



STATE OF IOWA

TERRY E. BRANSTAD, GOVERNOR
KIM REYNOLDS, LT. GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
CHUCK GIPP, DIRECTOR

July 28, 2014

Mr. Jade Dundas
Assistant City Manager
405 Sixth Street
Sioux City, Iowa 51102

Re: Sioux City - Digester Loading Variance Request
Project No. S2011-0051

Dear Mr. Dundas,

After careful and thorough consideration, the Department has denied the May 14, 2014 request from Olsson Associates for a design variance from Chapter 17 of the Iowa Wastewater Facilities Design Standards, Section 17.3.1.3, for a volatile solids (VS) loading rate of 190 lbs VS/1000 ft³ of volume per day on the basis of all primary digesters remaining in service for a design peak month VS loading of approximately 95,000 lbs/day. Based on the documentation presented by your Engineer, it is the determination of this Department that the justification submitted to limit the number of primary mesophilic anaerobic digesters to only four tanks to treat a peak month VS loading of 95,000 lbs/day does not warrant the granting of a variance. The requested variance is not deemed to be necessary and appropriate pursuant to the Iowa Code section 455B.181.

The project under consideration is for a plant organic design loading of 103,000 lbs BOD₅/day. Olsson Associates' 5/14/2014 request to amend the 4/22/2008 Facility Plan by variance to accommodate a higher peak month primary digester design loading to the level of 190 lbs VS/1000 ft³ of volume per day is based in part on a desire to support economic development and a concern for rate payers. Section 17.3.1.3 of Chapter 17 requires justification for the basis of design and calculations for the volume of sludge to be treated. The sludge volume estimate must be based on a design period of 20 years unless use of a shorter design period is justified, Section 14.4.4.1 of Chapter 14. When digester design calculations are not based on the factors listed in Section 17.3.1.3, a VS loading rate of 80 lbs VS/1000 ft³ of volume per day in the active digestion units shall be used.

The design calculations transmitted by Olsson Associates on December 11, 2013 include a primary digester loading rate of 165.61 lbs VS/1000 ft³ of volume per day. This loading rate calculation is based on a total primary digester volume of 499,220 ft³ (3.73 mg) and a design VS loading of 82,674 lbs/day. In the May 14, 2014 variance request, Olsson Associates cites a three month period from March to May 2011 in which two primary digesters were removed from service. The observed volumetric loading rate for the two tanks remaining in operation was at least 190 lbs VS/1000 ft³ of volume per day. One

secondary digester remained in service. For March, an influent CBOD5 loading to the plant of 60,800 lbs/day generated 63,106 lbs of VS/day.

Table 1 was prepared to illustrate the Department's concerns when the factor of primary digester reliability is considered. At a peak month VS loading of 95,000 lbs/day, the volumetric loading rate to the primary digesters with only three primary digestion tanks in service could be as high as 253 lbs VS/1000 ft³ of volume per day.

Table 1 – Estimated Volumetric Loadings and Sludge Retention Times

Completely Mixed Primary Digestion	3 Tanks	4 Tanks***	5 Tanks	6 Tanks
Primary Digester Volume (ft ³)	335,000	446,000	558,000	669,000
Primary Digester Volume with Cone Volume (ft ³)	374,000	499,000	624,000	748,000
Volatile Solids Loading at Peak Month Loadings* (lbs VS/1000 ft ³ /day)	221	166	132	111
Volatile Solids Loading at Peak Month Loadings** (lbs VS/1000 ft ³ /day)	253	190	152	127
Sludge Retention Time at Peak Month Loadings**** (days)	11.1	14.8	18.5	22.2

*Based on peak month VS design loading of 82,674 lbs/day per December 9, 2013 calculations and primary digester volume with cone volume included

**Based on revised peak month VS design loading of 95,000 lbs/day per May 14, 2014 variance request and primary digester volume with cone volume included

***Existing number of primary digester tanks

****Based on sludge feed volume of 245,788 gpd

The technical literature cited by Olsson Associates is unchanged since 2006. From MOP 8 (1991 and 1998 editions), peak loading rates in the range of 120 to 160 lbs VS/1000 ft³ of volume per day are typical of a high-rate digester design. At these high loading rates, MOP 8 emphasizes digester reliability. No specific examples of plants with similar configurations and long term operating experience at peak month volumetric loadings in the range of 253 lbs VS/1000 ft³ of volume per day are referenced by Olsson Associates. The 2008 Facility Plan (FP) prepared by Veenstra and Kimm, Inc. for the City of Sioux City stated that 150 lbs VS/1000 ft³ of volume per day “is at the upper end of what is considered an acceptable loading rate with a well mixed digester.”

The SRT for primary sludge digestion shall not be less than 15 days in any 15 day period for completely mixed systems. Olsson Associates states that their design SRT is over 15 days as required.

On February 11, 2014, the Department determined (per Exhibit 9B) that the FP prepared by the City of Sioux City was sufficiently complete for a detailed review. Comments were forwarded to the City on February 26, 2014. On March 27, 2014, a response letter with Design Schedule Q was received by e-mail from the City of Sioux City. On April 2, 2014, Jade Dundas, Jim Condon, Jeremy Walker and Jay Niday met with Shelli Grapp and Terry Kirschenman in the Wallace State Office Building to discuss IDNR's

2/26/2014 comment letter. Sioux City's most recent variance request for a peak month primary digester volumetric loading rate of 190 lbs VS/1000 ft³ of volume per day was received on May 23, 2014. We offer the following comments on the FP and the City's 5/14/2014 variance request:

- 1) With only four completely mixed mesophilic primary digesters, as described in Section 17.3.1.3 of Chapter 17, the plant is unable to consistently accommodate a BOD₅ loading of 103,000 lbs/day. The plant's rated organic design capacity shall remain at no more than 87,208 lbs BOD₅/day; 69,696 lbs TSS/day; and 12,338 lbs TKN/day.
- 2) With complete and satisfactory solids handling design calculations, increasing the **design peak month** volumetric loading to no more than 190 lbs VS/1000 ft³ of volume per day **with the largest primary digester out of service** may be considered. However, the volumetric loading should not exceed 200 lbs VS/1000 ft³ of volume per day with all primary digesters in service at the **design peak week VS loading** (previously 110,949 lbs VS/day). In addition, adequate consideration shall be given to the active digester volume in the digester design calculations.

Additional background information used in evaluating the variance request:

Chapter 17 was adopted by the Department in 1980. Section 17.3.1.3 of Chapter 17 requires sufficient storage for inclement weather and equipment failure. If possible, adequate detention to avoid sludge application on frozen or snow covered ground is recommended.

Section 17.5.3 of Chapter 17 requires standby mechanical dewatering facilities unless adequate sludge storage is provided.

Reliability Class I facilities as described in Chapter 14 (amended 1987) are required to provide sludge wasting, sludge stabilization (defined by process) and holding, and a final disposal site. Reliability Class I includes all facilities which discharge into navigable waters that could be permanently or unacceptably damaged by effluent which was degraded in quality for a few hours. The Missouri River is designated as a Class A1 Primary Contact and Class B(WW) Significant Resource warm water stream.

The following recommendations are excerpted from page 22-33 of MOP 8 (1998 edition):

"...Estimates should also anticipate poorer than average performance of upstream thickening processes during periods of peak loading. In addition, designs for multiple digesters should anticipate that the largest digester will be out of service during the design peak sludge loading condition. The design should include appropriate provisions for continued stabilization during these periods."

Special condition No. 3 of construction permit No. 2007-0085 issued on September 7, 2006 required Sioux City to submit a report with a sludge processing plan no later than November 1, 2006. This plan was prepared by CDM and forwarded to the Department by November 1, 2006. The Department offered its review comments on November 14, 2006. See also letters from Aaron Kraft dated 8/8/2006 and 12/18/2006.

The March 23, 2009 Finding of No Significant Impact emphasized that only stabilized sludge would be dewatered.

The 4/30/2009 letter from Ellen Myers indicated that the City of Sioux City would reevaluate the plant after completion of construction to determine its actual capacity and initiate planning as necessary to address South Sioux City's request for additional industrial treatment capacity.

From page 22 of the April 2013 FP, "The stress testing did not include any analysis of the digestion/solids handling part of the treatment process...."

The April 2013 FP also states that two of the existing secondary digesters need cover replacement to be able to use these digesters.

The design assumption for waste activated sludge thickening is unchanged from 2006, 4 percent with a target of 5 percent.

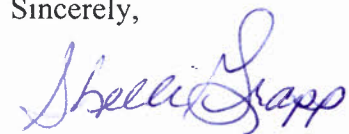
In the past 12 months, monthly average influent loadings to Sioux City's plant have varied from a low of 35,212 lbs CBOD5/day to a high of 51,494 lbs CBOD5/day. A peak day influent organic loading of 83,986 lbs CBOD5/day was observed in January.

Based on the May 2014 construction cost estimate of \$2-3 million, the project cost to convert a secondary digester to a primary digester is \$4.86 per population equivalent.

Pursuant to Iowa Code Section 455B.181, and 561 Iowa Administrative Code (IAC) 7.4(1), as adopted by reference by 567 IAC Chapter 7, a written notice of appeal to the Environmental Protection Commission may be filed within 30 days of receipt of this letter. The notice of appeal is required to be filed with the Director of the Department, and must identify the specific portion or portions of the variance denial that are being appealed and include a short and plain statement of the reasons for appeal. A contested case hearing will then be commenced pursuant to Iowa Code Chapter 17A, 561 IAC Chapter 7, and 567 IAC Chapter 7.

Should you have any questions, please contact Terry Kirschenman at 515-281-8885.

Sincerely,



Shelli Grapp, Bureau Chief
Water Quality Bureau

c: Olsson Associates, 600 Fourth Street, Suite 333, Sioux City, IA 51102
Field Office 3, Spencer Iowa
Anne Hildebrand, NPDES Permits Section
Eric Wiklund, NPDES Permits Section

VARIANCE REQUEST
Iowa Department of Natural Resources

1. Date: June 18, 2014 2. Reviewer/Engr.: Terry Kirschenman 3. Date Received: May 23, 2014 4. Facility Name: Sioux City 5. Facility Number: 6-97-78-0-01 6. County Number: 97 7. Program Area: CP 8. Facility Type: CO9 9. Subject Area: 375(b) 10. Rule Reference: 64.2(9)a 11. Design Std. Ref.: 17.3.1.3 12. Consulting Engr.: Olsson Associates 13. Variance Rule: 64.2(9)c	14a. Decision: <i>Denied</i> Date: <i>7-28-14</i> Expiration Date 14b. (if any): 15. Appealed: Date:
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16. Description of Variance Request:

Allow the design volatile solids loading for the anaerobic digesters to be increased from 129 lbs VS/1000 ft of volume per day to 190 lbs VS/1000 ft³ of volume per day.

17. Applicant's/Consulting Engineer's Justification:

- 1) The tank volume design is supported by rational calculations
- 2) The Department previously agreed to a VS loading rate of 129 lbs/1000 ft³ of volume per day in 2007.
- 3) The Department previously agreed to a plan with minimal sludge storage
- 3) WAS sludge thickening has improved to 5 percent with the waste activated sludge Rotary Drum Thickeners (RDTs).
- 4) The City of Sioux City will provide an SRT of at least 15 days in its primary digesters.
- 5) The total amount of volatile solids to be processed at Sioux City is greater than most facilities.
- 6) Excessively low VS can result in digester designs that are expensive for both construction and operation. This might necessitate sludge thickening.
- 7) The proposal of 190 lbs VS/1000 ft³ is within the top range cited by MOP8 and EPA literature.
- 8) "In general," Sioux City's primary digesters were able to handle VS loading rates in the range of 192 to 253 lbs VS/1000 ft³ of volume per day for a three month period in 2011 and achieved a VS reduction not less than 40.76 percent. The VS reduction achieved was greater than 38 percent at a reduced SRT of 8.23 days.
- 9) DNR's design standards are antiquated.

18. Department's Justification:

Denial is recommended. The tank volume design as proposed is not justified by rational calculations.

- 1) Olsson Associates overestimated the working volume for each digester.
- 2) Olsson Associates did not consider digester loading rates with one tank out of service either.
- 3) Rather than 190 lbs VS/1000 ft³ of volume per day, the range for high rate digestion is more typically between 120 and 160 lbs VS/1000 ft³ of volume per day at peak month loadings.
- 4) The City has secondary sludge thickening. Building more WAS sludge thickening facilities is not a legitimate concern.
- 5) The WAS sludge thickening rate cited in Olsson's design calculations for the rotary drum thickeners is 4 percent rather than 5 percent. This assumption (4 to 5 percent) is not an improvement over the design assumptions made previously in 2006.
- 6) If peak month influent BOD₅ loadings increase to 103,000 lbs/day, the VS loading rate to the primary digesters will not be excessively low if more than 4 primary digesters are provided. The total amount of volatile solids to be processed at Sioux City is greater than most facilities.
- 7) The Department is looking for a design which may achieve stabilization as opposed to partial stabilization. Sludge stabilization was emphasised in the March 23, 2009 FNSI.

- 8) The EPA literature referenced by Olsson is based on 1960's era publications which would have been available to the Department prior to the adoption of Chapter 17.
- 9) The proposed design by Olsson Associates at an SRT of 13.4 days, by definition, does not meet EPA requirements for significant pathogen reduction.
- 10) Only the minimum required rate of ventilation has been provided in the digested sludge dewatering building (12 fresh air changes per hour for the belt filter press room). The ventilation rate in the digested sludge load out area is less, 6 fresh air changes per hour. The ventilation rate in the digested sludge cake storage hopper is 12 fresh air changes per hour.
- 11) Adequate stabilization and reliability is more critical at Sioux City than other plants due to minimal onsite sludge storage. State rules discourage sludge application on frozen ground. One day of dewatered sludge cake storage in the sludge hopper is provided. This hopper storage is in an enclosed building.
- 12) The total cost to comply with Iowa's design standards (only \$4.86 per person to convert one secondary digester to a primary digester) will not be noticed by local residents if construction costs are fairly distributed to users.
- 13) DNR's comment on the requirement of 80 lbs VS/1000 ft³ of volume per day was initially given to the City of Sioux City in 2001. They have had sufficient time to address Iowa's design standards without the need for a variance.
- 14) Hopefully things have changed, but Sioux City's track record with respect to digester downtime is dismal.
- 15) Sioux City is a Reliability Class I facility. This includes all facilities which could be unacceptably damaged by effluent which was degraded in quality for a few hours.
- 16) Peak 7 day loadings were not considered by Olsson Associates.
- 17) Local residents have been quite concerned about plant odors. Exhaust air for the digested sludge dewatering building and load out area is conditioned for odor control and reduction.
- 18) During construction, three employees were sickened by inadequate ventilation in the digested sludge dewatering building because the ventilation rate was less than 12 fresh air changes per hour.
- 19) In 2006, the City of Sioux Falls approved the option of accepting sludge from Sioux City in their landfill as a back up plan to sludge disposal in the L.P. Gill Landfill as long as Sioux City's sludge is digested. See letter from Aaron Kraft dated December 18, 2006.
- 20) Sioux Falls is approximately 90 miles from Sioux City.
- 21) The waste characteristics from much of Sioux City's proposed economic development is unknown.

19. Precedents Used:

A VS loading rate of 120 lbs/1000 ft³ of volume per day was approved for Iowa City for their anaerobic digesters.

The design volatile solids loading rate at Ames was 100 lbs VS/1000 ft³ of volume per day.

20. Staff Reviewer:		Date:	
21. Supervisor:		Date:	
22. Authorized by:		Date:	