Emerging Biotechnology and Nanotech Hazards Canadian OHS Professionals Should Watch in 2026

Why biotech and nanotech belong on the 2026 risk radar

Biotechnology and nanotechnology are no longer edge cases for Canadian OHS programs. They are moving through universities, hospitals, research institutes, pharmaceutical companies, start-ups, vaccine and biologics manufacturers, food and agriculture innovators, clean-technology firms, advanced material producers, and contract labs. The work can look clean, controlled, and highly technical, but that can make the hazards easier to underestimate.

Traditional safety programs tend to recognize visible energy: machines, falls, vehicles, heat, electricity, trenches, cranes, and chemicals with familiar labels. Biotech and nanotech hazards are different. A worker may be exposed through an aerosol generated during a routine manipulation, a viral vector handled outside the expected containment logic, a nanopowder weighed at a balance, a contaminated waste stream, a maintenance task on equipment that normally looks closed, or a data-access failure that becomes a biosecurity issue. The

hazard may not be visible, may not have a strong odour, and may not produce immediate symptoms.

That is why these fields deserve more attention in 2026. The risk is not only that the science is advancing. It is that the science is advancing faster than many workplace safety systems, committee review processes, procurement practices, maintenance routines, and supervisor competency models. Canadian OHS professionals need to be close enough to the work to understand when a research activity, material, production process, or digital workflow has changed the exposure profile.

Canada’s biosafety framework is being modernized

The Canadian regulatory context is also changing. In March 2026, the Government of Canada announced that amendments to the Human Pathogens and Toxins Act received Royal Assent, describing the changes as a modernization of oversight and security for work involving human pathogens and toxins. PHAC stated that the amendments are intended to strengthen biosecurity oversight, improve clarity around roles and responsibilities, improve security screening requirements, reduce reporting thresholds to prevent underreporting of potentially dangerous incidents, and modernize compliance and enforcement measures. [1]

For OHS professionals, that is more than a legal update for biosafety officers. It signals that the risk conversation around biotechnology is expanding from laboratory containment alone to include biosecurity, access, remote technologies, reporting thresholds, compliance, enforcement, and the growing number of organizations involved in higher-risk life sciences work. The current Canadian Biosafety Standard, Third Edition remains the national standard for facilities where regulated human and terrestrial animal pathogens and toxins are handled or stored, and it sets minimum physical containment,

operational practice, and performance and verification testing requirements for facilities handling regulated materials. [2]

The practical message is that Canadian employers should not treat biosafety compliance as a static binder maintained by one technical specialist. Where pathogens, toxins, cell lines, viral vectors, genetically modified organisms, biological samples, or regulated materials are handled, the OHS program needs to understand how the biosafety program works and where it connects to training, supervision, incident reporting, emergency response, waste handling, maintenance, contractor access, security, and committee review.

The hazard profile changes when research moves into scale-up

A small-volume research process can become a different hazard when it moves into pilot production, contract manufacturing, or commercial scale-up. The organism, vector, particle, or material may be the same, but the exposure conditions change. Volumes increase, batch frequency increases, more workers and contractors interact with the process, equipment becomes larger and more automated, waste streams increase, cleaning becomes more complex, and maintenance becomes a more important exposure pathway.

This is a common weak point in emerging technology. A procedure that was safe in a research lab may not be safe in a production environment without redesign. A biosafety cabinet may control a small manipulation, but it does not answer every question about transfer lines, centrifugation, filtration, cleaning, spills, equipment failure, aerosol generation, or waste movement. A nanoparticle suspended in liquid may present a different exposure profile when dried, sprayed, machined, sanded, filtered, or cleaned from equipment. The transition from bench to process is where familiar assumptions can fail.

OHS professionals should therefore treat scale-up as a hazard trigger. Any move from research to pilot scale, from pilot scale to production, or from manual handling to automated or semi-automated handling should prompt a new hazard assessment. That assessment should examine not only the biological or chemical agent, but also energy sources, pressure, heat, cleaning chemicals, confined or restricted access, ergonomics, maintenance, contractor work, waste, emergency response, and supervisor competency.

Synthetic biology and viral vectors need occupational review

Synthetic biology, gene editing, cell and gene therapy, and viral vector work raise a specific challenge for OHS programs because they blend biological risk, process risk, and uncertainty. The work may involve engineered organisms, modified genetic material, viral vectors, transfection or transduction procedures, cell cultures, animal models, and specialized containment or quality systems. It may also involve workers outside traditional research roles, including health care staff, cleaning and maintenance personnel, transport staff, animal care workers, quality-control employees, and production operators.

NIOSH has identified synthetic biology as an occupational risk area and has pointed to viral vectors used in gene therapy as an example of worker exposure concern. Its bulletin notes that some widely used viral vectors include lentiviral vectors and that unintentional exposure can raise concerns such as off-target transduction, generation of replication-competent virus, insertional mutagenesis, and other serious worker health concerns. [6] The details will vary by vector, system, containment level, and process, but the OHS lesson is clear: these hazards cannot be managed as ordinary laboratory routines.

Canadian employers should ensure that biological safety officers, principal investigators, OHS professionals, supervisors, and JHSC members each understand their role. The technical risk assessment may sit with biosafety expertise, but occupational controls need to be understood by the people who assign work, train workers, inspect the area, respond to incidents, and review systemic hazards. If only the scientist understands the risk, the safety system is too narrow.

Biosecurity is becoming part of workplace safety

Biosafety and biosecurity are related but not identical. Biosafety focuses on preventing accidental exposure or release. Biosecurity focuses on preventing loss, theft, misuse, diversion, or deliberate release. In older safety programs, biosecurity may have been treated as a security or compliance issue separate from worker safety. That separation is becoming harder to defend.

The Government of Canada's 2026 HPTA modernization expressly links oversight of human pathogens and toxins with modern biosecurity threats, higher-risk activities, access to sensitive information, security screening, and strengthened compliance. [1, 3] OHS professionals do not need to become national security experts, but they do need to understand that access control, inventory accuracy, incident reporting, remote access, cybersecurity, information handling, and contractor management can affect the safety of workers and the public.

This is especially important as automation and remote technologies become more common. A containment facility may have remote monitoring, digital access logs, connected equipment, cloud-based data, vendor diagnostics, AI-enabled workflow tools, or automated synthesis and screening functions. If those systems are poorly controlled, the hazard is not only a cyber issue. It can become a biological,

chemical, or operational safety issue.

Nanomaterials are still easy to underestimate

Nanotechnology creates another kind of OHS challenge because the hazard can be difficult to characterize and easy to miss. CCOHS explains that nanotechnology involves materials with dimensions roughly between 1 and 100 nanometres, and that nanomaterials can include particles, tubes, shells, quantum dots, and other forms. It also notes that worker exposure can occur during manufacturing and use, not only during research. [4]

The health and safety question is complicated because a nanomaterial cannot always be assessed only by the chemical name of the bulk material. CCOHS explains that nanomaterial effects can be influenced by chemical characteristics as well as shape, size, crystal structure, surface coatings, surface texture, surface charge, surface reactivity, and other factors. It also notes that nanomaterials may not have the same characteristics as the normal-sized version of the same material. [5]

That means OHS professionals should be cautious about assuming that a familiar substance has a familiar risk profile when it appears in nanoscale form. The same material may behave differently when it is dry, airborne, agglomerated, suspended in liquid, embedded in a matrix, heated, machined, sanded, sprayed, cleaned from filters, or disposed of as waste. The label may look familiar while the exposure pathway is not.

The highest nano exposures may

happen outside the obvious task

In many workplaces, nanomaterial exposure is not limited to the scientist or technician intentionally handling the material. CCOHS identifies activities such as working with nanomaterials in liquids during pouring or mixing, generating nanomaterials in non-enclosed systems, handling powders, maintenance on production or fabrication equipment, cleaning spills and waste, cleaning dust collection systems, and machining, sanding, drilling, or mechanically disrupting materials that contain nanomaterials as activities that can create exposure. [4]

This matters because exposure may increase during tasks that are treated as secondary. Maintenance workers may open equipment that normally contains the process. Cleaners may handle contaminated surfaces or waste. Production workers may transfer materials between systems. A shipping employee may handle containers that were not adequately cleaned. A worker machining a composite may aerosolize particles that were controlled during original production.

Canadian employers should therefore map the full lifecycle of the nanomaterial. Where does it arrive? How is it stored? How is it transferred? Is it dry, liquid, embedded, heated, sprayed, milled, cut, or cured? Who cleans the equipment? Who changes filters? Who handles waste? Who responds to spills? Who maintains ventilation or enclosure systems? The highest exposure may not be where the process owner expects it.

The precautionary principle is a practical control strategy

A 2026 Government of Canada guideline on engineered nanoparticles describes engineered nanoparticles as an emerging occupational hazard and advises employers, health and

safety professionals, and employees to stay current because nanotechnology is rapidly evolving. It also emphasizes the need for a precautionary approach where data on a new agent is insufficient or inconclusive. [4]

That is an important point for OHS governance. Employers do not need to wait for perfect toxicology before controlling exposure. Where uncertainty is high, the responsible response is to reduce exposure as far as reasonably practicable through elimination, substitution, enclosure, local exhaust ventilation, process isolation, wet methods where appropriate, safe transfer methods, restricted access, good housekeeping, spill control, waste management, respiratory protection where warranted, and training.

CCOHS recommends applying the hierarchy of controls to nanotechnology hazards and considering the characteristics of the material, the amount handled, and whether the material is dry powder, in solution, or contained in a solid material. [5] That approach helps OHS professionals move the issue out of vague concern and into a structured control process.

Hidden hazards surround the science

Biotech and nanotech risk is not limited to the biological agent or nanomaterial. Many of the most serious hazards may come from the supporting process. Laboratories and biomanufacturing settings may involve cryogenic liquids, compressed gases, solvents, disinfectants, sterilants, autoclaves, centrifuges, sharps, lasers, high-pressure systems, clean-in-place and steam-in-place systems, ergonomics, repetitive pipetting, animal handling, waste treatment, and emergency power or ventilation dependencies.

These hazards can be missed when the OHS discussion is dominated by the headline technology. A gene therapy process still has chemical, ergonomic, biological, and equipment hazards. A nanomaterial process still has ventilation,

maintenance, waste, respiratory protection, and contractor-management issues. A highly automated laboratory still has workers who load, clean, troubleshoot, maintain, and respond when the automation fails.

This is where OHS professionals add value. They bring the discipline of asking how the work is actually performed, who interacts with the hazard, what happens during upset conditions, and what controls fail first when schedules, staffing, maintenance, or procurement drift. Emerging technology does not remove ordinary hazards. It often layers new uncertainty on top of them.

JHSCs need enough information to ask useful questions

Joint health and safety committees and worker representatives should not be left out of biotech and nanotech risk conversations simply because the science is technical. They do not need access to confidential intellectual property, sensitive biosecurity details, or unnecessary personal information. But they do need enough information to understand the nature of the hazards, the exposed worker groups, the controls in place, the incident and near-miss trends, and the issues requiring follow-up.

A committee that only sees injury totals will miss the point. Emerging hazards often appear first as containment deviations, spill reports, abnormal ventilation readings, equipment maintenance issues, waste-handling questions, minor exposures, near misses, unusual symptoms, worker discomfort, or confusion about procedures. These are safety signals. They should not be hidden inside technical departments until a serious event occurs.

The committee’s role should be systemic. It can ask whether workers have received role-specific training, whether

contractors and cleaners are covered by procedures, whether emergency response has been tested, whether waste handling is clear, whether nanomaterial use has been inventoried, whether exposure controls are verified, and whether changes in process scale or material form have triggered a new hazard assessment.

What OHS professionals should watch in 2026

Canadian OHS professionals should watch for several early warning signs in biotechnology and nanotechnology settings. These signals do not prove that a workplace is unsafe, but they do indicate that the hazard profile may be changing and that the safety system should take a closer look.

The most important signals include research moving into pilot or production scale, new pathogens or toxins added to the work, viral vector or gene-editing work expanding beyond a small expert team, nanomaterials moving from liquid suspension to dry powder or aerosol-generating tasks, increased maintenance on enclosed systems, use of connected or remote technologies in containment or production areas, contractor involvement in technical spaces, rapid hiring of inexperienced workers, more automated workflows, and incident reports that are being handled as technical deviations rather than safety events.

The strongest response is to connect these signals to action. If scale changes, reassess hazards. If worker groups change, update training and supervision. If materials change form, reassess exposure potential. If technology becomes connected, review cyberbiosecurity and access controls. If contractors enter technical spaces, confirm orientation and task-specific controls. If near misses increase, treat them as risk intelligence, not paperwork.

The better standard

The future of OHS in biotechnology and nanotechnology will not be managed well by treating these topics as niche technical issues. They are workplace safety issues, and they belong inside the same disciplined system that Canadian employers use for other serious hazards: hazard identification, risk assessment, controls, training, supervision, reporting, investigation, verification, and worker participation.

The difference is that uncertainty must be managed more deliberately. OHS professionals may not have complete toxicology for every nanomaterial, every exposure pathway, or every novel biological system. They may not have decades of incident history for every synthetic biology workflow. They may not know in advance how a process will behave when it moves from bench scale to production scale. That uncertainty is not a reason to wait. It is a reason to use precaution, containment, verification, and stronger change management.

In 2026, the strongest Canadian OHS programs will be the ones that ask better questions earlier. What has changed in the science? What has changed in the scale? What has changed in who is exposed? What has changed in how the work is controlled? What has changed in access, automation, waste, maintenance, or emergency response? Those questions are how employers keep pace with innovation without leaving workers to absorb the uncertainty.

Biotechnology and nanotechnology can bring enormous benefit. But benefit does not reduce the employer’s duty. It raises the standard for knowing the work, controlling the exposure, and proving that innovation is being matched by prevention.