CSA TS-001:24

Biosecurity for robotics in greenhouses

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Preface

This is the first edition of a CSA TS-001, *Biosecurity for robotics in greenhouses*.

This Technical Specification is not a consensus product; that is, it is not a Standard and it has not been formally reviewed or approved by a CSA Technical Committee.

This Technical Specification has been prepared and reviewed by the Development Committee on Biosecurity for Robotics in Greenhouses.

Notes:

1) *Use of the singular does not exclude the plural (and vice versa) when the sense allows.*
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   a) *designation (number);*
   b) *relevant clause, table, and/or figure number;*
   c) *wording of the proposed change; and*
   d) *rationale for the change.*

SDG Foreword

CSA Group develops and maintains Standards across a broad range of topics, most of which support the United Nations Sustainable Development Goals (UN SDGs) towards shaping a sustainable and resilient future.

Through a robust mapping process, connections between CSA TS-001:24 and the following SDGs have been identified:

SDG			
Targets	2.1	3d	12.3

CSA TS-001:24 has notable linkages with the following SDGs:

- SDG 2: *Zero Hunger*
- SDG 3: *Good Health and Well-Being*
- SDG 12: *Responsible Consumption and Production*

For further information on CSA Group's SDG Mapping initiative, please visit: https://www.csagroup.org/sdg/

Disclaimer: It is important to note that although some Standards explicitly support SDG targets, not all Standards link to the SDGs. Standards users should always take care and be specific when claiming their support of SDGs through the use of Standards. The SDG mapping outcomes made available by CSA Group are intended to assist users in their evaluation of how the application of a Standard can support their work towards SDG achievement.

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0 Introduction

0.1 Greenhouse robots

Greenhouse robots are increasingly being used for a variety of tasks throughout greenhouse operations, including production, pesticide application, pest scouting, applying biological control agents, logistics processing, packing, and business management (Hemming, 2019; Bagagiolo et al., 2022). There is the potential for greenhouse robots, interacting closely with plants, to pose unique biosecurity challenges (Hemming, 2019). While some risks might be similar to the risks associated with existing greenhouse practices and equipment, robots represent a new and emerging technology in the greenhouse environment; therefore, the risks associated with robots might not be immediately or intuitively recognized. Explicitly identifying the potential risks linked to the expanded use of robots in the greenhouse is the first step towards developing and implementing biosecurity measures and protocols for mitigating those risks.

0.2 Potential risks posed by greenhouse robots

0.2.1 Plant interaction

Greenhouse robots often operate in close proximity to plants, which can lead to direct physical contact. This interaction can facilitate the transfer of pests, diseases, and contaminants from one plant to another. Unlike human workers, robots might not be as gentle when navigating through the crops, increasing the risk of plant damage and creating potential entry points for pathogens.

0.2.2 Cross-contamination

Cross-contamination can occur when robots move between different greenhouse sections or zones, carrying contaminants from one area to another. For example, a robot that services multiple greenhouses can transport pests between them. Robots can inadvertently spread pests if they pick up contaminated materials (water, soil, plant tissue) or propagules on their wheels, tracks, or structure and then move to uninfected areas. This can lead to the rapid spread of pests among greenhouse crops. Similar risks have been linked to reusable plastic containers.

0.2.3 Inter-greenhouse transmission

As robots are introduced or serviced by external suppliers, they can serve as potential vectors for introducing new pests or pathogens into the greenhouse environment. The lack of awareness about the specific biosecurity measures employed by these suppliers can pose risks.

0.2.4 Limited space

Greenhouses are typically designed for efficient use of space, and robots must navigate through tight rows of plants. This limited space can make it challenging to establish clear pathways for robots that minimize the risk of collisions and potential contamination.

