# Employee activities and recommended minimum controls

| State of the nanomaterial | Employee activity | Potential exposure source | Recommended engineering controls |
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| **Bound or fixed nanostructures (polymer matrix)** | Mechanical grinding, alloying, etching, lithography, erosion, mechanical abrasion, grinding, sanding, drilling, heating, cooling | Nanomaterials may be released during grinding, drilling, and sanding. Heating or cooling may damage the matrix, allowing release of nanomaterial. | Local exhaust Ventilation<br>Laboratory chemical hood (with HEPA filtered exhaust)<br>HEPA-filtered exhausted enclosure (glovebox)<br>Biological safety cabinet class II type A1, A2, vented via thimble connection, or B1 or B2<br>Liquid suspension, liquid dispersion |
| **Synthesis methods: chemical precipitation, chemical deposition, colloidal, electrodeposition crystallization, laser ablation (in liquid)** | Pouring and mixing of liquid containing nanomaterials<br>■ Sonication<br>■ Spraying<br>■ Spray drying | Exposures may result from aerosolization of nanoparticles during sonication or spraying, equipment cleaning and maintenance, spills, or product recovery (dry powders). | Laboratory chemical hood (with HEPA filtered exhaust)<br>HEPA-filtered exhausted enclosure (glovebox)<br>Biological safety cabinet class II type A1, A2, vented via thimble connection, or B1 or B2 |
| **Dry dispersible nanomaterials and agglomerates** | Collection of material (after synthesis), material transfers, weighing of dry powders, mixing of dry powders | Exposures may occur during any dry powder handling activity or product recovery | Laboratory chemical hood with HEPA filtered exhaust<br>HEPA-filtered exhausted enclosure (glovebox)<br>Biological safety cabinet class II, B1 or B2 |
| **Nanoaerosols and gas phase synthesis (on substrate)** | Vapor deposition, vapor condensation, rapid solidification, aerosol techniques, gas phase agglomeration, inert gas condensation(flame pyrolysis, high temperature evaporation), or spraying | Exposures may occur with direct leakage from the reactor, product recovery, processing and packaging of dry powder, equipment cleaning, and maintenance | Glovebox or other sealed enclosure with HEPA-filtered exhaust<br>Appropriate equipment for monitoring toxic gases (e.g. CO) |