

Report No. 48 of the Director of Audit – Chapter 8

TREATMENT AND DISPOSAL OF SEWAGE SLUDGE

Summary

1. The Drainage Services Department (DSD) is responsible for the operation and maintenance of sewage treatment works. During the sewage treatment process, a large quantity of sludge (a mixture of water and solid waste) is produced. Owing to its high water content, sludge is dewatered at sewage treatment works before disposal at landfills. The Environmental Protection Department (EPD) is responsible for developing waste management strategies and managing waste disposal facilities, including landfills. Of the 70 DSD sewage treatment works, only 12 delivered the sludge produced directly to landfills for disposal. Audit selected the 12 major sewage treatment works for conducting a review. Audit has found that there are areas where improvements can be made in the treatment and disposal of sewage sludge (see paras. 2 to 16).

Implementation of sludge dryness requirement

2. ***Need to issue technical circular to promulgate landfill requirements.*** In June 1993, an EPD study found that there would be a significant increase in the volume of sewage sludge after the commissioning of the Harbour Area Treatment Scheme. The increase in sludge would cause operational problems at landfills, including instability of landfill slopes, excessive leachate (a highly contaminated liquid) generation and potential surface water contamination. To minimise these problems, the EPD determined that sewage sludge disposed of at landfills should have a minimum dry solids content of 30% by weight (hereinafter referred to as the 30% dryness requirement). In 1993, the EPD drafted a technical circular and circulated it to the concerned government departments for comments. However, up to November 2006, this technical circular had not been issued. *Audit has recommended that the Director of Environmental Protection should issue circulars to promulgate sludge disposal requirements at landfills for compliance by government departments.*

3. ***Need to comply with the sludge dryness requirement.*** In December 1995, the Administration informed the Finance Committee of the Legislative Council (LegCo) that the EPD had laid down a requirement that all sludge disposed of at the three landfills should meet the 30% dryness requirement by mid 1997. In June 1996 and March 1997, the EPD informed the DSD that, with effect from 1 June 1997, any sludge which did not meet the 30% dryness requirement would not be accepted for disposal at landfills.

4. Audit examination revealed that, except the sewage treatment works at Stonecutters Island and Siu Ho Wan, all the other 10 major sewage treatment works did not consistently produce sludge meeting the 30% dryness requirement from September 2005 to August 2006. Audit estimated that, of the 304,954 tonnes of sludge produced by the 12 sewage treatment works during this period, 20,270 tonnes (7%) did not meet the 30% dryness requirement. *Audit has recommended that the Director of Drainage Services should take action to ensure that all sewage treatment works comply with the 30% sludge dryness requirement as far as possible. Audit has also recommended that the Director of Drainage Services and the Director of Environmental Protection should jointly work out mutually acceptable arrangements if some sewage treatment works cannot meet the requirement.*

Upgrading of sludge dewatering facilities

5. ***Need to conduct a post-implementation review.*** In 1995 and 1996, the Administration sought funds from the Finance Committee of LegCo for two works projects (Projects A and B). Project A was for upgrading the sludge dewatering facilities at the sewage treatment works at Tai Po, Yuen Long, Shek Wu Hui and Sai Kung, and Project B was for that at the Shatin Sewage Treatment Works. The Finance Committee was informed that the main objective of the two projects was to upgrade the sludge dewatering facilities so that they could produce sludge meeting the 30% dryness requirement. Project A was completed in 1997 and Project B was completed in 1999.

6. Audit examination revealed that, after the upgrading works, although there were improvements in sludge dryness, the five sewage treatment works did not consistently produce sludge meeting the 30% dryness requirement. *Audit has recommended that the Director of Drainage Services should conduct a post-implementation review of the two works projects to identify areas for improvement.*

7. ***Need to review use of chemicals for dewatering sludge.*** After the completion of the upgrading works at the five major sewage treatment works, in order to improve the efficiency of the mechanical dewatering process, the DSD added chemicals to sludge as conditioners prior to the dewatering process. Audit examination of the use of chemicals at the sewage treatment works at Shek Wu Hui and Tai Po revealed that, after the completion of the upgrading works in 1997, there was a significant increase in the quantity of chemicals added. The chemicals added would increase the total quantity of sludge for disposal. *Audit has recommended that the Director of Drainage Services should conduct a review of the use of chemicals in the sludge dewatering process with a view to optimising the quantity of chemicals to be applied.*

8. ***Need to provide full information to Finance Committee.*** Regarding Project A, the Finance Committee of LegCo was informed in December 1995 that the landfill contracts were structured such that a higher operation fee would be charged on sludge with a dryness

below 30%. However, Audit examination revealed that, while the West New Territories (WENT) Landfill and South East New Territories (SENT) Landfill operators charged a higher operation fee for sludge with a dryness below 30%, the North East New Territories (NENT) Landfill operator charged a lower operation fee for such sludge. Regarding Project B, in November 1996, the Finance Committee of LegCo was informed that, as an interim measure, the DSD had contracted out the dewatering service at the Shatin Sewage Treatment Works and that the contractor was able to produce sludge meeting the 30% dryness requirement. However, Audit examination revealed that, of the 202 days of operation during the contract-out period in 1996, the Shatin Sewage Treatment Works was only able to produce sludge meeting the 30% dryness requirement on 14 days. *Audit has recommended that the Director of Drainage Services should provide the Finance Committee of LegCo with full and relevant information in seeking funds for works projects in future.*

Administration of sludge dryness tests

9. ***Room for improvement in administering landfill admission tickets.*** The EPD has implemented a landfill admission ticket system to control the disposal of dewatered sludge. Under this system, in applying for admission tickets from the EPD, the DSD provided the estimated quantity and dryness percentage of the sludge produced. Based on such information, the EPD issued landfill admission tickets for each sewage treatment works stating the estimated sludge dryness. Regarding sludge not complying with the 30% dryness requirement, in June 1996, the EPD informed the DSD that, while the EPD might instruct the landfill operators to accept such sludge, the instructions would only be given under exceptional circumstances and only for very small quantities of sludge.

10. Audit examination revealed that, as stated in the landfill admission tickets between April 2006 and September 2006, the estimated dryness of sludge produced by the sewage treatment works at Tai Po and Sai Kung was 15%, and that by the sewage treatment works at Sham Tseng, Yuen Long and Shek Wu Hui was 20%. However, the EPD approved the DSD's disposal of such sludge at landfills on an on-going basis instead of under special circumstances. *Audit has recommended that the Director of Environmental Protection should conduct a review of the practice of approving the disposal of sludge not meeting the 30% dryness requirement at landfills on an on-going basis.*

11. ***Room for improvement in administering sludge dryness tests.*** DSD staff at sewage treatment works conducted sludge dryness tests every day and provided the test results in monthly returns to the EPD. On the other hand, the landfill operators conducted their own sludge dryness tests for facilitating landfill operations and for charging landfill operation fees. Audit examination revealed that there were significant variances between the two sets of test results. *Audit has recommended that the Director of Drainage Services and the Director of Environmental Protection should jointly conduct a review to find out the*

reasons for the variances between the sludge dryness test results of the landfill operators and those of the DSD, and take appropriate improvement measures.

12. ***Room for improvement in transporting and storing dewatered sludge.*** At sewage treatment works, the dewatered sludge was loaded into containers for transportation to the landfills by trucks or barges. Of the 12 sewage treatment works, 10 used open-top containers with tarpaulin covers, and the remaining two (one at Stonecutters Island and one at Siu Ho Wan) used purpose-built sealed containers. The dewatered sludge was sometimes required to be stored overnight in the containers before delivery to the landfills. Audit considers that there are merits for the DSD to replace open-top containers by purpose-built sealed ones because the latter would help avoid seepage of rainwater into the sludge, minimise the absorption of moisture, obviate spillage of sludge onto roads and reduce odour nuisance during transportation. *Audit has recommended that the Director of Drainage Services should consider using sealed containers for storage and transportation of dewatered sludge to the landfills for disposal.*

Implementation of sewage sludge reduction plans

13. ***Need to attain co-disposal ratio at landfills.*** In 1993, in the light of its study findings (see para. 2), the EPD set a landfill co-disposal ratio of 1:10 by weight between sludge (including sewage sludge) and other solid waste (including municipal solid waste and construction waste) to further minimise the operational problems (see para. 2) at landfills. In 1999, another EPD study on sludge management found that there would be an increase in the quantity of sewage sludge due to implementation of sewage upgrading projects, and a decrease in the quantity of solid waste due to the implementation of waste reduction measures. The study forecasted that the 1:10 co-disposal ratio would not be maintained by 2008.

14. Audit examination revealed that there had been a significant decrease in the sludge/solid waste co-disposal ratio over the past ten years, and the ratio had fallen below 1:10 in the first 8 months of 2006. For individual landfills, from 2003 to 2005, while both SENT Landfill and NENT Landfill exceeded the co-disposal ratio of 1:10, WENT Landfill attained only a co-disposal ratio of 1:7.6. WENT Landfill received a large portion of sewage sludge produced by the Stonecutters Island Sewage Treatment Works, which produced the largest quantity of sludge. *Audit has recommended that the Director of Environmental Protection should take appropriate measures with a view to attaining the 1:10 co-disposal ratio, particularly at WENT Landfill. Audit has also recommended that the Director of Environmental Protection should explore the feasibility of diverting some sludge produced by the Stonecutters Island Sewage Treatment Works from WENT Landfill to SENT Landfill for disposal.*

15. ***Need to explore opportunities for recycling sewage sludge.*** The 1999 EPD study (see para. 13) found that one option for sewage sludge disposal was recycling. However, the high chloride content of sewage sludge (due to the use of seawater for flushing) and the lack of markets for compost had rendered this option not feasible. Audit notes that, while 80% of the households use seawater for flushing, households in some districts (such as Southern District, North District and Yuen Long) still use fresh water for flushing. Thus, sludge produced by the sewage treatment works at Stanley, Yuen Long and Shek Wu Hui has a relatively low chloride content. *Audit has recommended that the Director of Environmental Protection should explore the opportunities for recycling sludge with a low chloride content.*

16. ***Need to implement sludge reduction proposals.*** The 1999 EPD study (see para. 13) recommended that all sewage sludge should be dewatered and incinerated prior to final disposal at landfills, and that a centralised treatment facility for incinerating sewage sludge was the preferred option for doing this. Nevertheless, there are public concerns over air pollution associated with sludge incineration. *Audit has recommended that the Director of Environmental Protection should expedite action to implement the proposed sludge treatment facility, and implement measures to minimise the impact on air quality due to incineration of sludge.*

Response from the Administration

17. The Administration has accepted the audit recommendations.

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