

Occupational Safety and Health Problems of Workers in Hong Kong Recycling Industry – A Preliminary Ergonomic Study

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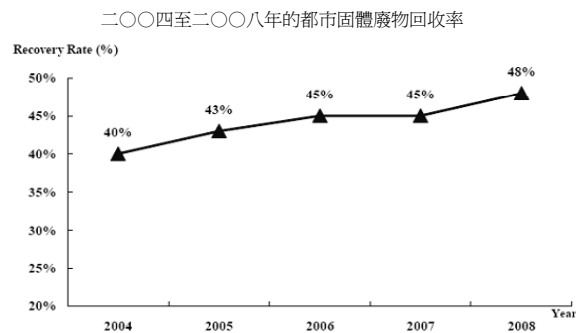


1. INTRODUCTION

OBJECTIVES

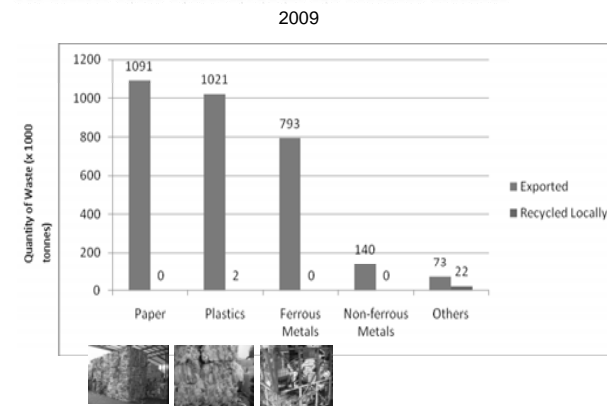
- To understand the situations and possible causes of workers' safety and health problems in recycling industry in Hong Kong
- To identify and evaluate the safety and health problems of the workers in the industry
- To propose possible solutions for the identified problems
- To provide indications of further possible work

RECYCLING INDUSTRY IN HONG KONG

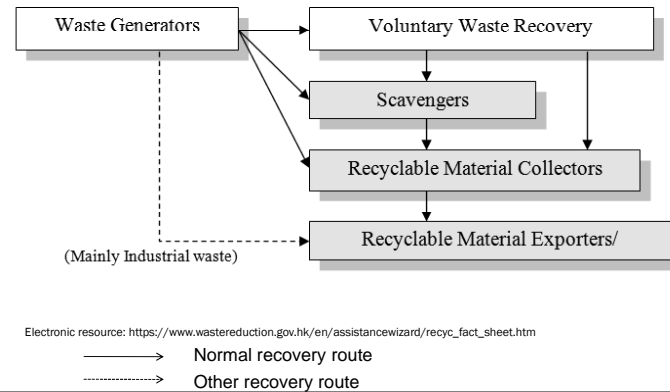


Adopted from: Waste Statistic for 2008, The Environmental Department

RECYCLING INDUSTRY IN HONG KONG

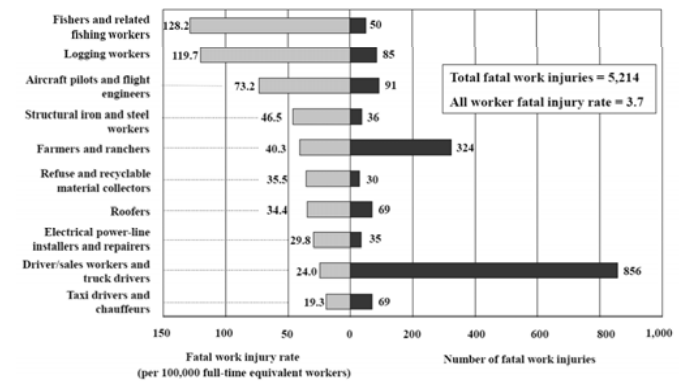


WASTE RECOVERY FLOW IN HK



THE US BUREAU OF LABOR STATISTICS

Selected occupations with high fatal injury rates, 2008



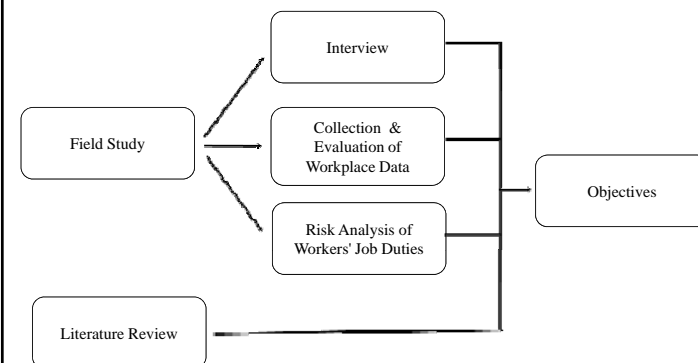
Electronic resource: <http://www.bls.gov/iif/oshwc/cfoi/cfoh0007.pdf>

OCCUPATIONAL ACCIDENT IN RECYCLING INDUSTRY

Reported Exposures	Reported Health Effects
Diesel Exhaust	Eye irritation, asthma, decreased lung function, upper respiratory tract irritation, lung cancer
Carbon monoxide	No documented health effects; potential cardiovascular, neurologic, asphyxiation
Polycyclic Aromatic Hydrocarbons	No documented health effects; potential carcinogenic
Dust	Eye irritation, organic dust toxic syndrome (ODTS), non-allergic pulmonary disorders, impaired lung function
Microorganisms	Dry cough, exercise induced dyspnea, asthma, chronic bronchitis, ODTS, chest tightness, fever, chills, flu symptoms
Endotoxin	Fever, chest tightness, airway irritation, headache, joint and muscle pain, nausea, fatigue, non-allergic pulmonary disorders, impaired lung function, acute gastrointestinal symptoms
Gram-negative bacteria	Inflammation of airways, diarrhea, nausea
Fungal spores	Allergic alveolitis, asthma
Aerosols from waste	Eye and nose irritation, nausea, vomiting
Chemicals improperly disposed of	Burns, fires, explosions, eye and skin irritation
Sharp and broken objects	Lacerations, punctures, abrasions
Heavy traffic	Pedestrian accidents, broken bones, bruising, death
Machinery	Crushed body parts, broken bones, lost limbs, musculoskeletal aches, twisted muscles, sprains, permanent disability
Heavy lifting	Disorders of the neck, shoulder and back, tendon diseases, extreme pain, lumbar disc prolapse, increased pulmonary ventilation
Unknown exposure	Coronary heart disease, myocardial infarction, angina, insufficiency

Table showing the reported exposures and related health effects for waste collectors
 Adopted from Englehardt et. al., 2000

2. METHODOLOGY



METHODOLOGY - INTERVIEW

- One-to-one face interview
- 2 Detailed Questionnaires were developed for
 - Factory Management
 - Workers
- To gather information about the health and safety conditions of workers and some health and safety issues of the companies

INTERVIEW

- Questionnaire for **Workers**:
 - 5 sections
 1. Work Practice
 2. Health Condition
 - a. Medical Background
 - b. Work Related Health Problems and Illness
 3. Work History
 4. Occupational Safety and Health Situation at Work
 5. Personal Information
 - For sections 2 and 3, the questions were formed based on the instrument from Lemasters and Atterbury (1996), which was used to estimate the prevalence of WMDs among carpenters in an ergonomic intervention study among journeymen carpenters through phone interview.
 - The questions are modified according to characteristics of recycling industry and reorganized for convenience of use in face-to-face interview.

QUESTIONNAIRE FOR WORKERS

This questionnaire is used to identify the existing occupational safety and health problems for workers in Hong Kong recycling industry. All the information provided will be kept confidential.

Please tick the appropriate response for the following questions.

Section 1: Work Practice:

- 1) Working Mode: ☐ Full Time ☐ Part Time
- 2) Number of working days per week: _____ days
- 3) Your working time: From _____ to _____.
- 4) How long have you worked in this industry?
 - ☐ Less than 1 year ☐ 1 – 2 years ☐ 3 – 5 years ☐ 6 – 10 years
 - ☐ 11 – 15 years ☐ 16 – 20 years ☐ 21 – 25 years ☐ 26 – 30 years
 - ☐ More than 30 years
- 5) How long is your meal break a day? _____ mins
- 6) Besides meal break, how many breaks do you have per day? _____ breaks
- 7) How long does each break last? _____ mins
- 8) Nature of work:
 - ☐ Recycled item collector ☐ Sorting recycled items
 - ☐ Equipment / Machinery operator ☐ Maintenance and repair
 - ☐ Driver ☐ Others, please specify: _____

9) Type of recycled items being handled and processed:

- ☐ Glass ☐ Paper ☐ Ferrous Metal ☐ Non-Ferrous Metals
☐ Plastics ☐ Textile ☐ Computer Product ☐ Electrical Appliances
☐ Food Waste ☐ Restaurant Waste (Oil, Grease Trap) ☐ Wood
☐ PVC Banner ☐ Rubber / Tyre ☐ Toner Cartridge ☐ Others: _____

10) Machine and tools used at work

- ☐ Forklift ☐ Loader ☐ Mechanical sorter ☐ Compactor
☐ Conveyor ☐ Cart ☐ Spanner ☐ Hammer
☐ Screwdriver ☐ Others: _____

Section 2: Health Condition

a. Medical Background

11) Have you ever been told by a physician that you had any of the following disease?

- | | Yes | No |
|---|--------------------------|--------------------------|
| a) Gout | <input type="checkbox"/> | <input type="checkbox"/> |
| b) Ruptured disc in the neck | <input type="checkbox"/> | <input type="checkbox"/> |
| c) Banstead syndrome | <input type="checkbox"/> | <input type="checkbox"/> |
| d) Diabetes | <input type="checkbox"/> | <input type="checkbox"/> |
| e) Hypothyroidism | <input type="checkbox"/> | <input type="checkbox"/> |
| f) Ruptured disc in the back | <input type="checkbox"/> | <input type="checkbox"/> |
| g) Rheumatoid arthritis | <input type="checkbox"/> | <input type="checkbox"/> |
| h) Carpal tunnel syndrome | <input type="checkbox"/> | <input type="checkbox"/> |
| i) Side: Left <input type="checkbox"/> Right <input type="checkbox"/> Both <input type="checkbox"/> | | |
| j) Thoracic outlet syndrome | <input type="checkbox"/> | <input type="checkbox"/> |
| i) Side: Left <input type="checkbox"/> Right <input type="checkbox"/> Both <input type="checkbox"/> | | |

b. Work Related Health Problems and Illness

- 12) Within the past 12 months, have you experienced any problem in your body parts?
- Yes ☐ (Please answer question 13 according to the diagram below)
- No ☐ (Please go to question 14)

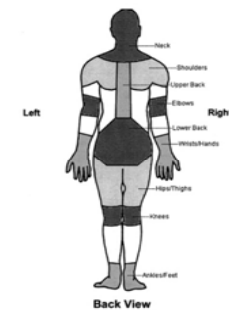


Diagram adapted from NIOSH 2004

13)	Neck	Shoulder	Elbow / forearm	Hand / wrist	Back	Hip / thigh	Knee	Ankle
Do you have problem in this area?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
The position of problem occur:	Left Right Middle	Left Right Both	Left Right Both	Left Right Both	Left Middle Right Both sides Whole back	Left Right Both	Left Right Both	Left Right Both
How long have this problem existed?	_____ years _____ months	_____ years _____ months	_____ years _____ months	_____ years _____ months	_____ years _____ months	_____ years _____ months	_____ years _____ months	_____ years _____ months
Frequency of the problem in the last year	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Frequency:	(1) 1-2 Times/Year (2) 1-2 Times/Month (3) 1-2 Times/Week (4) Every Day							
Duration of the problem in the past year	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Duration:	(1) Less than a week (2) Between a week and 1 month (3) Longer than a month but not constant (4) Constant							
Level of discomfort	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Severity:	(1) Mild pain or discomfort (2) Moderate pain with no reduction in activity (3) Severe pain with reduction in activity (4) Unbearable pain requiring time off work							

13	Neck	Shoulder	Elbow / forearm	Hand / wrist	Back	Hip / thigh	Knee	Ankle
Did you become aware of the problem when started to work at here?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Do you feel this problem was caused by this job?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Have you seen a doctor nurse or health provider for this problem?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
How many days of work did you miss because of this problem?	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month
	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month
	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month
	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month
Did you have to change your job task because of this problem?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Does this problem wake you from sleep at night?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No

Injury History								
	Neck	Shoulder	Elbow / forearm	Hand / wrist	Back	Hip / thigh	Knee	Ankle
Did you ever have any type of injury on the body part due to:	1 2 3 4 (5) others: _____	1 2 3 4 (5) others: _____	1 2 3 4 (5) others: _____	1 2 3 4 (5) others: _____	1 2 3 4 (5) others: _____	1 2 3 4 (5) others: _____	1 2 3 4 (5) others: _____	1 2 3 4 (5) others: _____
Type of injury:	(1) a fall or slip injury (2) an object hitting you or falling on you (3) an auto accident (4) a sports activity							
What type of injury was this?	Neck:	1) Broken Bone 2) Whiplash 3) Ruptured Disc 4) Burn 5) Others: _____						
	Shoulder:	1) Broken Bone 2) Dislocation 3) Severe Bruise 4) Cut 5) Burn 6) Others: _____						
	Elbow / Forearm:	1) Broken Bone 2) Dislocation 3) Severe Bruise 4) Cut 5) Burn 6) Others: _____						
	Hand / Wrist:	1) Broken Bone 2) Dislocation 3) Severe Bruise 4) Cut 5) Burn 6) Others: _____						
	Back:	1) Broken Bone 2) Ruptured / Slipped disc 3) Severe Bruise 4) Cut 5) Burn 6) Others: _____						
	Hip / Thigh:	1) Broken Bone 2) Dislocation 3) Severe Bruise 4) Cut 5) Burn 6) Others: _____						
Knee:	1) Broken Bone 2) Severe Bruise 3) Torn ligament 4) Torn meniscus 5) Dislocated Kneecap 6) Others: _____							
Ankle:	1) Broken Bone 2) Severe Bruise 3) Torn ligament or sprain 4) Dislocated Ankle 5) Others: _____							

	Neck	Shoulder	Elbow / forearm	Hand / wrist	Back	Hip / thigh	Knee	Ankle
How long ago did this injury occur?	_____ years _____ months	_____ years _____ months	_____ years _____ months	_____ years _____ months	_____ years _____ months	_____ years _____ months	_____ years _____ months	_____ years _____ months
Which part of body did this injury occur?	Left Right Middle	Left Right Both	Left Right Both	Left Right Both	Left Right Middle Both sides Whole back	Left Right Both	Left Right Both	Left Right Both
Do you think the current problem is a result of this injury?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Have you seen a doctor nurse or health provider for this problem?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
How many days of work did you miss because of this problem?	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month
	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month
	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month
	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month	_____ Days: _____ Year Month
Did you have to change your job task because of this problem?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No
Does this problem wake you from sleep at night?	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No

14) Do you suffer from the following work related health problems and illness in the past 30 days?

Health problems and illnesses*	Severity				Duration of the health problems (in past 30 days)
	Not at all	A little	Some	Serious	
Puncture, scrape					
Irritation of the eyes/skin/mucous membranes					
Leg cramp / foot pain					
Organic dust toxic syndrome					
Spasm					
Sprain					
Throat dryness					
Others: _____					

15) In the last 12 months, how many days of sick leave have you taken due to work-related health problems?
_____ days

Section 3: Work History & Satisfaction:

16) "The next series of questions asks HOW OFTEN certain things happen at your job, over the past twelve months.

Please answer the following questions with a number in a scale from 1 to 5, with 1 being rarely and 5 being very often."

Scale: Rarely1
Occasionally2
Sometimes3
Often4
Very Often5

OVER THE PAST TWELVE MONTHS: (CIRCLE CORRECT NUMBER)

a) How often does your job require you to work VERY FAST?
1 2 3 4 5

b) How often does your job require you to work VERY HARD?
1 2 3 4 5

c) How often are you PHYSICALLY exhausted at the end of the work day?
1 2 3 4 5

d) How often does your job leave you little time to get things done at work?
1 2 3 4 5

e) How often is there a great deal to be done at work?
1 2 3 4 5

17) All in all, HOW SATISFIED are you with working in this job position?

1 Very satisfied?
2 Somewhat satisfied?
3 Not too satisfied?
4 Not at all satisfied?

Section 4: Occupational Safety and Health Situation at Work

18) Have you received any occupational safety and health training in the company?
☐ Yes ☐ No

19) Has the company provided any personal gears?
☐ Yes, please specify the provided gears: _____
☐ No

20) What kind of protective gears have you worn at work?
☐ Helmet ☐ Goggles ☐ Mask ☐ Glove
☐ Anti-slip footwear ☐ Safety belt ☐ Hearing protection
☐ Others: _____

21) Do you think the noise level in the workplace is acceptable?
☐ Yes ☐ No

22) Do you think the lighting in the workplace is sufficient?
☐ Yes ☐ No

23) Do you think the thermal condition in the workplace is good enough?
☐ Yes ☐ No

24) Do you have any views and suggestions on the improvement of the current safety and health situation at work?

Section 5: Personal Information:

1) Gender: ☐ Male ☐ Female

2) Age:
☐ under 18 ☐ 18-20 ☐ 21-30 ☐ 31-40 ☐ 41-50 ☐ 51-60
☐ 61 or above

3) During work, you use
☐ right hand?
☐ left hand?
☐ both hand?

4) Educational Level:
☐ No formal education ☐ Primary ☐ Secondary ☐ Diploma ☐ University or above
☐ Others: _____

5) Your income is about:
☐ less than \$ 8000
☐ between \$ 8000 - \$ 10000
☐ between \$ 10000 - \$ 15000
☐ between \$ 15000 - \$ 20000
☐ over \$ 20000

INTERVIEW

Questionnaire for Managers:

5 Sections:

1. Work Practice
2. Work Related Health Problem and Illness
3. Control Measures at Workplace
4. Collective and Individual Means of Protection
5. Risk of Accident at Workplace

- Questions were formed based on the instrument proposed by Chan and Leung (2009).

QUESTIONNAIRE FOR MANAGERS

This questionnaire is used to identify the existing occupational safety and health problems for companies in Hong Kong recycling industry. All information provided will be kept confidential.

Company Name: _____

Date: _____

Section 1: Work Practice

1) Type of recycled items being handled and processed in the company:

- ☐ Glass ☐ Paper ☐ Ferrous Metal ☐ Non-Ferrous Metals
☐ Plastics ☐ Textile ☐ Computer Product ☐ Electrical Appliances
☐ Food Waste ☐ Restaurant Waste (Oil, Grease Trap) ☐ Wood
☐ PVC Banner ☐ Rubber / Tyre ☐ Toner Cartridge
☐ Others: _____

2) Where the recycled items come from?

- ☐ Household ☐ Industrials ☐ Commercial ☐ Construction
☐ Others, where specify: _____

- 3) Number of employees in the company _____
4) Average number of working days per week _____ days
5) Average number of working hours per day _____ hours
6) Number of work shifts per day _____
7) Break periods provided to all workers: A.M. _____ mins
P.M. _____ mins

8) How many employees are working in the following natures of works?

- | Nature of Work | Number of employees |
|-----------------------------------|---------------------|
| a) Recycled item collector | _____ |
| b) Sorting recycled items | _____ |
| c) Equipment / Machinery operator | _____ |
| d) Maintenance and repair | _____ |
| e) Driver | _____ |
| f) Others, please specify: _____ | _____ |

- 9) Machines and tools used at work:
☐ Forklift ☐ Loader ☐ Mechanical sorter ☐ Compactor
☐ Conveyor ☐ Cart ☐ Spinner ☐ Hammer
☐ Screenshoter ☐ Others: _____

Section 2: Work Related Health Problem and Illness

10) Is there any employees' injury log or statistics on work related health problem and illnesses maintained?
☐ Yes ☐ No

11) Did your employees suffer from the following work related health problems and illness in the past 30 days?

Health problems and illnesses*	Severity				Duration of the health problems (in past 30 days)
	Not at all	A little	Some	Serious	
Cut, puncture, scrape					
Dislocation					
Due to a fall or slip injury					
Fracture					

QUESTIONNAIRE FOR MANAGERS

Irritation of the eye/skin/mucous membranes						
Leg cramp/foot pain						
Musculoskeletal problems						
Organic dust toxic syndrome						
Spasm						
Sprain						
Throat dryness						
Others:						

*Source: Fodor et al. (1995), An et al. (1999) and Jasse et al. (2002)

12) Did your employees get any injuries to the following body locations at work in past 30 days?

Injured Body Location	Frequency				What kind of injuries have your employees had?
	Not at all	Often	Sometimes	Always	
Head					
Neck					
Upper Extremities					
Trunk					
Lower Extremities					
Back					
Others					

13) In the last 12 months, how many days of sick leave have your employees taken due to work-related health problem?
_____ days

Section 3: Control Measures at Workplace

14) Administrative controls

a) Have occupational safety and health rules and guidelines been implemented?	Yes	No
b) Is appropriate occupational safety and health training provided for employees?		
c) Has safety inspection been conducted regularly to ensure working environment is in compliance with regulated and internal safety standards?		
d) Are risks assessed before the introduction of procedures and new machines and facilities?		
e) Have appropriate warning signs been posted to identify specific hazards within an area?		
f) Are there signs or diagrams in appropriate local language indicating the importance of appropriate personal protective equipment use?		
g) Is fire drill carried out at least once per year?		

15) Engineering controls

a) Are recycling machines approximately maintained?		
b) Have employee been advised not to repair recycling machines themselves?		

QUESTIONNAIRE FOR MANAGERS

c) Are recycling machines equipped with proper emergency stops? ☐ ☐

d) Does the operator of a recycling machine have a padlock for locking out the control panel before leaving? ☐ ☐

e) Have installed alarms indicating recycling machines start-up? ☐ ☐

f) Are conveyor-driving mechanisms (belt, pulleys, couplings, etc) covered by solidly attached guards? ☐ ☐

g) Are the sources of noise originating from recycling machines isolated, confined or covered? ☐ ☐

Section 4: Collective and individual Means of Protection

16) Ergonomics measures

a) Are employees performing manual handling work provided with mechanical assistance?		
b) Is task variability incorporated so that workers do not have to perform similar repetitions tasks (e.g. push or pull handles of recycled items) throughout the full shift?		
c) Are appropriate rest breaks provided for employees?		
d) Are workers' sensations of discomfort and pain recorded?		
And the workstation, rotation and pace are adapted to reduce workers' constraints?		
e) Are the heights of the pick-up point and deposit point adjusted to reduce awkward neck movements and back posture?		

17) Personal protective equipments:

a) Is there sufficient personal protective equipment (e.g. gloves foot protectors) available for immediate use?		
b) Is the personal protective equipment free from scratches and in good condition?		
c) Do the workers utilize the provided Personal Protective equipments?		

18) Sanitation:

a) Are sufficient toilets and washing facilities provided for employees?		
b) Are the toilets and washing facilities kept clean and hygienic and cleaned at least once a day?		
c) Are the toilets and washing facilities equipped with sanitation products (e.g. soap, paper towels)?		

19) First aid facilities:

a) Have eye wash fountains and emergency showers been installed for emergency rinsing of the face or body?		
b) Are sufficient first aid boxes provided?		
c) Are the first aid boxes visible and easily accessible?		
d) Do the first aid boxes contain items required by law, such as sterile gauze, adhesive gauze bandages and triangular bandages?		

QUESTIONNAIRE FOR MANAGERS

20) Mean of escape:

a) Are there sufficient exits in the workplace to allow quick evacuation from the premises for all employees?		
b) Is emergency lighting provided in exits?		
c) Are all means of escape kept clean and unobstructed?		
d) Are all means of escape marked by an illuminated "EXIT" sign?		
e) Are all means of escape equipped with an automatic closure system which is functioning properly?		
f) Can all fire doors be easily opened for escape?		
g) Are all exits kept unlocked?		
h) Are the emergency diagrams accurately drawn, made clearly and visible to employees on work floor?		

21) Firefighting equipment:

a) Are proper type and number of firefighting equipment (e.g. fire extinguishers, fire blanket, and sand bucket) available?		
b) Is the firefighting equipment stored properly, clearly marked and visible to workers?		
c) Is the firefighting equipment easily accessible to workers?		
d) Is the firefighting equipment regularly checked and served?		
e) Have sufficient number of employees been trained to use the firefighting equipment?		

Section 5: Risks of accidents at workplace

a) Are there accidents occurred in the workplace?

☐ Yes, please specify the number of accidents: _____

Date: _____ Type of Accident: _____

☐ No

b) Have any change been made in the workplace since the accident occurred?

☐ Yes, please specify the changes: _____

☐ No

CONTACTING COMPANIES

- Phone invitation
- According to list of recycling companies (including collectors and recyclers) in Hong Kong provided by Environmental Protection Department
 - Total 410 companies during the study
- The companies were randomly selected from the list

Electronic resource:
https://www.wastereduction.gov.hk/apps/vicinity_result.jsp?collection_type=collector&material_type=all&district_id=0&view=%E5%8E%BB&extonly=0

METHODOLOGY – WORKPLACE DATA COLLECTION AND EVALUATION

➤ Evaluation of Workplace condition

- Lighting Level
- Noise Level
- Thermal Condition



Sound level meter
TES 1350A



Lux meter
CENTER 337



Thermo-anemometer
AZ Instrument 8908

LIGHTING LEVEL

Recommended Illumination Levels*		Area	Task	Lighting recommendations	CIE 015:2005 Ref.
Type of Activity	Range of Illumination (Lux)**				
Public spaces with dark surroundings	30	Driving lanes	Driving	Envi10 lx, Uo 0.25	5.1.2
Simple orientation for short temporary visits	50		Identifying other vehicles and pedestrians	En 30 lx, Uo 0.4	5.1.4
Working spaces where visual tasks are only occasionally performed	100		Visual search for signs	En 30 lx, Uo 0.4	5.1.4
Performance of visual tasks of high contrast or large scale	300	Area for employee handling of large containers	Driving work vehicles	En 30 lx, Uo 0.4	5.1.4
Performance of visual tasks of medium contrast or small size	500		Identifying other vehicles and containers	En 20 lx, Uo 0.4	5.1.4
Performance of visual tasks of low contrast or very small size	1000	User area near the large containers and recycling station	Driving	Envi10 lx, Uo 0.25	5.1.2
Performance of visual tasks near threshold of person's ability to recognize an image	3000-10000		Identifying other vehicles and pedestrians	En 30 lx, Uo 0.4	5.1.4
			Visual search for signs	En 30 lx, Uo 0.4	5.1.4
			Reading signs	En 30 lx, Uo 0.4	5.1.4
			Identifying different types of waste in the containers	(vertical) En 100 lx, Uo 0.4	5.1.2
			Sorting different types of waste	En 100 lx, Uo 0.4	5.1.2
			Carrying and disposing of waste	En 30 lx, Uo 0.25	5.1.4
			Visual search for signs	En 30 lx, Uo 0.4	5.1.4
			Reading signs	En 30 lx, Uo 0.4	5.1.4
			Identifying different types of hazardous waste	(vertical) En 200 lx, Uo 0.4	5.1.4
			Identifying different products	En 200 lx, Uo 0.4	5.1.4
			Reading labels	En 200 lx, Uo 0.4	5.1.4
			Sorting different types of waste	En 200 lx, Uo 0.4	5.1.4
			Carrying and disposing of waste	En 30 lx, Uo 0.25	5.1.4
		Dump area for garden waste and excavated material	Driving	Envi10 lx, Uo 0.25	5.1.2
			Identifying other vehicles and pedestrians	En 30 lx, Uo 0.4	5.1.4
			Visual search for signs	En 30 lx, Uo 0.4	5.1.4
			Reading signs	En 30 lx, Uo 0.4	5.1.4
			Identifying different types of waste in the dump area	(vertical) En 30 lx, Uo 0.25	5.1.4
			Carrying and disposing of waste	En 30 lx, Uo 0.25	5.1.4

Adopted from CCOSH (Canadian Centre for Occupational Health and Safety) 2003. *Lighting Ergonomics - Survey and Solution*

According to CIE (International Commission on Illumination) S 015:2005

NOISE LEVEL

Recommended exposure level (REL)

$$T = \frac{8}{2^{(L-90)/5}}$$

Where T = Duration permitted (hours)
L = exposure level (dBA)

THERMAL CONDITION

➤ Heat Index (HI):

- apparent temperature
- A measure of how hot it feels when *relative humidity* is added to the *actual air temperature*

3. RESULTS

- 3 companies visited
- Company A is situated at Pin Che, 坪輦
- Company B is situated at Cha Kwo Ling, 茶果嶺
- Company C is situated at Pat Heung, 八鄉

COMPANY_A

- Material exporter
- Buy materials from material collectors
 - ⇒ Export to other countries
- Open-air workplaces
- 13 workers

COMPANY_A - MATERIALS PROCESSED

Plastic materials ⇒ Compacted plastic material cube

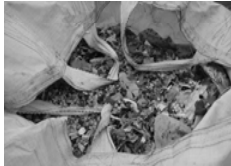


COMPANY_A - JOB DUTIES OF WORKERS

- Materials sorting
- Forklifts driving
- Materials loading
- Materials compacting

COMPANY_B

- Material exporter
- Plastic bottles \implies Plastic flakes
- Semi-open air workplaces (covered working area)
- 8 workers

**COMPANY_B - JOB DUTIES**

- Materials sorting
- Materials crushing
- Forklifts driving
- Materials loading and organizing

COMPANY_C

- Material exporter
- Tyres
- Open-air workplaces
- 9 workers

**COMPANY_C - JOB DUTIES**

- Putting tyres to forklift and organizing the tyres
- Forklifts driving
- Putting tyres to forklift and into containers

QUESTIONNAIRE RESULTS

Number of interviewees

- Company A:
10 out of 13 workers accepted the interview
- Company B:
7 out of 8 workers accepted the interview
- Company C:
7 out of 9 workers accepted the interview
- Duration of interview with workers: 20-25 minutes each

QUESTIONNAIRE RESULTS

		Company		
		A	B	C
26. Age	31 - 40	1	2	5
	41 - 50	8	5	2
	51 - 60	1	0	0

QUESTIONNAIRE RESULTS

- All were full time workers
- 12 male workers, 12 female workers
- 5-day work (58.3%); 6-day work (41.7%)
- 8-hour daily work (70.8%); 9-hour daily work (29.2%)
- Number of break other than meal break: None (100%)

4. Work Experience

Years	Frequency
1 - 2	1
3 - 5	10
6 - 10	13

- had more than one job duty
- loading materials → male workers
- repetitive

Health Condition – Work Related Health Problems and Illness

		Count
13a. Do you have problem in this area: Neck	no	17
	yes	7
13a. Do you have problem in this area: Shoulder	no	10
	yes	14
13a. Do you have problem in this area: Elbow / forearm	no	19
	yes	5
13a. Do you have problem in this area: Hand / wrist	no	22
	yes	2
13a. Do you have problem in this area: Back	no	12
	yes	12
13a. Do you have problem in this area: Hip / thigh	no	21
	yes	3
13a. Do you have problem in this area: Knee	no	16
	yes	8
13a. Do you have problem in this area: Ankle	no	22
	yes	2

QUESTIONNAIRE RESULTS**Health Condition:**

- All workers → Musculoskeletal problems within ‘mild’ and ‘moderate’ levels
- Main Musculoskeletal Problems:
Shoulder problems → 58.3% workers
Back problems → 50% workers

		Company					
		A		B		C	
		Count	%	Count	%	Count	%
17. Are you satisfied with working in this job position?	very satisfied	0	0.00%	0	0.00%	0	0.00%
	somewhat satisfied	10	100.00%	7	100.00%	7	100.00%
	not too satisfied	0	0.00%	0	0.00%	0	0.00%
	not at all satisfied	0	0.00%	0	0.00%	0	0.00%

		Company					
		A		B		C	
		Count	%	Count	%	Count	%
18. Have you received any occupational safety and health training in the company?	no	10	100.00%	7	100.00%	7	100.00%
	Yes	0	0.00%	0	0.00%	0	0.00%

16a. Does your job require you to work VERY FAST?	Frequency	Percent
very often	1	4.2
often	7	29.2
sometimes	11	45.8
occasionally	5	20.8
Total	24	100

QUESTIONNAIRE RESULTS**General Observations**

- Low Health Seeking Behaviour
- Good Job Satisfaction
- Satisfactory Work Pace
- Low safety awareness (Workers and Managers):
 - ✓ Basic protective gears
 - ✗ Lack of occupational safety and health training
 - ✗ No injury log
 - ✗ No general safety practices

RULA ANALYSIS

Company	Job Duty	Side	Wrist and Arm Score	Neck Trunk & Leg Score	Final Score	Action Level
A	Sorting Materials	Right Hand	5	9	7	4
		Left Hand	5	9	7	4
	Putting Materials into Compactor	Right Hand	7	8	7	4
		Left Hand	7	8	7	4
	Driving Forklift	Right Hand	4	3	3	2
		Left Hand	4	3	3	2
	Loading Materials	Right Hand	4	3	3	2
		Left Hand	4	3	3	2
B	Sorting Materials	Right Hand	5	9	7	4
		Left Hand	4	9	7	4
	Putting Materials into Crusher	Right Hand	3	4	4	2
		Left Hand	4	4	4	2
	Driving Forklift	Right Hand	4	4	4	2
		Left Hand	4	4	4	2
	Loading Materials	Right Hand	4	3	3	2
		Left Hand	4	3	3	2
C	Putting Tyres into Forklift	Right Hand	6	2	4	2
		Left Hand	6	2	4	2
	Driving Forklift	Right Hand	4	4	4	2
		Left Hand	4	4	4	2
	Putting Tyres into Container	Right Hand	7	8	7	4
		Left Hand	7	8	7	4

RULA ANALYSIS

- Some job duties required immediate improvements
- Materials → not close to workers → not easy to reach or grab
- Wrong postures
 - ⇨ Bending and twisting the backs and necks

LIGHTING CONDITION

- Most of the lighting conditions of the workplaces were satisfactory
- **Concerns:**
 - All the three companies are in open / semi open area
 - Light source: natural daylight
 - No good lighting system
 - Evening period (starting from 5:00 p.m.), daylight < recommended levels
 - Weather
 - Maintenance of lighting system
 - The low lighting level (1.198 lux) was measured inside a container full of tyres.

NOISE LEVEL

- In general, noise levels were not satisfactory in companies A and B
- Noise condition in the tyre processing company is better
- **Concerns:**
 - Workers were exposed to high level noise sources throughout the whole working day
 - No hearing protectors

OTHER OBSERVATIONS

- In material exporter companies, chance for workers to be exposed to bio aerosol would be lower than that of waste collectors
- Workers usually had dangerous acts during work cycle, such as putting hands into machines when the machines are operating; wearing casual wear to operate forklift

4. POSSIBLE PRELIMINARY SOLUTIONS

- Health and safety training for employers and employees
 - ⇒ To increase the awareness of occupational safety and health
 - ⇒ Workplace design for materials and equipment and provision of related training
 - ⇒ Correct lifting posture

Design of working area and positions of materials should be well defined. If the materials are close to workers, they could easily pick up the materials during the sorting process, and hence twisting of their backs and the need of moving their lower arms across the midlines of their bodies would be reduced.

- Lighting condition:
 - Installing adequate lighting system
 - Encourage maintenance of lighting system
- Noise level:
 - Increase the distance between the noise source and workers
 - Providing hearing protectors
- Thermal condition:
 - For thermal stress
 - Installing ventilation system
 - Introducing rest pause

- For cold stress
 - Consume high-energy food
 - Wear warm clothing - especially neck, head, chest, hands, ears, nose and feet

- Raising the awareness of the concerns of the recycling workers' safety and health:
 - Advertising through media
 - Conduct comprehensive and intensive research on these topics

5. LIMITATIONS

- Interview time was too long → workers wanted to finish it as soon as possible → validity of answers?
- Interviewees distracted → missed the explanations of the questions by the interviewer → misinterpreting questions
- Personal interview – interviewees might embellish their answers

6. RECOMMENDATIONS FOR FURTHER WORK

- Need more data → more accurate and detailed information for knowing the real situations
- Conduct study in different seasons
- Conduct study in 'peak activity season'
- Conduct study in other worker groups in the waste recovery flow, i.e. "Scavengers", "Recyclable Material Collectors".

**THE END
&
THANK YOU!**