling basins		
Volume of solids settled out	Compare the volume of solids being settled out with the volume assumed to be settled in planning/design.	If found to be less, check detention time assumed in design. If found inadequate, increase detention time by reducing inflow and/or outflow from the settling basin or increasing volume of settling basin.

Treatment Function—Continued

Element to check	How to check	Recommended action
Dilution		
Adequacy of dilution	Test diluted wastewater for total solids. Compare with the desired total solids for the treated wastewater assumed in design.	If significantly different than assumed, evaluate the consequence of it being different on the basis of the purpose for dilution. Either reduce amount of dilution water added or add additional water with a lesser amount of total solids to achieve desired total solids.
Vegetative filters		
Performance of vegetative filter (infiltration area)	See that wastewater is not leaving filter area.	Lengthen filter if wastewater exits filter area.
	Assure that filter is given a minimum 2-day rest period each week.	
	Assure that wastewater is uniformly distributed over the width of the filter.	Regrade and revegetate filter as necessary.
Composting		
Pile temperature	Using thermometer probe, check internal temperature of compost pile. The pile temperature should be checked at a point one-third the distance from the outside of the pile to the center of the mass. Compost temperatures should peak between 130 and 140 degrees F in 5 to 7 days.	See the troubleshooting guide if piles fail to heat or exceed 150 degrees F.
Carbon:nitrogen ratio of compost mix	Take a representative sample of the raw compost mixture and have a laboratory determine the carbon and nitrogen content. The carbon to nitrogen ratio should range between 25 and 40 to 1.	Make adjustments to the ingredients of the recipe as necessary to achieve a carbon to nitrogen ratio within the range of 25 to 40 to 1.
Moisture of compost mix	Take sample and check moisture content. The moisture content should range between 40 and 60 percent.	Add water or drier material to adjust moisture content. If drier material is added, care must be taken to see that the carbon to nitrogen ratio of the mix is still in the 25 to 40 to 1 range.

Treatment Function—Continued

Element to check	How to check	Recommended action
Composting (Continued)		
pH of compost mix	Check pH of compost mix. The pH preferably should range between 6.5 and 8. Composting may be adequate between a pH of 5.5 and 9.0	
Finished compost	Observe that compost has little or no trace of the original raw material and has little odor. The material should be black to brown in color. Particle size should be consistent and soil-like in texture.	

Transfer Function

Element to check	How to check	Recommended action
Reception pits		
Structural integrity	For concrete and concrete block structures, inspect for excessive cracking and concrete deterioration.	Consult with concrete repair specialist for recommended repairs.
Foreign material	Check for excessive debris that will impair function of pit.	Remove debris remotely from outside the pit.
Safety	Assure that protective grates are installed in good condition. Assure that pits enclosed in buildings are properly vented to prevent accumulation of gases.	
Gravity pipelines		
Outlet	See that outlet is free flowing and is not causing erosion.	
Safety	Note that pipeline inlets located within buildings are properly vented so gases do not accumulate.	
Pushoff ramps		
Safety	Assure that restraints to prevent equipment from accidentally going off the end are in place and in good repair. Assure that traction surfaces are exposed.	

Transfer Function—Continued

Element to check	How to check	Recommended action
Picket fences		
Function	Assure that water has a clear drainage path from the face (leading edge) of the manure pile to the picket dam.	
Structural integrity	Inspect lumber and hardware elements for deterioration.	Replace as necessary.
Pumps		
Operation	Ascertain that pump and motor are receiving regularly scheduled lubrication. Note that intake is properly protected to screen out oversized material and is not plugged. Notice that wastewater to be pumped is adequately agitated prior to pumping to assure that all solids are in suspension. During periods of non-use see that pump is drained or otherwise protected from freezing, if appropriate for climate.	
	Listen to operation of pump and motor for abnormal noise.	The pump and motor should be serviced by a qualified technician if abnormal noise is heard or excessive vibration is noted.
Suction and discharge	See that supports to bear weight of suction pipe and discharge pipes are in place and adequate.	
Pump and switch housing	Observe that housing for motor and switches is adequate for protection from sun and rain.	

Transfer Function—Continued

Element to check	How to check	Recommended action
Pumps (Continued)		
Safety	Determine that adequate safety devices, such as guards and shields, are in place.	
	Check that motors and switches are properly grounded and that exposed wiring is both insulated and protected against accidental contact.	
Equipment		
Proper operation and maintenance	Verify that equipment is operated and maintained in accordance with manufacturer's recommendations. Records of use should be kept.	Perform maintenance at recommended intervals.
Safety	Assure that safety devices and equipment is in good repair and being used as appropriate.	
	Assure that tractors are matched with hauling equipment being pulled.	
	Assure that public safety is protected when hauling equipment uses public roads.	Use proper signage and clean up spilled materials.

Utilization Function

Element to check	How to check	Recommended action
Land application		
Amount applied	Measure the amount of waste actually being applied. Estimate the amount of nutrients being applied by considering nutrient losses involved to the point of application. A laboratory analysis to determine nutrient content of the waste applied allows a more precise estimate. Compare actual amount of waste and nutrients being applied to the recommendations in the nutrient management plan. Observe the condition of the crop. For example, yellowing might indicate that not enough nutrients are being applied. On the other hand, burned leaves might indicate that too many nutirents are being applied.	If nutrients being applied are found excessive or crop condition indicates overapplication, reduce future application amounts. This may require that additional fields receive waste or that waste treatment be included in the AWMS to reduce nutrient content of the waste. If nutrients being applied are found insufficient for optimum production or the crop condition indicates under-application of nutrients, consider supplementing with commercial fertilizer. Recommend calibrating application equipment.
Method of application	Observe method being used to apply waste. Compare method being used with the method assumed in computing nutrient losses for the nutirent management plan.	If a different method is being used, it may be necessary to adjust to the amount of the waste applied. For example, if the nutrient management plan it was assumed a surface application method and an injection method is being used, nitrogen loss may be less than assumed, so more nutrient are actually being applied to the crop than planned. This may make the nutrient application excessive.
Placement of waste	Observe how the waste is being placed and its distribution on the farm. Check for field runoff during application.	Compare fields to which waste is being distributed to those planned to receive waste in the nutrient management plan. Recommend appropriate modification if they are found different. If waste application is not evenly distributed or is causing runoff, recommend adjustment to equipment itself or in the way equipment is being used.

Utilization Function—Continued

Element to check	How to check	Recommended action
Land application (Continued)		
Timing of application	Observe when waste is being applied.	Compare actual fiming with timing recommended in the nutrient management plan. Consider the environmental consequences if actual timing of application and recommended timing differ. Consequences, such as increased runoff and leaching losses, and inability of crop to use available nutrients should be considered. Recommend modification to timing of application if appropriate.
Safety	Observe unsafe actions or conditions, such as unshielded moving parts that could be injurious.	Recommend appropriate modification to unsafe activities or correct unsafe conditions (see 651.1303).
Biogas production		
Overall system	Evaluate daily operating temperatures and gas production records.	If gas production is not to the level anticipated, check volatile solid loading rates. Make appropriate adjustments.
Covered lagoon	Check cover visually for rainwater accumulation, tearing, wear holes, and proper tensioning.	Make appropriate repairs or adjustments to the cover.
Complete mix digester	Check operating temperature. Check cover visually for rainwater accumulation, tearing, wear holes, and proper tensioning. Evaluate mixer and heat exchanger maintenance records for proper lubrication.	Make appropriate repairs or adjustments to the operation of the digester system.
Plug flow digester	Check operating temperature. Check the effluent outlet and digester gas relief values for proper operation. Check cover visually for rainwater accumulation, tearing, wear holes, and proper tensioning. Evaluate heat exchanger pump maintenance record for proper lubrication.	Make appropriate repairs or adjustments to the digester system.

Utilization Function—Continued

Element to check	How to check	Recommended action
Biogas production (Continued)		
Safety	Visually check to see that safety fencing and warning signs are in good condition.	Correct unsafe conditions.