Summary of Risk Assessment Conducted Pursuant to subsection 108(1) of the *Canadian Environmental Protection Act, 1999*

New Substances Notification 19393: *Escherichia coli* strain C003

Regulatory decisions

Under the provisions for Animate Products of Biotechnology in Part 6 of the *Canadian Environmental Protection Act, 1999* (CEPA), and pursuant to section 108 of the Act, the Minister of the Environment and the Minister of Health have assessed information in respect of the living organism *Escherichia coli* strain C003 and have determined that it is not anticipated to enter the environment in a quantity or concentration or under conditions that have or may have an immediate or long term harmful effect on the environment or its biological diversity, constitute or may constitute a danger to the environment on which life depends, or constitute or may constitute a danger in Canada to human life or health.

Organism identity

Escherichia coli strain C003 is a genetically modified bacterium.

Notified and potential uses

E. coli strain C003 was notified according to the requirements for Schedule 1 of the *New Substances Notification Regulations (Organisms)* [NSNR(O)], under an exception which applies to manufacture or import of micro-organisms for introduction in accordance with confinement procedures. It is proposed to be manufactured in Canada solely for use in sealed containers for the detection of a heavy metal found in water samples. The micro-organism is not eligible for addition to the *Domestic Substances List* on the basis of this assessment, and a new notification would be required before the micro-organism is imported or manufactured for any use outside of these confinement procedures.

Environmental fate and behaviour

Results of tests involving persistence of the parental micro-organism of *E. coli* strain C003 indicated that the micro-organism's population was reduced significantly within two days after inoculation in groundwater, with loss of all viable cells by two weeks. When tested in soil samples, the numbers of the micro-organism were reduced significantly within two weeks after inoculation, with loss of all viable cells within two months. Based on its biological and ecological characteristics, if the micro-organism is released to the environment, it is not expected to survive and proliferate because it would lack the necessary nutrients and moisture to survive.

Environmental assessment

Hazard Considerations

The environmental hazard potential of *E. coli* strain C003 is assessed to be low for the following reasons:

- *E. coli* strain C003 is a derivative of a well-documented strain of *E. coli* (i.e. the parent micro-organism) with a long history of safe use in the laboratory.

- The parent micro-organism is non-pathogenic as it lacks the known disease causing properties of *E. coli*. Therefore, it is unable to cause any harm to aquatic or terrestrial plants, invertebrates and vertebrates.

- The modifications that were made in the manufacturing of *E. coli* strain C003 did not add any hazardous genetic elements to the strain.

Exposure Considerations

The environmental exposure potential of *E. coli* strain C003 is assessed to be low for the following reasons:

- The manufacture of *E. coli* strain C003 is expected to be a small-scale operation where only small volumes of the notified micro-organism are produced.

- The notified micro-organism *E. coli* strain C003 is confined to small sealed containers with no intended release into the environment.

- In case of accidental spills, the notifier has adequate emergency response procedures in place, thus potential dispersal into the environment of *E. coli* strain C003 or any introduced genetic material would be limited.

- Based on information on the parental strain, *E. coli* strain C003 has limited capacity to survive and proliferate in the environment. There is no other potential use for *E. coli* strain C003 other than its notified use in the detection of a heavy metal in water samples.

Human health assessment

Hazard Considerations

The human health hazard potential of *E. coli* strain C003 is considered to be low for the following reasons:

- *E. coli* strain C003 is a derivative of a well-documented strain of *E. coli* (i.e. the parent micro-organism) with a long history of safe use in the laboratory.

- The parent micro-organism is non-pathogenic as it lacks the known disease causing properties of *E. coli*. Therefore, it is unable to cause any harm to humans.

- The modifications that were made in the manufacturing of *E. coli* strain C003 did not add any hazardous genetic elements to the strain.

- Compared to its parental micro-organism, *E. coli* strain C003 is resistant to additional antimicrobials as a result of the genetic modifications, but as *E. coli* strain C003 is susceptible to a number of antimicrobial drugs, in the unlikely event of human infection with the notified strain, clinically relevant antibiotics are available for treatment.

Exposure Considerations

The human exposure potential of *E. coli* strain C003 is considered to be low for the following reasons:

- The manufacturing process meets, at a minimum, the standards for the Biosafety Level 1 - Large Scale requirements, as defined in Appendix K-III of the 2016 *National Institutes of Health (NIH) Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules* (*NIH Guidelines*, 2016).

- In addition, multiple safety measures are in place to minimize the exposure of the laboratory personnel involved in the production of the notified micro-organism.

- Only small volumes of the notified micro-organism would be involved in the unlikely event of an unintended release from the production facility, which would thus not result in any significant exposure.

- The design of the sealed containers containing *E. coli* strain C003 does not allow any physical contact between the user and the notified micro-organism.

Risk assessment conclusion

Risk is typically described as the probability of an adverse effect occurring based on known hazards and a particular scenario of exposure (Environment Canada and Health Canada, 2011). In the present case, *E. coli* strain C003 will be manufactured for the detection of a heavy metal found in water samples. Due to specialized nature of modifications to the notified micro-organism, no other uses are envisaged.

Given the low environmental hazard potential and the low environmental exposure potential, the environmental risk associated with the use of *E. coli* strain C003 in sealed containers for the detection of a heavy metal found in water samples is assessed to be low.

Given the low human health hazard potential and the low human exposure potential, the human health risk associated with the use of *E. coli* strain C003 in sealed containers for the detection of one of the heavy metals found in water samples is assessed to be low.

Therefore, *E. coli* strain C003 is not anticipated to enter the environment in a quantity or under conditions that have or may have an immediate or long term harmful effect on the environment or its biological diversity, constitute or may constitute a danger to the environment on which life depends, or constitute or may constitute a danger in Canada to human life or health.

References

(excluding proprietary information or references provided by the notifier)

Environment Canada and Health Canada (2011). Framework for Science-Based Risk Assessment of Micro-Organisms Regulated under the Canadian Environmental Protection Act, 1999 (2011). http://www.ec.gc.ca/subsnouvelles-newsubs/default.asp?lang=En&n=120842D5_1 (viewed June 2020).

NIH Guidelines (2016). NIH guideline for research involving recombinant or synthetic nucleic acids molecules. https://osp.od.nih.gov/wp-content/uploads/2016/03/FR_on_2016_RAC_Revisions.pdf (viewed June 2020).