## Stage 2 Scientific Studies: Assessment Type 1: Investigation Folio

**Science as a Human Endeavour Investigation**

**“*Chemistry in the Toilet*”**

The purpose of this task is to demonstrate the influence and interaction between a contemporary science issue and society.

**Introduction**

Ever since humans have lived in big groups and formed towns and cities, it has become necessary to develop public sanitation to prevent the residents from getting sick. A major part of public sanitation is the ability to deal with human waste – or sewage. The bigger the city – the bigger the requirement for wastewater treatment. By way of example, New York City has 14 wastewater treatment plants and together, they treat approximately 4.92 billion litres of wastewater daily.

From <https://en.wikipedia.org/wiki/Sewage_treatment>

*“Sewage treatment is the process of removing contaminants from wastewater, primarily from household sewage. Physical, chemical, and biological processes are used to remove contaminants and produce treated wastewater (or treated effluent) that is safer for the environment. A by-product of sewage treatment is usually a semi-solid waste or slurry, called sewage sludge. The sludge has to undergo further treatment before being suitable for disposal or application to land.”*

Sewage treatment doesn’t just involve human excreta; it also contains whatever is poured down the sink. This includes large amounts of fat and grease which complicates the treatment process.

**Task**

Your task is to investigate sewage treatment and the role of new technologies, communication, the influence of other areas of science and the beneficial (or unexpected) consequences of sewage treatment science and technology.

You are to analyse and synthesise information from different sources to explain the scientific concepts relevant to the focus of the investigation, show its connections to science as a human endeavour, and develop and your own conclusions based on your investigation.

You must explore and understand the connection between science and society through the topic of contemporary sewage treatment.

You need to select a focus area for your investigation; this can include (but is not limited to) a specific sewerage treatment process (chemical or biological), a treatment plant or setup in a particular location (either national or international) or a new idea or concept for the treatment of sewage.

Focus examples include:

* gravity fed biological treatment of sewage water in Darwin
* recycling of water and biosolids on the International Space Station
* large scale rapid chemical treatment of sewage water in New York City
* human biosolids – a current and future source of nutrients for a growing population
* localised low- cost sewage treatment in third world countries
* fatburgs – the giant fat deposits clogging the sewers of London
* recycling sewage water – are we really drinking poo?

You need to prepare a scientific investigation, which should contain:

* an introduction to identify the focus of the investigation and the key concept(s) of science as a human endeavour that it links to
* relevant scientific concepts or background
* an explanation of how the focus of the investigation illustrates the interaction between science and society, including a discussion of the potential impact of the focus of the investigation, e.g. further development, effect on quality of life, environmental implications, economic impact, intrinsic interest
* a conclusion
* citations and referencing

You should endeavour to use scientific terminology wherever possible throughout your investigation.

**Assessment conditions**

The scientific investigation should be a maximum of 10 minutes for an oral presentation, 1500 words if written, or the equivalent in multimodal form.

This communication could take the form of, for example:

* an oral or multimodal scientific presentation
* an article for a scientific publication
* a scientific research poster

You must submit your investigation electronically using the following naming protocol:

*SACE registration number-2STU20-AT1-SHE task*

**Assessment Design Criteria**

Your investigation will be assessed against the following Performance Standards

* Knowledge and Application: KA 1, 3, 4

**Considerations**

* It is important to recognise that this is a science as a human endeavour task and, hence, it should have a major focus on the impact of science on society connected with contemporary sewage treatment. It is not a research task on sewage treatment.

Notes for teachers:

Some of the following resources may be useful:

<https://www.sciencealert.com/monster-fatbergs-clogging-sewers-valuable-source-biofuel-methane-bacteria>

<https://www.eurekalert.org/pub_releases/2018-11/kift-rmb110618.php>

https://eurekalert.org/pub\_releases/2018-11/f-pb110818.php

<https://www.waterworld.com/articles/print/volume-30/issue-9/features/waste-not-want-not-how-innovations-in-wastewater-treatment-are-turning-waste-into-revenue.html>

<http://hyecoinnovation.com/sewage-treatment-system/>

<https://www.youtube.com/watch?v=Ko0TWHKa14k>

<https://www.veoliawatertechnologies.com/en/wastewater>

<https://www.greenbiz.com/blog/2013/12/16/drain-drink-innovations-wastewater-reuse>

<https://www.sciencealert.com/who-owns-your-sewage>

**You may wish to remove this list before printing the task**

Performance Standards for Stage 2 Scientific Studies

| - | **Investigation, Analysis, and Evaluation** | | **Knowledge and Application** |
| --- | --- | --- | --- |
| **A** | **Critically** deconstructs a problem and designs a **logical**, **coherent**, and **detailed** scientific investigation using a scientific method and/or engineering design process.  Obtains, records, and represents data, using **appropriate** procedures, conventions and formats **accurately** and **highly** **effectively**.  **Systematically** analyses and interprets data and evidence to formulate **logical** conclusions with **detailed** justification.  **Critically** and **logically** evaluates procedures and their effect on data.  **Critically** and **perceptively** evaluates the effectiveness of collaboration and its impact on results/outcomes. | Demonstrates **deep and broad** knowledge and understanding of a **range** of science inquiry skills and scientific concepts.  Applies science inquiry skills and scientific concepts **highly** **effectively** in new **and** familiar contexts.  **Critically** explores and understands in **depth** the interaction between science and society.  Communicates knowledge and understanding of science concepts coherently, with **highly effective** use of **appropriate** terms, conventions, and representations. | |
| **B** | **Logically** deconstructs a problem and designs a **well**-**considered** and **clear** scientific investigation using a scientific method and/or engineering design process.  Obtains, records, and represents data, using **appropriate** procedures, conventions and formats **mostly** **accurately** and **effectively**.  **Logically** analyses and interprets data and evidence to formulate **suitable** conclusions with **reasonable** justification.  **Logically** evaluates procedures and their effect on data.  **Critically** evaluates the effectiveness of collaboration and its impact on results/outcomes. | Demonstrates **some depth and breadth** of knowledge and understanding of a **range** of science inquiry skills and scientific concepts.  Applies science inquiry skills and scientific concepts **mostly effectively** in new **and** familiar contexts.  **Logically** explores and understands in **some depth** the interaction between science and society.  Communicates knowledge and understanding of science concepts with **mostly coherent and effective** use of appropriate terms, conventions, and representations. | |
| **C** | Deconstructs a problem and designs a **considered** and **generally** **clear** scientific investigation using a scientific method and/or engineering design process.  Obtains, records, and represents data, using **generally** **appropriate** procedures, conventions and formats with **some** **errors** but **generally accurately and effectively**.  Undertakes **some** analysis and interpretation of data and evidence to formulate **generally appropriate** conclusions with **some** justification.  Evaluates procedures and **some** of their effect on data.  Evaluates the effectiveness of collaboration and its impact on results/outcomes. | Demonstrates knowledge and understanding of a **general range** of science inquiry skills and scientific concepts.  Applies science inquiry skills and scientific concepts **generally effectively** in new **or** familiar contexts.  Explores and understands **aspects** of the interaction between science and society.  Communicates knowledge and understanding of science concepts with **generally effective** use of appropriate terms, conventions, and representations. | |
| **D** | Prepares a **basic** deconstruction of a problem and an **outline** of a scientific investigation using a scientific method and/or engineering design process.  Obtains, records, and represents data, using procedures, conventions, and formats **inconsistently**, with **occasional accuracy and effectiveness.**  **Describes** data and undertakes some **basic** interpretation to formulate a **basic** conclusion.  **Attempts** to evaluate procedures or **suggest** an effect on data.  **Attempts** to evaluate the effectiveness of collaboration and its impact on results/outcomes. | Demonstrates **some basic** knowledge and **partial** understanding of science inquiry skills and scientific concepts.  Applies **some** science inquiry skills and scientific concepts in **familiar** contexts.  **Partially** explores and **recognises** aspects of the interaction between science and society.  Communicates basic scientific information, using **some** appropriate terms, conventions, **and/or** representations. | |
| **E** | **Attempts** a **simple** deconstruction of a problem and a procedure for a scientific investigation using a scientific method and/or engineering design process.  **Attempts** to use **some** procedures and record and represent some data, with **limited** accuracy or effectiveness.  **Attempts** to **describe** results **and/or** interpret data to formulate a basic conclusion.  **Acknowledges** that procedures affect data.  **Acknowledges** the effectiveness of collaboration and its impact on results/outcomes. | Demonstrates **limited** recognition and **awareness** of science inquiry skills **and/or** scientific concepts.  **Attempts** to apply science inquiry skills **and/or** scientific concepts in **familiar** contexts.  **Attempts** to explore and identify **an aspect** of the interaction between science and society.  **Attempts** to communicate **information** about science. | |