Annex 1. Detailed Project Workplan: Pilot-scale urine treatment in Hiedanranta
16.5.2019

**Pilot-scale urine treatment in Hiedanranta, Research plan**

**Background**

The City of Tampere (TAM) is running a project (NutriCity) in which it aims to enhance nutrient recycling in urban environment. The Project is funded by the Ministry of Environment, Finland. Project partners are Tampere University of Applied Sciences (TAMK) and Finnish Environment Institute (SYKE).

The goal is to promote on-site technologies for recycling nutrients present in sanitation waste by methods of source separation and urine dehydration. The pilot site is a Manor House in the Hiedanranta area of Tampere city where approximately 100 personnel are currently working.

Sanitation360 AB (S360) has developed an on-site sanitation technology that converts human urine into a dry, hygienic, and high quality fertiliser (>10% N, >1.5% P, and >5%K). The technology is called alkaline urine dehydration, and is a two-step process where fresh urine collected using a urinal or a urine-diverting toilet is first biochemically stabilised (by increasing its pH); then the stabilised urine is dehydrated using an alkaline substrate to yield a dry, nutrient rich powder. S360 has already piloted this technology in Uppsala, Sweden and also in Säkylä, Finland.

Timeframe of the project is until the end of September 2019. Construction of a pilot urine treatment system is planned for June 2019 and 3-month piloting is scheduled during June-September 2019.

**Objective, tasks and deliverables**

S360 will develop an on-site urine dehydrating system that treats urine from approximately 20 people during a working week (5 days) for a period of 3 months. A system with capacity of dehydrating 25 L of fresh urine will be constructed and installed at Hiedanranta, in Tampere, Finland. The dehydration system will be built to function for a period of three months, between 17 June 2019 and 18 September 2019.

S360 will construct (either in part or as one whole system), a urine dehydrator with a daily evaporation capacity of 25 L of urine. The system will be designed to fit into an existing basement in the manor house. The schematics of the manor house along with piping and HVAC layout will be provided by TAM and partners, and the layout of the urine dehydration system in the basement will be mutually agreed between S360 and TAM.

S360 holds responsibility for transporting and integrating the dehydration system with the cubicle during week 24 (10.6.-14.6.). TAM and partners will provide the space and necessary assistance for integrating the dehydration system with the cubicle. Responsibility for connecting the dehydrating system to existing wastewater pipes & ventilation in the manor house rests with TAM and partners. S360 will provide an oral/written operational guide documenting the start-up, running, and maintenance of the dehydration system.

All responsibility for operating, maintaining, monitoring and sampling the pilot project (toilets with dehydration system) rests with TAM and partners. S360 is responsible for dismantling the dehydration system at the end of the project, and for its transport back to Sweden.

S360 will design the dehydration system to allow TAM to monitor the following aspects

- Weight of the unit (measured, using a digital scale; e.g. OHAUS Defender 5000 Series or similar). This can be used as a proxy to measure the rate of moisture removal, dehydration rate, as well as the total weight of urine added in the pilot.

- Air temperature and relative humidity will be measured on-line, with the data logged locally using Tinytag data loggers.
- An industrial dehumidifier will be placed in the basement to condense the outgoing air from the urine drying system. The dehumidifier will be connected to a tank that collects the condensed water. This has to be emptied once a week, and the responsibility for this rests with TAM and partners.
- A usage (door) counter will be placed in the toilet cubicles to help monitor the number of users, used as proxy to estimate the volume of urine added to the dehydrating system every day.
- Energy use using standard plug-in energy meters
- Characteristics and composition of input and output of the system; e.g. nutrients, metal content and pharmaceuticals.

The ownership of the dehydration system, along with any monitoring components added to the dehydration system remains with S360 during the entire project duration as well as after the project is concluded.

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Table 1. Workplan and timeline, 2019

| # | Responsibility | **Task** | **May** | | **June** | | **July** | | **August** | | **September** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | TAM | Preparations for the pilot | | | | | | | | | | |
| 2 | S360 | Construction of pilot in Sweden | | | | | | | | | | |
| 3 | S360 | Testing in Sweden | | | | | | | | | | |
| 4 | TAM | Hiedanranta space preparation | | | | | | | | | | |
| 5 | S360 | Transport and pilot integration | | | | | | | | | | |
| 6 | TAM +S360 | Start of the pilot | | | | | | | | | | |
| 7 | TAM + TAM K | Operating the pilot | | | | | | | | | | |
| 7 | S360 | Sampling & Follow-up | | | | | | | | | | |
| 8 | TAM K | Sampling & Follow-up | | | | | | | | | | |
| 9 | S360 + TAM K | Analysis of samples | | | | | | | | | | |
| 10 | S360 | Dismantling the pilot unit | | | | | | | | | | |

**Budget for piloting urine drying technology in Finland**

The total budget for the project on Sanitation360's side is approximately 192,000 SEK (Table 2).
The budget requested from TAM and partners is one-time fee of **100,000 SEK**.
The surplus will be covered by the Swedish University of Agricultural Sciences by co-funding through existing research grants.

Table 2: Total budget of piloting

| **Salary/Consultancy** | **Cost/hr** | **# hours** | **Total** |
|---|---|---|---|
| **Personnel Costs** | | | |
| Prithvi Simha (PS) | 465 | 100 | 46500 |
| Jenna Senecal (JS) | 465 | 40 | 18600 |
| Giulio Zorzetto (GZ) | 465 | 64 | 29760 |
| Sven Smårs (SS) | 580 | 16 | 9280 |
| Evgheni Ermolaev (EE) | 580 | 16 | 9280 |
| Björn Vinnerås (BV) | 900 | 20 | 18000 |
| | | Subtotal: | 131420 |
| **Travel** | | | |
| System integration and installation | | | 15000 |
| Decommissioning and wrap-up | | | 15000 |
| **Capital expenditure** | | | |
| Urine dehydrator (25 L capacity/day); Material costs | | | 15000 |
| **Sampling and Lab-analysis** | | | |
| Urine and fertiliser analysis/sampling | | | 15000 |
| **Total cost (in SEK)** | | | **191420** |
| **Total cost (in EUR)** | | | **19142** |

| | |
|---|---|
| Type: | One-time payment/fee |
| Project Duration: | 20 May 2019 to 30 September, 2019 |
| Piloting Duration: | 3 months, from 17 June 2019 to 18 September 2019 |

If the beginning of the piloting is delayed, the ending will be also so that the test period is three months. The total budget includes costs related to installing and dismantling of the urine dehydrator in Finland.

This contract and the pilot installation may be extended beyond 3-months by mutual agreement at the end of the project. If the piloting is mutually extended for two more months (September-November 2019), a one-time additional fee of 25,000 SEK will be applicable.