GYPSUM TO GYPSUM

GTOG: From production to recycling: a circular economy for the European gypsum Industry with the demolition and recycling Industry

GYPSUM TO GYPSUM

DB3: Guidance document with criteria for acceptance of secondary gypsum for recycling

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Contact Information

Lead Contact	NWGR
Phone Number	+32 2 227 11 30
Email	info@eurogypsum.org

Document Contact	NWGR
Deliverable	**DB3 report: Guidance document with criteria for acceptance of secondary gypsum for recycling**
Phone Number	+32 2 227 11 30 (Christine Marlet, Eurogypsum)
Email	info@eurogypsum.org
Participants	Knauf,S1,S2,SG1,SG2,LOEMCO,NWGR, GRI

GtoG Project Management Bureau

Name	**Title**	**Phone**	**Email**
Christine Marlet	Project Director	+32 2 227 11 30	info@eurogypsum.org
Luigi Della Sala	Project Manager	+32 2 227 11 62	project@eurogypsum.org
Thierry Pichon	ERMC Chair/President of the GtoG SC		Thierry.Pichon@siniat.com

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Contents

1. Introduction

Before the Gypsum based waste is accepted for recycling, the latter must be accepted by the recyclers. The waste acceptance criteria of the recyclers have been analyzed during the report on current practices for gypsum recycling. We added in this report the waste acceptance criteria of Siniat France.

Further to the testing of the re-incorporated recycled gypsum in the 5 pilot manufacturer's plant, the quality of the recycled gypsum meets the criteria (technical and toxicological) for re-incorporation.

For the time being and unless proven by other testing of the recycled gypsum, the current practices of the recycler for accepting gypsum based waste for recycling become best practices. As a conclusion, we draw the list of accepted and non-accepted gypsum based waste by the three recyclers.

2. Grant Agreement

B2.1 Processing of deconstruction gypsum waste

COORDINATOR: NWGR

Partners: NWGR, GRI, SINIAT France

Duration: M10- M30

This step will allow selection of the waste processing method. When the material arrives at the recycling facility it is examined to ensure there is no contamination and that it satisfies the WAC (Waste Acceptance Criteria). This is an essential validation step to ensure legal compliance, protect human health and safeguard the environment. Once accepted, the material is prepared and fed into the recycling plant where it undergoes a second inspection and any inappropriate substances (wood, plastic, metal etc.) are identified and removed by hand before the material reaches the main body of the plant. This step may take place in-situ (visual) and/or in the premises of NWGR, SINIAT France and GRI (manually). The logistics used for gypsum waste are similar to those used for any other non-hazardous C&D waste. Reference to Action A1 and B1 will be done for logistics.

3. Terms and definitions

The glossary refers to definitions of terms as used in this report. Most of the definitions have been extracted from the UK specification for the production of reprocessed gypsum from waste plasterboard[1].

WAC (Waste acceptance criteria)
Criteria against which the re-processor will assess the waste plasterboard load to ascertain if they will accept it for processing or reject it.

[1] WRAP, & BSI. (2013). PAS 109:2013. Specification for the production of reprocessed gypsum from waste plasterboard.

Impurities
Unwanted material or substances not fitting the acceptance criteria in waste plasterboard or recycled gypsum.

Cross contamination
Gypsum waste is contaminated by other (construction building) materials in trace levels (inorganic impurities e.g. heavy metals and organic impurities).

Facility
Premises, equipment and plant used to process waste plasterboard into recycled gypsum.

Load (noun)
Single consignment.

4. Waste Acceptance Criteria (WAC) for Recyclable Plasterboard Waste

The WAC of the three gypsum recyclers part of the GtoG project (Gypsum Recycling International, New West Gypsum Recycling and Siniat FR) is described below. Most of the information has been taken from the DA1 report[2].

As the tested recycled gypsum meets the quality criteria (technical and toxicological parameters) for the recycled gypsum, there is currently no need to change the WAC or recycled gypsum for recycling.

a. Gypsum Recycling International (GRI) current WAC

The following materials are accepted for recycling:

- Calcium based reaction waste from flue gas desulphurization or gypsum mining waste
- Virgin gypsum board cut-offs
- Gypsum board under layers/dunnage
- Gypsum blocks
- Complete boards or broken parts
- Gypsum ceilings, floors, walls, stucco etc.
- Boards with tinfoil and polystyrene
- The gypsum waste may contain nails and screws, wallpaper, glass tissue and other wall coverings

According to GRI's output specification, free moisture of the gypsum powder must be under 10 per cent in weight. The receiving plasterboard plants refuse to take in any recycled gypsum with more than 10% moisture, as the plants must

[2] Gypsum to Gypsum project LIFE11 ENV/BE/001039. (2013). DA.1: Inventory of current practices. GtoG: From production to recycling!: a circular economy for the European Gypsum Industry with the Demolition and Recycling Industry.

drive out this moisture, which is costly. The 10% moisture limit value is therefore also a requirement of the receiving plasterboard plants.

The problem of plasterboard waste with high humidity is not only that the receiving plasterboard plants will not take it, but also that leakage at customers' sites can occur and it requires an increased use of fuel in the processing. It also becomes increasingly difficult to achieve the required quality of the output when recycling waste with a higher humidity, as the separation of the materials becomes more challenging. Additionally, humid waste can also jam the sorting sieves. Processing wet/humid waste is therefore technically possible with GRI's patented technology, but not desirable.
Hence GRI has developed a collection and transport system that assures that the plasterboard waste is kept dry. The system operates with closed top containers, closed transport trucks and covered warehouses, where the waste is never exposed to rain anywhere in the chain. This is to assure that the receiving plants receive the driest material possible.
However, if a gypsum waste fraction is particular humid, it can be mixed with a dryer fraction to keep the average down.

- **Fibre board**

Fibre boards are accepted by GRI as part of a plasterboard waste fraction. The acceptance of these boards is however limited to small amounts as the high organic content can reduce the quality of the recycled gypsum powder when the recycled plasterboard waste consists to a substantial amount of such boards.

- **EPS thermal insulation board**

Expanded polystyrene (EPS) is a rigid, closed-cell foam. Boards covered with this material for insulation purposes cannot be accepted for the recycling at GRI gypsum recycling facilities as there is too much risk of contamination of the recycled gypsum.

- **Hardened boards**

Hardened boards will not be accepted for the recycling at GRI gypsum recycling facilities due to the hardener in the boards that destroys the quality of the recycled gypsum powder.

- **Cement bound boards**

Cement bound boards will not be accepted for the recycling at GRI gypsum recycling facilities due to the cement in the boards that destroys the quality of the recycled gypsum powder.

Not acceptable:
GRI accepts up to 2-3 percent impurities in weight in its waste. Particularly, the following materials are not accepted in the gypsum waste fraction and count as impurities:

- Insulation material
- Wood, especially solidified wood and fiberboards
- Metal
- Plastic

The following materials are not accepted at all:

- Autoclaved aerated concrete (AAC)
- (Plasterboards with) tiles
- Hardened plasterboards
- Cement bound plasterboards and EPS thermal insulation boards
- Asbestos

GRI procedure for testing asbestos

1. How to take and prepare samples

This procedure describes how to take and prepare homogenized powder samples during production for later analysis.

A. Every 1,5 hour (on the hour) 2 * 1 litre of powder is taken from the powder conveyor or top/side of the powder pile. The samples are homogenized.
B. The samples are homogenized as follows:
    1. Each 1 litre powder sample is poured on a line of 50 cm length. All the samples are poured next to each other.
    2. Then across the middle of the samples and perpendicular to samples 5 cm of each sample is taken by dragging a spoon or similar.
    3. The samples are then mixed together to form a homogenized sample.

The principle is shown below:

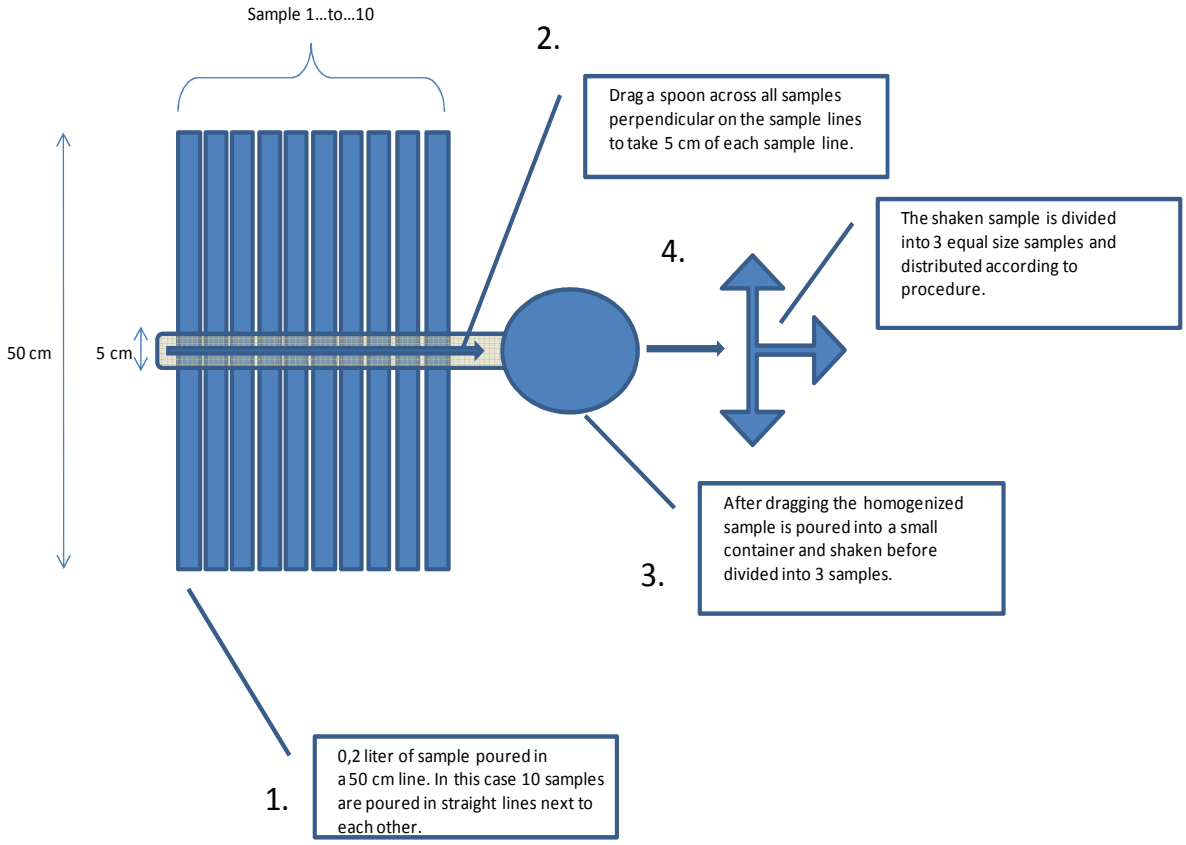


Figure 1: GRI procedure for taking and preparing samples to be tested for asbestos

The homogenized sample is divided into 2 individual sample containers all marked with date, production hours and sample responsible. One container is delivered to GRI (or to laboratory pending instructions from GRI), the second is stored on production site.

2. Test of sample

The first sample is tested for content of asbestos. Testing should include Aktinolit, Amosit, Antofyllit, Krokydolit, Crysotil and Tremolit using stereo- and polarization microscopy (PLM-method) and performed by XXXX or similar accredited laboratory. The process of taking and homogenizing the sample, transport to the laboratory and receiving back the test report, may take up to two working days.

b. New West Gypsum Recycling (NWGR) current WAC

Acceptable:

- Gypsum blocks
- Painted board
- board with vinyl, wallpaper, tile
- Wet or dry
- Gypsum ceilings, floors, walls, stucco etc.
- Boards with tinfoil and polystyrene
- The gypsum waste may contain nails and screws, wallpaper, glass tissue and other wall coverings
- Coving
- Gypsum based ceiling tiles
- Glass Reinforced Gypsum (GRG) products
- Moulds
- Plaster in bags

Remark: NWGR does not limit the amount of free moisture in the above mentioned gypsum waste. NWGR's patented equipment has no difficulties with the moisture content, able to process wet material that was kept stored outside for long periods.

Not Acceptable:

Max 2% non-gypsum waste.
Of course no hazardous materials e.g. asbestos is accepted.

NWGR Group procedure for testing asbestos

NWGR has developed an asbestos program policy whose content is reproduced in Annex I of this document. This program is valid for Europe and the US.

Through the provision of this document, New West Gypsum Recycling (BC) Inc. (New West Gypsum) is committed to protecting the health and safety of their Employees who may be potentially exposed to asbestos in the course of their daily work activities. To accomplish this, New West Gypsum will take all reasonable care to protect the well being of employees by utilizing the principles of occupational

health and safety in the management of all activities and programs pertaining to working with and/or in close proximity to asbestos-containing materials (ACMs).

Specifically, it is the responsibility of line management to identify, control and/or eliminate potential hazards associated with asbestos work activities which may result in compromised personal health/disease development, or a negative environmental impact.

All New West Gypsum employees are to take all reasonable care to protect their health and safety. Furthermore are to take reasonable care to protect the health and safety of any other persons whom maybe affected by their acts or omissions in the workplace, by complying with legislative, company and industry standards as they relate to asbestos work activities and where possible and practical, exceeding the applicable legislation to meet industry-accepted best asbestos practices. Additionally, all personnel operating within New West Gypsum work sites must immediately report all unsafe acts or conditions to their assigned Supervisor. The Supervisor is responsible for initiating immediate action to resolve and correct any such issues.

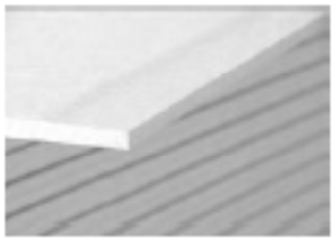
c. Siniat France current WAC

1. Will be accepted only gypsum based waste, such as plasterboards, blocks or plaster powders as defined below.
2. Waste of different type (boards, blocks etc.) can be loaded in the same container.
3. The only accepted wall linings/finishes are lead-free paint and paper-based wall paper.
4. Deliveries will be free of any kind of contaminants such as:

    - Screws, nails, studs and tracks, wood or plastic.
    - Inert waste such as cement, concrete, bricks, stones, or soil/earth.
    - Carpets, PVC, linoleum, aluminium.
    - Asbestos, fibre-cement, tiles, ceramics, cellular concrete (AAC).
    - Dangerous waste, empty packaging and objects that have been in contact with dangerous substances, various pollutants, or any other waste that presents a hazard for recycling.
    - Contaminated waste, explosives, corrosive waste or any other waste mentioned herein.
5. Gypsum based waste shall be stored and transported in such a way as to maintain it as dry as possible.
6. The current gypsum based WAC are subject to change.

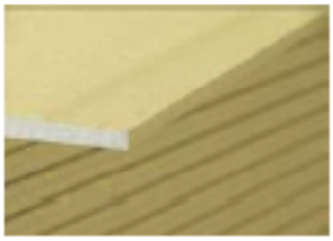
ACCEPTED WASTE :

Cream plasterboard
(Standard)



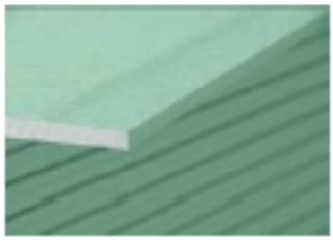
White plasterboard
(Deco, Fire)

Orange plasterboard
(very wet area)



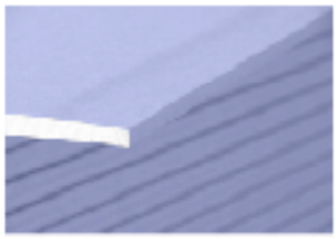
Yellow plasterboard
(High density)

Light Green plasterboard
(VOC absorption)



Green plasterboard
(wet area)

Pink plasterboard
(fire)



Blue plasterboard
(Acoustic)

Honeycomb partitions

White, pink, green and blue plaster blocks
(Standard, fire, wet area, acoustic)

Plaster powder – accepted under certain conditions
Please contact us prior to delivery

Figure 2 and 3: examples of accepted and non-accepted waste for Siniat France.

d. Comparison of the different WAC

DA1 comparison between GRI and NWGR has been taken as a basis of this extended analysis, which now includes Siniat FR requirements.

After analyzing the specifications for recyclable gypsum waste of GRI and NWGR, partners of the GtoG project, the following can be concluded:

- Gypsum blocks, gypsum ceilings, floors, walls, stucco, boards with polystyrene, wall coverings, coving and glass reinforced gypsum products are accepted by most of the recyclers under study (see table 2-22).
- Hazardous waste is always avoided in the load.
- NWGR does not limit the amount of free moisture in the gypsum waste. However, GRI limits it to 10 percent in weight as the receiving plasterboard plants have the same requirement for the recycled gypsum.
- Recyclers accept up to 3 percent impurities in weight in its waste (see table below)

	GRI	NWGR	SINIAT
Gypsum blocks			
Gypsum ceilings, floors, walls, stucco…			
Boards with tinfoil and polystyrene			
Gypsum waste with nails and screws, glass tissue and other wall coverings			
Gypsum with wall paper and/or lead-free paint			
Autoclaved aerated concrete (AAC)			
Hazardous materials, e.g. Asbestos			
Cove			
Gypsum based ceiling tiles			
Glass reinforced (GRG) gypsum products			
Fibre board	Limited to small amounts		
Hardened boards			
Moulds	After approval		
Cement bound boards			
Plaster in bags			

Table 1. Acceptable and non-acceptable materials. Green = yes / Red = no.

	GRI	NWGR	SINIAT
Free moisture	<10% in weight		

Table 2. Gypsum waste free moisture.

	GRI	NWGR	SINIAT
Max percentage of non-gypsum waste (insulation material, wood, metal, plastic…)	2-3%	2%	<1%

Table 3. Maximum percentage of non-gypsum waste.

e. Impacts of Moisture and Impurities on the Recyclability of Plasterboard Waste

The below text has been taken from DB1 report on European handbook on best practices in deconstruction techniques.

The recyclable gypsum requirements given below have been developed by the plasterboard recyclers and manufacturers in the GtoG project team, in consultation with other relevant stakeholders and it has also been based on the developments from the DA1 deliverable and annexes.

The requirements defined in this section are used by recyclers when accepting gypsum waste to be processed into recycled gypsum at the recycling facility. Recycling acceptance criteria are essential for the achievement of quality-recycled gypsum.
A certain range of impurities and moisture content, are found to be the most common issues that might affect the gypsum waste and must be subjected to an acceptance assessment. Hereunder they are explained and their effects are outlined:

Moisture content
The moisture content of the gypsum waste influences the separation of the paper from the gypsum material. Additionally, presence of moisture may cause an increased use of fuel for processing the waste or even the blockage of the machine mechanisms. If a gypsum waste fraction has a particular high level of moisture, it can be mixed with a dryer fraction in order to decrease it, and leave it storage on the plant's tipping floor until it gets dry enough to be processed.

Impurities in the gypsum waste and their effects on recycling
Gypsum waste cannot be recycled when there is a certain level of impurities, which might be difficult to separate and can affect both the gypsum recycling process and the subsequent quality of the recycled gypsum.

It is important to distinguish endogenous "impurities" as the manufacturer may have the possibility to make them disappeared from the exogenous impurities such as plastic wall paper added on the plasterboard.

Before the gypsum waste is received at the recycler's facility, it must have been pre-sorted of large amounts of impurities such as metal, plastic and other debris on-site. Although most of these elements are separated at those stages, tiny parts

may be found mixed with the gypsum waste at the recycling facility when unloading or storage and removed by visual check.

When dry gypsum waste is loaded into recycling equipment, some recyclers implement another quality control while it passes the sorting belt.
The most common impurities and their effects are presented below:
Plastics, foils and insulation materials (stone/glass wool)
These materials are sorted out before they decrease the quality of the output fraction. In particular plastics, stone and glass wool insulation materials that can contaminate the recycled gypsum powder may end up in the paper output fraction.

Figure 4: examples of plasterboard systems with frequent impurities: plasterboard bonded to insulator (left), fiberglass coating (middle), plasterboard bonded to vapour barrier (right) – Source: Siniat France specifications

Steel rails and bars
Although nails and other small metal parts are not problematic, as they are easily removed during the processing by magnets, bigger metal parts such as steel rails and bars should be avoided or sorted out prior the recycling process as they can block the machines and cause a breakdown.

Figure 5: Example of large metal pieces that can be found mixed with gypsum waste – Source: Cantillon jobsite, Chiltern St, London UK

Wood

Big pieces of wood can also be a threat to the machine and block it and should be previously removed. However, once the gypsum waste is processed, smaller wooden impurities, unnoticeable for a visual check, might end up in the paper fraction.

Other impurities:

AAC Autoclave Aerated Concrete

Autoclave aerated concrete (AAC) and gypsum waste are often perceived as the same waste fraction and, therefore, commonly collected together by accident. As part of the collecting and pre-sorting it has to be made sure that AAC is not present in the gypsum waste fraction as a mix of the two is not accepted in gypsum recycling facilities.

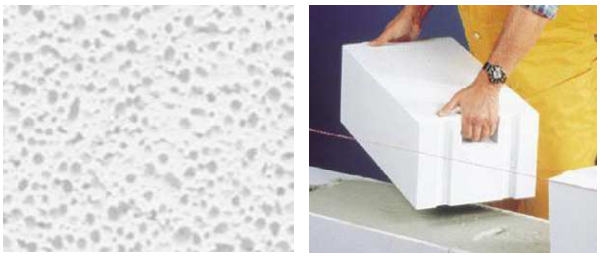


Figure 6: Autoclaved Aerated Concrete (AAC) blocks – Source: European autoclaved aerated concrete association

Anhydrite

Calcium Sulfate Anhydrite ($CaSO_4$) can mostly be found in some blocks or moulds. Unlike gypsum ($CaSO_4 \cdot 2H_2O$), calcium sulfate has no crystal water and cannot be turned into an active material that can be calcined, meaning that this material should be avoided in order to keep a high quality of the recycled gypsum powder.

The following table (Table 4) provides an overview of the acceptance criteria specified by the recyclers in the project team, divided by country**.**

ACCEPTANCE CRITERIA PER COUNTRY (only valid with the recyclers participating in the GtoG project and not in the whole country)		**FR**	**BE**	**UK**	**DE**
GENERAL ISSUES	**Free moisture content**	Not limited			<10% in weight
	Max percentage of IMPURITIES (insulation material, wood, metal, plastic, foils, concrete, sand, wallpaper, glass tissue and other wall coverings…)	2%			2-3%
GYPSUM BASED PRODUCTS	**Plaster ceilings and floors**	✓	✓	✓	✓
	Ceiling plaster tiles*	✓	✓	✓	✗
	Glass reinforced gypsum (GRG)	✓	✓	✓	✓

	products				
	Moulds / cove	✓	✓	✓	After approval
	Moulds used in foundry*	✓	✓	✓	After approval
	Plaster powder	✓	✓	✓	✓
	Plaster block	✓	✓	✓	✓
	Honeycomb plasterboard	✓	✓	✓	✓
	Plasterboard bonded to expanded polystyrene(EPS) , glass or rock wool, polyurethane (PU) **	✗	✗	✗	✗
FINISHING	**Wallpaper**	✓	✓	✓	✓
	Glass fibre wallpaper and vynil lining	✗	✓	✓	✓
	Lead based paint	✗	✗	✗	✗
OTHER	**Autoclaved aerated concrete (AAC)**	✗	✗	✗	✗
	Hazardous materials, e.g. Asbestos	✗	✗	✗	✗
	Fibre board*	✓	✓	✓	Limited
	Hardened boards	✓	✓	✓	✗
	Cement bound boards*	✓	✓	✓	✗

***In these cases gypsum waste isn´t accepted by SINIAT France.**
****Plasterboard can be recycled when it is separated from the insulation. Recyclers involved in the GtoG project don't accept insulated plasterboards.**

Table 4. Overview of the acceptance criteria specified by the recyclers in the project team, divided by country.

Gypsum waste acceptance criteria per country

From the table, it can be observed that there are minor differences among countries. The maximum percentage of impurities permitted ranges between 2% and 3%, and generally there is not a reference value set for the limit of moisture content, but for Germany, which restricts it up to 10% in weight. Nevertheless some recommendations to keep the loads dry are made by some recyclers.

Gypsum blocks, gypsum boards and tiles from ceilings, floors and walls, moulds and glass reinforced gypsum products are accepted by most of them. In the case of moulds for foundry, gypsum is highly calcined, hence not retaining its properties and in certain countries its recycling is submitted to approval.

Plasterboards with cement or high organic content (such as cement bound, fibreboard etc.) are not accepted in some cases, as they are considered to reduce the quality of the recycled gypsum. Autoclaved aerated concrete is often perceived as gypsum waste fraction on the deconstruction site, although it is not a gypsum product, and therefore not suitable for the gypsum recycling process.

Paint is usually not an issue, with the exception of lead based paints and vinyl lining or glass fibre wallpapers. Hazardous waste is always forbidden in the load (e.g. asbestos).

f. Waste Acceptance Criteria-Final

The three recyclers of the project agreed on the below WAC further to the detailed testing and analysis of the recycled gypsum by Loemco.

ACCEPTANCE CRITERIA PER RECYCLER (only valid with the recyclers participating in the GtoG project and not in the whole country)	Accepted by GRI, NWGR, SINIAT France	After approval by specific recycler	Not accepted by GRI, NWGR, SINIAT France
Gypsum Blocks	✓		
Gypsum ceilings, floors, walls, stucco	✓		
Gypsum waste with nails and screws, wallpaper, glass tissue and other wall coverings	✓		
Plaster in bags	✓		
Cove	✓		
Glass reinforced gypsum products (GRG)	✓		
Boards with tinfoil and polystyrene		✓	
Gypsum Fibre boards		✓	
Moulds		✓	
Plasterboard with glass fiber netting		✓	
Gypsum based ceiling tiles		✓	

Plasterboard with insulations (EPS-PS)	✓
Hazardous materials, e.g. asbestos	✗
Autoclaved aerated concrete (AAC)	✗
Cement bound boards	✗

Table 5. Overview of the final WAC specified by the recyclers in the project team.

5. Conclusions

The purpose of this document is to provide guidance on WAC to increase the usage of gypsum waste and reduce potential risks to the environment due to bad gypsum waste management. This attempt represents the first example of data collection and analysis on current practices for accepting gypsum waste. By detailing and comparing the WAC of three global recyclers (Gypsum Recycling International, New West Gypsum Recycling and Siniat France), the GtoG WAC can be truly considered best practices in accepting gypsum waste, and they are at disposal of all the interested stakeholders for being further analysed and strengthened. By actually contributing to the general aim of the GtoG project, namely to improve the way in which gypsum wastes are treated, these WAC fit perfectly to the GtoG project's main interest and way of working, which has always been to analyze the current situation and create examples that can guide all stakeholders to further improve it.

ANNEX I. NWGR asbestos exposure control policy

1. Purpose, objectives, scope

1.1 Purpose

To minimize as reasonably achievable, potential hazards associated with asbestos exposure.

1.2 Objectives

The objectives of this document are to:

Establish a safe work environment for New West Gypsum Employees and Contractors who may be potentially exposed to asbestos in the workplace during the receipt, transport, handling, and processing of drywall joint compound and associated materials received at New West Gypsum Recycling Facility;

Provide guidance to New West Gypsum operations personnel with regard to anticipating, recognizing, evaluating, controlling and eliminating potential asbestos exposures in their work environment; and

Outline the responsibilities and duties of Management, Supervisors and Employees.

1.3 Scope

This program applies to all New West Gypsum employees who may be potentially exposed to asbestos at the Recycling Facility. The scope of this program is limited to the identification of the following asbestos-containing materials:

- Drywall/Gypsum and other associated construction materials.

2. Applicable regulations and industry guidelines

2.1 Legislative Requirements

The Occupational Health & Safety Regulation 296/97 (OHSR) of WorkSafe BC pertains to health, safety and comfort in the workplace. Applicable sections for New West Gypsum employees include Section 5.54, 5.57 and 6.3.

2.2 Industry Guidelines

The WorkSafe BC publication, *Safe Work Practices for Handling Asbestos*, 2006 Edition will be referenced and utilized by New West Gypsum employees.

3. Glossary and abbreviations

Administrative Controls:	Controls that alter work methods (e.g. scheduling of work, work rotation, policies, etc.) and work practices (e.g. procedures, protocols, etc.) to minimize the number of workers exposed, or the exposure duration which includes training, housekeeping, equipment maintenance, and personal hygiene measures.
Air-purifying Respirator	A respirator with an air-purifying filter, cartridge, or canister

(APR)	that removes specific airborne contaminants by passing ambient air through the air-purifying element. An air-purifying respirator cannot be used in an oxygen-deficient atmosphere.
Asbestos-Containing Material (ACM)	Any materials which contains 1% or more asbestos by weight as determined in the National Institute for Occupational Safety and Health Manual of Analytical Methods, Method 9002, Issue 2 (microscopy, stereo and polarized light, with dispersion staining) or other methods acceptable to WorkSafe BC (WSBC).
As Low As Reasonably Achievable (ALARA):	Referencing the worker's exposure to a substance that must be kept to a level as low as is reasonably achievable.
Engineering Controls:	Design, construction or modification to materials, equipment, processes or the site to eliminate risk or to control and reduce risk to exposure from asbestos. Includes such methods as ventilation, process/operation design/modification and sound dampening materials.
Exposure	The subjection of personnel to potentially harmful physical, chemical, or biological agents.
Exposure Control Plan (ECP):	A plan designed and written to address, and eliminate or minimize potential hazards that may be associated with chemical or physical agents utilizing education, training and safe work procedures.
Exposure Limit (EL):	As set out in the WorkSafe BC Occupational Health and Safety Regulation (OHSR), is the concentration of a substance in air which may not be exceeded over a determined work period. May be either a time-weighted average (TWA) limit (8 hours), a 15-minute short term exposure limit, or a ceiling limit.
Friable Material	Any material which, when dry, can be easily crumbled or powdered by hand pressure, or a dry material that is already crumbled or powdered and therefore may release airborne asbestos fibre easily due to manual handing methods and practices.
Hazardous Waste	Waste which, due to its nature and quantity, are potentially hazardous to human health and/or the environment and which require special disposal techniques to eliminate or reduce the hazard as regulated by the BC Ministry of Environment
Joint Health and Safety Committee (JHSC)	Committee formed for a specific workplace that, acts as an advisory group for health and safety issues or concerns arising in the workplace. The JHSC is required for all workplaces with more than 20 workers and at least half of its membership must be workers (i.e., not management).
MSDS	Material Safety Data Sheet
Non-Friable	Composition or form of a material that is in a solid matrix which is not easily broken by simple hand pressure. This term is used to describe any asbestos-containing material that binds the fibre into the composition matrix that prevents the release of the

	fibre under normal daily usage conditions.
Notice of Project (NOP)	A document to be submitted to WorkSafe BC at least 24 hours prior to commencement of work activities, detailing the project owner, municipal address, detailed written safe work procedures, project start date and duration, and risk assessment.
Personal Protective Equipment (PPE) Controls:	Devices, equipment or clothing used/worn as a "last line of defense" by an individual to prevent/minimize exposure. Includes such equipment as respirators, safety glasses, face shields and hearing protection.
Qualified Person:	An individual knowledgeable of the work, the hazards involved and the means to control the hazards, by reason of education, training, experience or a combination thereof.
Risk Assessment	An evaluation of the location and condition of a material, prior to work, as well as any other potential hazards that might affect the workers..
WorkSafe BC (WSBC):	The Workers' Compensation Board of British Columbia, Canada.

4. Roles and responsibilities

4.1 Employer

- Endorse and promote the Asbestos Exposure Control Plan (ECP), program and required protocols;
- Assign program administration to a responsible person;
- Ensure and verify education and training is provided for New West Gypsum Employees who may be exposed to asbestos is delivered by a qualified and competent person;
- Assign roles and responsibilities as per this program;
- Ensure identification, assessment and evaluation of worker activities that may contribute to potential asbestos exposure;
- Ensure workers are not exposed to asbestos above the respective exposure limits;
- Ensure that a qualified and competent person, as defined by WorkSafe BC, is assigned to complete a risk assessment, and that applicable, detailed site-specific safe work procedures are produced for Employees, where required;
- Provide the necessary tools, resources, personal protective equipment (PPE), and support to site personnel to assist them in following this document and minimizing potential exposure to asbestos;
- Ensure that asbestos bulk sampling collection and analysis is completed and the results are available;
- Ensure all asbestos-related incidents and accidents are promptly investigated and that an appropriate plan is created to ensure that such instances do not re-occur; and
- Ensure that a review of this document and all its contents is conducted at least annually or sooner if required, with appropriate and required revisions included, and which includes Manager of Safety authorization and sign off.

4.2 Asbestos ECP Administrator

- Be familiar with the hazards and precautions required for handling and working around asbestos, and incorporating that information into the ECP;
- Be well-versed in the required and applicable components of this asbestos ECP;
- Ensure adequate coordination and understanding of the overall asbestos ECP; and
- Be familiar with the factors used to assess risks associated with asbestos and asbestos-containing materials.

New West Gypsum's *Asbestos Exposure Control Program Administrator* will be:

- Cheryl McKitterick

4.3 Supervisor

- Know the policies and procedures as outlined in this document;
- Ensure Employees under their supervision carry out their roles and responsibilities as per this ECP and the required policies and procedures;
- Verify proper and specific education and training is provided for New West Gypsum Employees who may be exposed to asbestos;
- Verify that the appropriate PPE is provided and assigned to New West Gypsum Employees, and that they are trained in the proper inspection, use, maintenance and care of that equipment; and
- Conduct prompt investigations of any incidents and accidents, including asbestos-related ones, where required, and adopt and implement appropriate plans to ensure that such instances do not re-occur.

4.4 Employees

- Be familiar with and follow the policies and procedures as outlined in this document;
- Participate in education and training – provided by the Employer – in the identified health and safety hazards associated with potential asbestos exposure;
- Follow applicable and specific safe work procedures for identifying asbestos-containing materials;
- Immediately report any unsafe practices, processes or conditions, including all accidents and incidents, or discovery of asbestos-containing materials immediately to their Supervisor; and
- Verify that the required identified asbestos control measures are in place and that their PPE is properly worn and functioning prior to the commencement of work activities involving asbestos.

5. Risk identification, assessment and control

5.1 Risk Identification & Assessment

Potential asbestos risks have been identified at the New West Gypsum Facility during a walkthrough inspection conducted by PHH ARC Environmental Ltd (PHH ARC) (qualified EH&S consultant) in conjunction with input from New West Gypsum.

Furthermore, a baseline exposure survey was conducted by PHH ARC on November 21, 2001. The risk assessment and results of this monitoring can be found in the PHH ARC report titled, " *WCB Compliance Air Monitoring,"* dated November 21, 2001 (refer to ***Appendix I***).

The risk assessment has been designed and limited to the identification, transport and handling of potential asbestos-containing drywall taping compound and associated materials received at the New West Gypsum Recycling Facility.

Work involving the handling, clean-up and removal of asbestos-containing materials will not be performed by New West Gypsum. When these materials are identified on site, Employees are required to stop work immediately and notify their Supervisor.

5.1.1 Work Activities

- Scale Operation
- Sorting Belt Operation
- Equipment Maintenance
- Housekeeping
- Loader Operation

5.1.2 Workers at Potential Risk of Exposure

- Sorting Belt Operator
- Plant Manager
- Loader Operator
- Contractors

5.1.3 Level of Exposure

New West Gypsum receives both new and renovation/demolition drywall taping compound and related materials from various industrial, commercial and residential construction sites. The material is present in a variety of conditions ranging from good to poor. Furthermore, manufacturing dates of the drywall and related materials vary and can be pre-1994, (where asbestos-containing material where potentially used in drywall taping compound). As such, the amount of exposure to potential asbestos-containing material may vary. Worker exposures to asbestos-containing materials are not anticipated – based on a "no asbestos" acceptance policy. However, based on the common use of asbestos in drywall taping compound, a potential asbestos exposure exists for Workers working with or in close proximity to these drywall materials.

5.1.4 Duration of Exposure

Workers may be exposed to asbestos fibres throughout the duration of their eight (8) hour shifts depending on production rates, type and location of work activities. Workers can be assigned various tasks, on an "as when and needed basis" and may not be required to conduct the same work activity for the entire duration of the work shift.

5.1.5 Type of Asbestos Material, Asbestos Content and Friability

Based on information provided by New West Gypsum and PHH ARC's experience, the following suspect asbestos-containing material may be present and handled at the Facility by New West Gypsum Employees:

Material	Asbestos Type	Asbestos Content	Friability
Drywall Taping Compound	Chrysotile	1-5%	Non-friable

It is New West Gypsum internal policy to identify asbestos-containing materials prior to disposal and refuse all materials that can not be verified as non-asbestos. Materials received in poor condition may be friable and/or an increased potential to become friable.

5.1.6 Potential for Fibre Release and Exposure of Workers

There is a low potential for Worker exposure to asbestos fibres because:

- All materials are screened prior to disposal at the facility;
- Periodic (i.e. monthly) bulk samples are collected from pre-processed materials;
- Materials are periodically misted, when required with water upon arrival on-site, and are further wetted and saturated by New West Gypsum throughout the process and prior to handling.
- Respirators are utilized during:
    - Sorting activities;
    - Activities within storage/processing shed; and
    - Entering and exiting machine cabs.

Based on the above preliminary risk assessment and PHH ARC's experience, the identified work activities would pose a Low Risk for Worker exposure to asbestos.

5.2 Required Controls

In order to minimize or prevent potential Worker exposures to asbestos fibres and the subsequent contamination into adjacent, unprotected work area(s), the following engineering, administrative, PPE and personal hygiene control requirements are used by New West Gypsum Employees.

5.2.1 Engineering

- General ventilation (bay doors);
- General exhaust ventilation (mechanical);
- Enclosed cabs on loaders;
- Local exhaust ventilation; and

- Wet processing (sprinklers and misting systems).

5.2.2 Administrative

- Non-Asbestos Acceptance Policy;
- Minimize potential disturbance of ACM products;
- Notification to clients regarding no Asbestos receiving policy;
- Verbal and visual confirmation with Materials History Questionnaire (see Appendix II);
- Decontamination/personal hygiene work practices;
- Coverall laundering services;
- Task variation;
- Hazard warning signs;
- Work area barriers to identify restricted processing areas;
- Specific and relevant training and education;
- Monthly bulk material sampling; and
- Occupational hygiene air monitoring.

IMPORTANT NOTE! Proper construction signage, as per WSBC OHSR Section 6.13, will be posted at the boundary of the work area. Signage will include, but is not limited to:

No Asbestos Materials Accepted; Potential Asbestos Hazard Area; Personal Hygiene Reminders; No Smoking, Eating, Drinking, Food Storage and/or Cosmetic Applications Within this Area.

5.2.3 Personal Protective Equipment (PPE)

PPE to be used will include, but is not limited to:

- North 5500 half-mask APR with P100 filters; and
- Washable Coveralls.

IMPORTANT NOTE! Please refer to the New West Gypsum's Respiratory Protection Program for additional information regarding respirator selection, inspection, use, maintenance and care.

IMPORTANT NOTE! It is New West Gypsum's responsibility to assign a qualified and competent person to conduct fit-testing of Employees who don respirators and that fit-testing records/cards are kept on file and maintained.

6. Hygiene and worker decontamination

Hand washing protocols and personal hygiene practices are used and followed by New West Gypsum Employees to reduce the potential exposure to asbestos from the work activities performed during processing of drywall taping compound and associated related materials at the Facility.

7. Education and training

All New West Gypsum Employees and Supervisors are trained in the hazards of asbestos and the implemented control measures required to eliminate or minimize their potential exposures during their work activities at Recycling Facilities. The following topics are included in the training:

- Introduction to Asbestos;
- Health Effects of Asbestos;
- WorkSafe BC Occupational Health and Safety Regulations;
- Elements of the ECP:
  - Materials Screening Procedure;
  - Personal Protective Equipment;
  - Decontamination and Hygiene Procedures; and
- Other requirements and protocols as outlined in this Asbestos ECP.

The training is conducted:

- Prior to the initial assignment to work areas where the potential asbestos exposure exists;
- When there is a change in assigned duties (where necessary);
- Whenever an Employee deviates from the established procedures; and
- When inadequacies in an Employee's knowledge are identified.

New Employees are trained in the required asbestos topics and associated documents during New West Gypsum's Employee indoctrination, and prior to commencing any work activities.

8. Documentation

Asbestos risk assessments (if required), inspections and air monitoring results are maintained for at least ten (10) years.

All other documentation, such as training and instruction certifications, written work procedures are maintained for at least three (3) years.

All documentation is kept in an easily accessible area and all Workers involved with asbestos work must be informed of the location of these documents.

9. Programme maintenance and review

The maintenance of the Asbestos ECP is the responsibility of the New West Gypsum asbestos ECP Program Administrator. The program will be:

- Distributed to all Employees who may be exposed to asbestos while working on the site;
- Reviewed and audited at least on an annual basis by the Manager of Safety and the Joint Health & Safety Committee;
- Maintained and updated as necessary in relation to new information or technologies, as well as any relevant legislative changes, revisions or amendments; and
- Signed off and dated by the Manager of Safety.

The Asbestos ECP Administrator for New West Gypsum will review the program frequently, in situations when the control measures implemented may not adequately protect Employees. Such circumstances include, but may not be limited to:

- Change in work procedures;
- Change in types of work environments encountered (i.e. unique or abnormal);
- Material Screening failures;
- Overexposures to asbestos; and
- Employer and/or Employee concerns about the effectiveness of the program and the outlined procedures.