



**Prevention of Occupational Health
and Safety Risks**

**IN RECYCLABLE MATERIAL
SORTING CENTRES**



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INTRODUCTION

This self-evaluation checklist intended for recyclable material sorting centres is the result of two studies carried out by the Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST) in collaboration with the Association sectorielle Transport et Entreposage (ASTE), the Association paritaire pour la santé et la sécurité du travail – Secteur affaires municipales (APSAM) and the Commission de la santé et de la sécurité du travail (CSST).

In summary, workers are exposed to a number of hazards from the treated material, handling equipment (forklifts, loaders, trucks), the machinery used (mechanical sorters, compactors, conveyors, vibrating screens, electromagnets), the manual sorting operations, as well as maintenance and repair tasks. These include contamination by biological or gaseous agents, and exposure to dust, noise, thermal stress, inadequate lighting conditions, musculoskeletal injuries mainly due to repetitive movements and awkward working positions, hazardous waste including syringes, and fire hazards (1,2).

It is important that the designers and managers of these centres be informed about the presence of these risks in order to control them. The proposed checklist takes into account the majority of the occupational health and safety aspects and will help recyclable material sorting centres evaluate their actual situation regarding prevention. Each point on this checklist will help orient them towards a solution to be implemented to correct or control a health or safety problem. Once the points to be improved have been identified, it will then be easier for them to establish their priorities and to draw up their action plan.



BIOLOGICAL HAZARDS

The presence of biological agents is linked to the type of substances handled. Paper, damp cardboard and material contaminated by food residues offer excellent support for mold and other microorganisms. These can contaminate work surfaces or be found in the air as bioaerosols (airborne biological agents). Also, sorting workers are often exposed to biological waste (contaminated with blood, urine, etc.) and other contaminated residues, mainly syringes. They then run the risk of contracting infectious diseases.

To control exposure to biological agents, a series of measures must be considered that involve the handling of the material, the layout of the building, ventilation, workplace hygiene, personal protection, and personal hygiene practices.

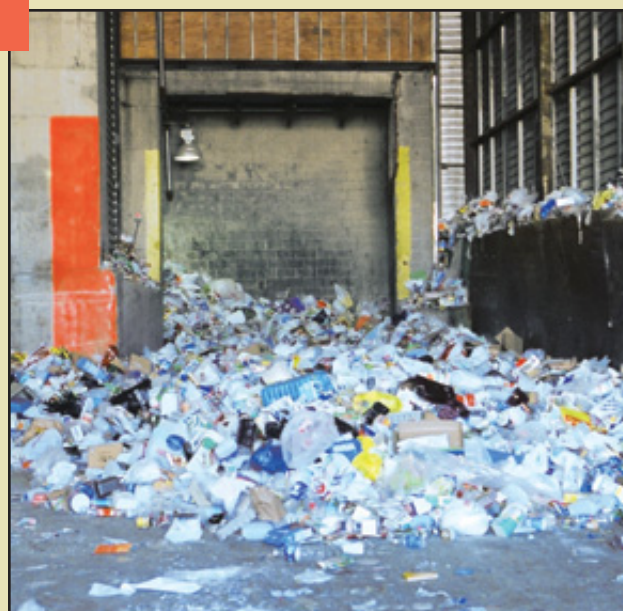
BIOLOGICAL AGENTS

In the studies of Lavoie et al. (2003) and Lavoie and Guertin (2001), regardless of the type of bioaerosols, the mean concentrations are higher than the guidelines in all the departments (receiving, sorting and shipping). The level of environmental hygiene must be high. Thorough cleaning should regularly be carried out. Spills and dirt should be cleaned up immediately. As much as possible, machines and surfaces should be free of dust (1).

OBJECTIVE : To control exposure to biological agents and waste

CHECK LIST

- ◆ I sort all the recyclable material received on a given day that same day or within the next 24 hours.
- I have isolated the material receiving area from the other departments in the sorting centre.
- ◆ I use technical means to reduce the high concentrations of bioaerosols: fresh air exchanges adapted to the operations (from one to six based on the level of contamination), local ventilation (collection at source), confinement of emission sources, including mechanical sorters, etc.
- ◆ I make sure that there is no recirculation of contaminated air in mechanically ventilated areas.



BIOLOGICAL AGENTS (cont'd)



- ◆ I clean the working areas daily by using a suction system, by avoiding stirring up dust (sweeping compounds, etc.) and by doing damp cleaning.
- ◆ I have designed the work areas in such a way that as little dust as possible accumulates on structural elements such as beams, walls, etc.
- ◆ I provide workers with personal protection (gloves) that offers maximum protection against biological waste, needle pricks and cuts.
- ◆ I apply an intervention protocol when there is biological waste on the sorting lines or in the material to be sorted, including:
 - The use of emergency stops when there are syringes on the conveyors.
 - The use of a syringe collection technique using a tool in order to avoid any contact with possibly contaminated material.
 - The use of special containers for disposing of the syringes removed from the conveyors.
 - The location of these containers according to an agreement with the health and social services centres.
 - First aiders in my company trained for taking action with a worker affected by biomedical waste.
 - The application of post-exposure procedures if a worker is pricked by a needle that was used for an injection (3).
- ◆ With public resource people, I have implemented a means of determining the origin of syringes found in a package and I keep a record of accidents and incidents.



CHEMICAL SUBSTANCES

Emissions from combustion motors, such as those from forklifts and loaders, are sources of gaseous contamination. Sorting of material is the main source of particles.

OBJECTIVE: To control the hazards related to the presence of vapours, dusts and gases

CHECK LIST

- I make sure that the ambient concentrations of exhaust gases (carbon monoxide [CO] and nitrogen oxides [NO_x]) are controlled.
- ◆ I have established a handling-equipment preventive maintenance program including regular analysis of exhaust gases. (4,5)
- ◆ I favour the use of technology to reduce gas emissions from motors: electric forklifts, catalytic converters, less polluting fuels such as natural gas or diesel.
- I ventilate work-vehicle traffic zones.
- ◆ I have isolated the material receiving area (collection trucks).
- ◆ I have pressurized the sorting department (positive pressure) and maintained a ventilation rate that eliminates air contaminants.
- ◆ I have confined, isolated or collected the gaseous emissions or particles at source (e.g., confinement of mechanical sorters) (1).
- ◆ I make sure that the active chutes are normally closed with a controlled opening (6).
- ◆ I have permanently closed the chutes that are not being used.



PHYSICAL AGENTS

The main physical agents identified are noise, lighting and summer or winter thermal environments.

OBJECTIVE: To comply with the standards of the *Regulation respecting occupational health and safety (RROHS)*

CHECK LIST

I have isolated, confined or covered the sources of noise originating from equipment and material impact points (e.g., material falling on a metal sheet, etc.).

- ◆ I have set the lighting level at the sorting workstations at 550 lux by locating the light sources so as to avoid glare (7).
- ◆ I control the temperature so as to comply with the regulations (7).
- ◆ I have planned for ways to lighten the workload during hot weather.

Photo: Christian Terrier (INRS)



ERGONOMIC COMPONENT

In 2001, regarding pain distribution in positive sorting, the upper limbs and back were the body parts most often solicited in 36% and 49% of the cases (1). In 2003, in negative sorting, pain distribution between the upper limbs, back and lower limbs became equivalent at approximately 33%. The frequency and amplitude of front and side movements and intensity are factors that affect musculoskeletal tension (1,2). Evaluation checklists and recent standards in ergonomics are not being respected for most movements (e.g., arm raising, throwing behind, movement involving the shoulders, etc.) (8-11)

OBJECTIVE: To reduce discomfort and risks of musculoskeletal injuries

CHECK LIST

- ◆ I consult an ergonomist for optimal organization of the sorting stations.
- I remove mechanically the large-volume or bulky parts before they go to sorting.
- ◆ I adjust the conveyor's speed in such a way that the left and right arms are used equally.



- ◆ I have installed emergency stops on the conveyor or other equipment at each workstation or at each step in sorting.

I have organized the workstations in order to bring the material to be sorted as close as possible to the worker (deflectors, face to face work).

- ◆ I have eliminated the obstacles between the pick-up and deposit points (e.g., protruding conveyor structure).
- ◆ I have installed height-adjustable footrests.
- ◆ I favour workstation rotation in order to balance the work constraints.
- ◆ I have checked that the height of the pick-up point on the conveyors is the same as that of the deposit point.

- ◆ I have positioned the product deposit point as close as possible to the worker and I have eliminated the need for throwing.

I have rounded the corners or covered the body resting points on the conveyor structure.

- ◆ I have planned for clearance for the ends of feet at each sorting station.
- ◆ Based on the solicitation rate, I have made sit/stand stools available for those wanting them.
- ◆ I have brought the worker as close as possible to the conveyor belt.
- ◆ I have eliminated the presence of additional containers at workstations in order to avoid movements of excessive amplitude.
- ◆ I record the workers' sensations of discomfort and pain and I adapt the workstations, rotation and pace to reduce their constraints.
- ◆ I introduce new workers to the sorting department by exposing them gradually to this task.
- ◆ I plan and I evaluate the introduction of procedures and new technologies so that they do not introduce new hazards, but instead reduce and even eliminate manual sorting (e.g., mechanical sorter, negative sorting using suction, more homogeneous material, etc.).



MECHANICAL AND OPERATING HAZARDS

Work in sorting centres may produce risks of entrainment, crushing, sectioning or shearing, cutting and pricking as well as risks of abrasion in maintenance or operations workers (1,2)

OBJECTIVE: To prevent hazards related to the presence of conveyors and other equipment and to maintain safe working conditions



CHECK LIST

- I make sure that the bundles are stable when they are being stacked.
- ◆ I have delimited and arranged the traffic routes, thus protecting pedestrians from the risk of being hit.
- ◆ I limit the movement of people in work-vehicle traffic areas, and operators are informed about any individual passing in their activity area.
- I have arranged the workstations located in vehicle traffic zones in order to eliminate the danger that people who work there will be hit.
- ◆ I have organized the area close to a floor-level conveyor or a conveyor in a trench in order to prevent access and risks of falling by people who approach these areas.
- I have equipped the elevated workstations as well as openings in the floors and walls with guardrails.
- ◆ I protect workstations and traffic routes from risks of being hit by thrown or falling objects and particles originating from the equipment (e.g., under the conveyors).

I make sure that all conveyor-driving mechanisms (belts, pulleys, couplings, etc.) are covered by solidly attached guards in compliance with the regulation respecting occupational health and safety. (7)

- ◆ I have installed a system and procedures for interlocking mechanical equipment that prevents access to a hazardous zone while the equipment is operating.
- ◆ I prohibit people from moving on a conveyor, unless its source of energy has been shut off and padlocked by each of the workers that must move on it.
- ◆ I have installed alarms indicating conveyor start-up.

I have equipped the machines, mainly the conveyors and compactors, with an emergency stop device at each workstation that requires reset and a restart action so that the machines can start again following such as stop.

- ◆ I make sure that the operator of a machine has a key or a padlock for locking out the control panel before leaving.
- ◆ I have clearly indicated the electrical panels, valves, control panels and control buttons, as well as the natural gas or propane installation, and I have protected them.
- ◆ I have equipped mobile equipment with backup signals that are sufficiently loud to be heard over the ambient noise.



EQUIPMENT MAINTENANCE AND REPAIR

Cleaning and repair work should be preceded by detailed planning of the work to be carried out (1).

OBJECTIVE: To avoid technical failures, which are often a source of danger.
To ensure workers' safety during maintenance activities

CHECK LIST

- ◆ I have made it easy and safe to access machine components for their maintenance (e.g., lubrication and repair).
- ◆ In the case of components that are difficult to access or have specific hazards, I have established adapted work procedures and temporary or permanent installations (walkway with guardrail, work platform, scaffold, anchoring device and fall protection equipment).
- ◆ Before performing a maintenance or repair activity, I apply a clearly defined lockout procedure if the uncontrolled start-up of the machine is likely to endanger a person.
- ◆ I apply a safe procedure if a worker must access a machine's danger zone (e.g., testing in the absence of guards).
- ◆ I make sure that my maintenance team and the companies that provide subcontracting services control and apply the company's safety rules (mainly lockout).
- ◆ I make sure that I identify the enclosed areas requiring inspection, maintenance, repair or construction work and that measures respecting occupational health and safety are applied (7).
- ◆ I make sure that equipment and machines are the subject of a preventive maintenance program.



FIRE PREVENTION

Material that is stored for sorting inside the centre, in receiving or shipping, can be a source of fire (2). A building where these activities are carried out must meet the requirements of the National Building Code (CNB) relating to medium or high risk industrial establishments and the National Fire Code (NFC). (12,13)

OBJECTIVE : To control the dangers related to fire hazards

CHECK LIST

- ◆ At strategic locations, I have installed extinguishers adapted to the operations.
- ◆ I have these extinguishers checked regularly.
- ◆ I have implemented an emergency and evacuation plan.
- ◆ I make sure that evacuation exercises are performed at least once a year.
- ◆ I do an evaluation of each exercise (evacuation time, etc.).
- ◆ I have installed fire alarms in everyone's view.
- ◆ I have ensured that there is a fire detection system.
- ◆ I have planned for manual pull handles in all sectors to trigger the fire alarm.
- ◆ I make sure that the construction of my building meets the applicable NBC requirements.
- ◆ I make sure that emergency exits are all clearly visible, functional, accessible and not blocked.
- ◆ The distance to be covered to reach an exit complies with the standards.
- ◆ I made sure that the number and location of emergency exits complies with the NBC.
- ◆ I had an emergency lighting system installed that provides a minimum level of lighting of 50 lux along the entire route leading to the exits.





FIRE PREVENTION (cont'd)

- ◆ I made sure that the fire resistance of the building's structure, partitions between the different sections, floors and routes towards the exits also complies with the standards.
- ◆ My fire detection system is paired with sound and visual alarm devices that cover the entire establishment including the noisiest zones.
- ◆ I have equipped my fire detection system with a device that signals any failure.
- ◆ This system is connected to a central surveillance station 24 hours a day.
- ◆ It is checked annually or according to the manufacturer's recommendations.

I have had a competent firm design a sprinkler system that controls the source of a fire. I had it installed based on the density of each zone's fire loads (high density in the deposit and storage zones, low to medium density in the sorting and treatment zones).

- ◆ My sprinkler system is inspected annually by a competent firm.



COLLECTIVE AND INDIVIDUAL MEANS OF PROTECTION

Work and street clothes should be kept in different lockers. Drinking and eating should only be done in the cafeteria and coveralls must be removed before entering. Gloves and coveralls should be supplied and cleaned by the employer. Disposable coveralls should be available for doing dirty work or clean-up work. (1)

OBJECTIVE: To ensure that the work is done in the best way possible and to protect personnel from hazards that cannot be eliminated

CHECK LIST

- ◆ I provide workers with:
 - appropriate gloves,
 - coveralls,
 - N-95 disposable respirators for dust and bioaerosols,
 - safety glasses with side shields,
 - footwear with a steel tip and perforation resistant soles (depending on the work zones),
 - reflective safety patches for moving in vehicle traffic zones, and fall protection equipment (harness, energy absorber, etc.) and,
 - any other protective equipment if the hazard analysis requires it.
- ◆ I provide them with work clothing that fits and I make sure that it is cleaned on site or by a specialized firm.
- ◆ I make sure that the workers wear no scarves, ties or rings.
- ◆ I provide them with double lockers to separate their street and work clothes.

I have installed moderate temperature eyewash fountains and emergency showers near sorting lines and other required locations, in order to be able, as needed, to treat a person who is the victim of a splash requiring emergency rinsing of the face or body.



COLLECTIVE AND INDIVIDUAL MEANS OF PROTECTION (cont'd)



◆ I provide sanitary facilities that are cleaned daily, appropriately ventilated and equipped with sanitation products (soap, paper towels, etc.).

I provide clean and functional showers.

I provide workers with a clean, appropriately ventilated and heated dining room.



TRAINING, INFORMATION AND SUPERVISION

Safe work procedures should be established by the occupational health and safety committee for each of the workstations (1)

OBJECTIVE: To avoid health and safety hazards by implementing safe procedures

CHECK LIST

- ◆ I have implemented a training and information program for workers on the company's working methods and safety guidelines (14).
- ◆ I have posted hygiene rules (14).
- ◆ I provide contractors and their employees with instructions on the company's work methods and safety guidelines in order to ensure their health and safety (14).
- ◆ I make sure that all personnel (internal and external) present in the company are supervised.
- ◆ I make sure that operators of vehicles (forklifts, loaders, etc.) are trained and competent.
- ◆ I pay special attention to the development of safe working procedures and the training of personnel when temporary installations are required (lockout, work at heights, etc.).



REFERENCES

1. LAVOIE, J., GUERTIN, S. (2001). *Evaluation of Health and Safety Risks in Municipal Solid Waste Recycling Plants. Journal of the Air and Waste Management Association* 51(3):352-360.
2. LAVOIE, J., GUERTIN, S., VERDON, C. (2003). *Intégration de la santé et de la sécurité du travail lors de la conception du réaménagement d'un centre de tri de matières recyclables*. (2003). Institut de recherche Robert-Sauvé en santé et en sécurité du travail du Québec, document No. R-347, Montréal, Québec, 34 pages.
3. CSST (2003). *Guide de gestion des risques biologiques à l'intention des groupes visés par le programme d'intervention intégré sur les risques biologiques*. Commission de la santé et de la sécurité du travail du Québec, Montréal, Québec, 50 pages.
4. ROBERGE, B. (1998). *Evaluation and Control of carbon Monoxide Exposure from Propane-Fueled Forklifts. Applied of Occupational and Environmental Hygiene* 13(3) :183-191.
5. ROBERGE, B., COULOMBE, G. (1996). *Fiche technique pour les mécaniciens lors de l'entretien des chariots au propane*, Institut de recherche Robert-Sauvé en santé et en sécurité du travail du Québec, 2e édition, document n° RF1-102, Montréal, Québec, 16 pages.
6. INRS. (2003). *Conception des centres de tri des déchets. Déchets ménagers et assimilés issus de la collecte sélective*, Institut National de Recherche et de Sécurité, document ED 914, Paris, France, 54 pages.
7. Éditeur officiel du Québec. (2001). *Règlement sur la santé et la sécurité du travail, Décret 885-2001*.
8. ISO. (2000). *ISO 11226. Ergonomie : évaluation des postures de travail statique*. International Standards Organization, Geneve, Suisse. Aptel, M. (2000). *Un outil de dépistage : la check-list de l'OSHA. Document pour le médecin du travail* 83(3) :195-198.
9. CEN. « Évaluation des postures de travail en relation avec les machines – prEN 1005-4 », Sécurité des machines- Performance physique humaine – Partie 4, 1998.
10. WAC (2000). *WAC 296-62-05105. What is a caution zone job?*. Washington State Department of Labor and Industries, Washington, WA.
11. APTEL, M. *Un outil de dépistage : la check-list de l'OSHA, Document pour le médecin du travail* 83 (3) 195-198, 2000.
12. CNB. (1985). *Code national du bâtiment du Canada*. Conseil national de recherches du Canada, Ottawa, 487 pages.
13. CNPI (1995). *Code national de prévention des incendies – Canada 1995, Premières modifications*. Commission canadienne des codes du bâtiment et de prévention des incendies, Conseil national de recherche du Canada, Ottawa, Ontario.
14. Éditeur officiel du Québec. (1994). *Loi sur la santé et la sécurité du travail, L.R.Q. chapitre 2.1*.

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PHYSICAL AGENTS

ERGONOMIC COMPONENT

MECHANICAL AND OPERATING HAZARDS

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FIRE PREVENTION

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TRAINING, INFORMATION AND SUPERVISION



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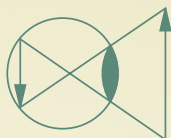
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