# Annex B.2.10-A1

## *Decommissioning and cessation plan*

*Rev.01*

## Summary

# 1. Introduction

The plan aims to identify potential forms of environmental impact caused by building and equipment decommissioning. This annex aims to highlight the potential impact of the buildings and plants phasing out stage forming resources which are functional to the Sterling Chemical Malta LTD's IPPC activity.

Specifically, the study of the potential impact determined by the decommissioning phase is divided into three distinct parts:

1. Estimated useful lives of buildings and equipment;
2. Identification of potential environmental impact of phenomena associated with the phasing out stage;
3. Decommissioning and phasing out of the plant
4. The treatment of potential waste.
5. Investigations and possible remediation
6. Conclusion.

# 2. Estimate of the useful life of the IPPC

Key element in the definition of the possible issues of environmental impact on the area of interest due to the phasing out stage of the plant is the definition of the useful life.

On the basis of current knowledge about the technologies used in the production of fine organic chemicals and pharmaceutical chemistry it is believed that the plant may have a time horizon of useful life of at least twenty years. This value is consistent with the term generally used in the investment plan of this type of plant. It should be noted, however, that the maintenance activities that may be required during the year to ensure the efficiency of the activity, also refer to the process of replacement of parts most subject to wear or damage (heat exchangers, pumps vacuum, reactors, flue gas treatment system parts, etc.) At the end of the life of the production, which is the heart of the company production system, it is still possible to assume that the area and the structures within contained can be converted by a mission of the new company forming part of the same active branch (chemical manufacturing, chemical and pharmaceutical industries) exploiting knowledge and operational bases of new concept defined from technologies not currently available on an industrial scale or only at experimentation stage. This plan will take into account the possible developments of the system in the coming years as the construction of a new flammable raw materials storage and a temporary storage of waste, and a warehouse in which to conduct laboratory and office activities as well as the storage of not flammable raw materials. The two future structures will be connected to the main activity that takes place in the building B1, and in particular the storage of flammable raw materials will be physically connected to the production through the underground pipelines that will lead the main solvents used in the production process from the silos in which will be stored in the flammable storage at different supply lines and production.

# 3. Potential sources of pollution

The potential sources of impact related to a decommissioning and subsequent phasing out stage of the plant, are strongly related to the possibility that the same plant will become a dumping ground for all of the material pertaining to the activity and that its structure is left unattended at the mercy of time. A summary of the possible sources of pollution are the following:

1. Plant parts, tanks, pipes and other metallic material or plastic material contaminated by pollutant either above ground and underground;
2. Demolition of buildings with mixed construction material (glass, iron, plastic, concrete, wood, etc. ..);
3. Potential and groundwater contamination from leaking structures utilised for storage of hazardous liquids/chemicals

# 4. Decommissioning and phasing out of the plant

The phase of decommissioning and phasing out, will be subcontracted to one or more specialized companies equipped with all the necessary requirements to ensure maximum safety and protection of the environment and health during the operations on the site. The decommissioning phase includes a series of activities planned in the Phasing out Environmental Plan in preparation for the phase of demolition and removal of the implants. The activities planned in the decommissioning activity will allow the suspension of the system in conditions of maximum security.
The following activities will provide:

- Removal of chemicals, lubricating oils, fuels and the specific substances contained in equipment, piping and tanks of the plant;
- Reclamation of equipment, piping and storage tanks to remove any residue of substances;

For the next phase of demolition will be identified in advance the types of waste generated by various operations, estimating the amount, and establishing the procedures for the disposal and the final destination. All demolition operations will be carried out by applying organizational, operational and management that ensure the minimization of all related impacts (e.g., the formation of dust, noise, traffic, etc. ..).
The activities planned during the demolition are as follows:

- Dismantling of the restored mechanical components of the plant;
- Dismantling of the electrical components;
- Removal of the insulations;
- Demolition of buildings and structures;
- Removal of waste materials in accordance with the regulations;

The following describes in detail the techniques used to achieve the decommissioning and phasing out of the plant.

## 4.1 Decommissioning

The suspension of the plant, will result in the implementation of all the necessary procedures in order to allow the subsequent phasing out operations. The parts of the plant that during the year have contained specific substances such as bioliquid, lubricants, chemicals, flammable liquids and fuels, will be treated by performing the following tasks:

- ✓ discharge of the substances at the time of the suspension period;
- ✓ remediation to remove any residue of the product;

Prior to the emptying phases of equipment installation, it must be carried out necessary checks in order to determine the possible presence of hazardous atmospheres and ensure the conditions to carry out the emptying of the components in total safety. This activity will be performed by introducing into the components specific probes to detect the possible presence of hazardous substances. Of course, the operation will be carried out using non-sparking tools.

The remediation of the components and systems lines will be carried out through special flushing fluid to perform specific function of the substances to be removed:

- ✓ the washing of oils and combustible substances will be carried out with steam or hot water;
- ✓ the washing of flammable substances will be carried out only with cold water;
- ✓ the washing of chemicals may be performed with cold water possibly with added surfactants or with neutralizing substances;

For parts of the system affected by liquids, cleaning will be carried out through the combined cisterns Canal Jet type, by inserting high pressure reaction probes in the pipes and equipment and arranged to collect the waste in the tanker. For storage tanks of liquid fuels, will be carried out the emptying and washing with cold water, after which there will be the flushing with nitrogen gas. The gas will be injected at the base of the tank and extracted from the top of the same through an outlet pipe connected to an active carbon filter. The flushing will help removing any residue or pockets of gas that will be absorbed by the active carbon filter. At the end of this activity will be carried out a purge air.

In order to verify the absence of hazardous gases and reclamation of equipment and lines, the following tasks will be performed:

- ✓ execution of targeted openings on the pipes and components for the introduction of probes for testing of gas free;
- ✓ check on the inner walls of the pipes and components to verify the removal of any substance within contained;

The certificate of free gas will confirm the reclamation of the plant equipment and will enable the next phase of demolition.

## 4.2 Decommissioning of the plant

### 4.2.1 Remediation from insulating materials

Once the remediation of the tanks, lines and system components is done, there will be the remediation of such insulating materials. The project will be executed in accordance with the laws and regulations of national and local, as well as the requirements that the organization of local control put in place. The intervention of insulation removal will be carried out before the decommissioning operations, but it may coexist within the plant areas in decommissioning phase (on plants already insulated-removal) and areas undergoing insulation removal. The removal of the insulations from pipework and plant components, can be made either in work or in a dedicated area.

The insulation work will be mainly implemented for the following parts of the plant:

- ✓ components and valve bodies;
- ✓ pipes that grow to a height of up to 10 m above the ground level, easily reachable by small temporary works or hydraulic platforms with limited height growth;

In case the insulation is made up of cups based Vetronite material, the insulation removal will be performed in work and small in size in order to optimize the removal activities.
In case the insulation is made from glass wool/mineral fibrous, the insulation removal will be performed in work using appropriate devices such as the enclosure of the area around the equipment, the use of "glove bags" for small components or pipe sections, the use of mixed

techniques (cutting of pipes using components or "glove bags" on the sectioning points, removal of cut parts and insulation removal in confined area).
The confinement of the areas will be carried out through the tube-joint structures covered with polyethylene sheeting in accordance with local regulations. If required by the standard, the confinement will be maintained in depression.
The personnel access will be done through a decontamination unit of the staff directly related to the confinement. The size of the area will be defined on the base of the specific needs of bulk materials to be insulation removed. Prior to the removal of the fibrous material, the coating itself will be sprayed, with the encapsulating product, with the use of manual or electric airless pump at low pressure.
The removal of material will be used only by hand using manual equipment such as a spatula or scraper. The removed material will be immediately bagged in special polythene bags from 15-20 l, closed on the spot. The bags are then placed inside the big bag with liner and labeled in accordance with the law and transported by truck in reported area waiting to be sent to the final destination.
The insulation removal personnel will wear specific PPE against inhalation or contact of mineral fibers such as Tyvek suit and mask with filter type P3. The operations of donning and doffing of PPE will be made in specific Personal Decontamination Unit (PDU) in three stages consisting of uncontaminated area, shower room/air lock, contaminated area.

### 4.2.2 Demolition of the plants and buildings

To preserve the environment from the impacts it has also been chosen a type of selective demolition, in case the company decides to restructure, extend or convert the plant, so as to improve the recycling solution of the material and/or return to the supplier. Another fundamental aspect is the possibility of controlling on the place of production of the waste their actual composition, in such a way as to confer to a treatment plant an effectively inert material and separated from substances that can affect the recovery process itself. In the interests of recycling, demolition material becomes more valuable the more it is selected: therefore, a practice of selective demolition involves a by-product of greater value. This technique of disposal involves three stages of work:

A. Recover the equipment and facilities required;
B. Remove anything that can be dismantled;
C. Finally, demolish the structure.

While the first two steps are manual, the last phase of demolition is mechanical and requires the use of specific equipment. The success of that business recovery and recycling of demolition material is guaranteed if:

- ✓ all the dismantled demolition products are separately placed on the site in order to maximize the recycling;
- ✓ any possible damage to the environment is minimized;
- ✓ the movement of the machinery and vehicles is performed with special care to avoid any disturbance to the surrounding environment;
- ✓ the temporary accumulations of waste present on the site will be left clean and tidy.

In this case the cost of demolition for the company is more than 20% compared to traditional techniques, however, this loss will turn back because it will be possible, for example, to recycle many materials for reuse in new projects or other buildings, sometimes it is also possible to sell recyclable waste, in good condition and not dangerous, the acquiring more prestige in the international arena being a company with a green heart. In addition, all recycling technologies that will be present in 20 years (expected time horizon) will be extremely varied and will enable a wider choice of service providers. So, compared to a more economic expenditure for the activation of the demolition, it will have greater gains in the future. For some materials, such as glass and metals, recycling technologies already exist, in this case, the recycling is a simple pre-treatment. For other materials (plastic and composite materials), however, the recycling technologies may vary depending on the composition of the specific material. In the end, for hazardous materials such as asbestos, specific treatments arerequired. The best experiences of selective demolition successfully carried out in the world, suggest the most effective method to follow, that is separate and then store the materials operating the demolition in four stages:

- ✓ Hazardous materials and components: To avoid causing pollution and to protect the operators of the site from the risk of improperly handling hazardous substances, first of all it is essential to check if in the building there are materials and hazardous components (e.g. switches containing PCBs, HFC etc..). Once these materials have been identified and located, the next step is cleaning up the building, removing them and then disposing in accordance with the procedures prescribed by specific regulations.
- ✓ reusable components: after cleaning up the hazardous materials, there is the dismantling of all those elements that can be reused. In many cases, bricks, tiles, beams, railings and parapets, windows etc.., if removed with care and without being damaged, can be reused. Reused as they are or, after simple treatments (cleaning, review of the functioning, repair, painting) that fit them to a new use;
- ✓ recyclable materials: once removed hazardous materials and reusable components, it is possible to continue the work demolishing parts of the building made of recyclable materials or aggregates. Recyclable means that these materials, once subjected to appropriate treatments can be used to produce new materials, functions and uses even different from those of the original residue. For example, fragments and debris of bricks or concrete, whether or not mixed, as a result of crushing, mixing, sieving or other treatments they are suitable materials for the construction of embankments, refillings, foundations. Or wood residues that once shredded, dried and glued in industrial plants can be transformed into suitable panels of shaving.
- ✓ non-recyclable waste: all that's left after the selection is the set of materials that technically or economically (or for the possible presence of foreign elements or heterogeneous) can not be exploited. Materials which then have to be sent for disposal.

The complete decommissioning of the plant, will result in the demolition of all the works above ground and all the underground works.

The main facilities and buildings to be demolished will be:

- ✓ Main building production/workshop/office;
- ✓ Outdoor storage of raw materials and flammable wastes;
- ✓ Steam generator and boiler;
- ✓ Underground tanks to collect water for washing and service utilities and laboratories;
- ✓ Line flue gas treatment (activated carbon filters and scrubbers);
- ✓ Chimneys;
- ✓ Removing the LPG tank and pipes to them connected.

The demolitions will be conducted with the best technology available at the time of the work and in compliance with applicable regulations and good technique. The demolition will be grouped as follows:

- ✓ Demolition of storage tanks;

- ✓ Demolition of buildings;
- ✓ Demolition of the plant above ground;
- ✓ Demolition of underground works.

In the following are indicated the techniques with which to date can be executed the demolition of the plant.

### *4.2.2.1 Demolition of tanks and major silos storage*

In this case, reference is made to the LPG tank used to supply the boilers and the tank of liquid nitrogen. There will be demolished proceeding sequentially and following for each storage structure, the following activities:

- ✓ Removing the perlite insulation;
- ✓ Demolition of the roof;
- ✓ Demolition of cloaks and containment of the fund;
- ✓ Demolizione della platea di base e delle teste di palo fino al piano spiccato.

#### 4.2.2.1.1 Removing the perlite insulation;

The pearlite present in the cavity of the tanks has powdery consistency and will be removed with the aid of cyclone suction through the following steps:

- ✓ opening hole 200-250 mm in the lower part of the tank;
- ✓ connection through the cyclone suction nozzle and hose;
- ✓ intake of perlite and accumulation in a reservoir for subsequent transfer directly to big bags;
- ✓ repetition of the above operations along the entire circumference of the tank;

#### 4.2.2.1.2 Demolition of the roof;

The demolition of the roof will be preceded by the removal of accessory components such as valve bodies and pipes that will be harnessed and cut hot to be subsequently lowered to the ground via the aerial platform.

The demolition of the metal roof, will be conducted with small radio-controlled excavator (quintals 100-150) kept at the workload by crane.

The excavator will be remotely operated by radio control from operator stands on the aerial platform. The operator of the platform and the crane, as well as in visual contact, may communicate via two-way radios.

The excavator will be harnessed and raised to the height of the roof of the tank. The body of the excavator will be placed on the roof to stabilize the camera during the subsequent stages of work, but the weight of the vehicle will be fully supported by the crane, not going to weigh on the roof structure to be demolished.

The demolition will begin removing a section of the roof plate of the tank, until a complete opening. The resulting material will be conveyed inside the tank, in order to avoid risks of falling material from the top to the areas with the presence of operators.

We will proceed to demolish progressively areas of the roof, until the complete demolition of the roof. The technique described will not have workers exposed to the risk of burial. Any unexpected collapse of the structure will remain confined within the structure of the tank.

#### 4.2.2.1.3 Demolition cloaks and bottom tanks

The demolition will be carried out with small crawler excavator (800 to 1.000 quintals) arm equipped with special hydraulic demolition shears and metal. With the shears it will be open a gap in the mantles of the tank (external and internal), for a width of about 2 mt, starting from the top and up to about half the height, with horizontal cuts spaced not more than 2 mt (so as to create pieces mantle of amplitude up to 4 m2). The cutting sequence will be:

- ✓ execution of two vertical cuts to a maximum height of 1.5 mt, and spaced approximately 1 mt;
- ✓ bending sector cut towards the inside of the tank;
- ✓ execution of the horizontal cut about 1 mt below the free top edge;

It will then proceed to remove another area of the tank, taking care to gradually lower the mantles on the whole circumference and for free edge heights. Once removed all the cloak, it will remove the metal bottom, always with excavator equipped with shears, raising portions of the bottom plate and metal cutting with shears

#### 4.2.2.1.4 Demolition base stall

As a last step of the removal of the tanks the further step is the demolition of the base stalls and the pilings until the grade plane. The demolition will be carried out with crawler excavator medium-sized (300-500 quintals), equipped with a hammer.
To the resulting material will be removed the iron with an excavator equipped with crusher.
In order to minimize the generation of dust during the whole phase of demolition of the reinforced concrete portions, it is necessary to proceed to bathe the affected parts with water.

### *4.2.2.2 Aboveground plant demolition*

In general, the major components of plant such as boiler, flue gas line, condenser, turbine, pumps, valves and various machinery, once reclaimed will be insulation-removed in work and then scrapped in work. The piping will be demolished either after insulation removal in work or after removal of pipe portions to be insulation-removed subsequently in a dedicated area, as described above. The components and piping insulation-removed will be demolished with excavators equipped with shears or cuts through hot if the thickness exceeds 15 mm. The pumps and valves will be demolished with cuts through hot. The piping will be sheared for traits, from support to support, by sectioning the first in correspondence with a support, and then sectioned and chucked at the ends and bent towards the ground, finally perform the cutting at the closest support, where the pipe has been bent. Once on the ground, the pipes will be reduced volumetrically still with shears. Similarly, we will work to reduce volumetrically pipes insulation-removed off, in a dedicated area. Once pulled down the tubes, we will proceed to destroy the structures of the rack, in a similar way.

The stands will be demolished with excavator equipped with a hammer. The chimneys and vents shall be removed with the aid of cranes of adequate capacity, catering to breech every single chimney at the top. We will proceed to hot-dissect the column starting from the top and then lift the trunk and place it horizontally on the ground for subsequent volume reduction conducted with excavator equipped with hydraulic shears.

### *4.2.2.3 Demolition of buildings*

After performing the decommissioning of plants above ground, in the buildings to be demolished must be previously performed the task of strip-out aimed at the removal of all equipment and furniture to optimize the management of waste materials.
The removal will be conducted by opening one or more gates in a wall of the concerned building, by excavator equipped with hammer in an amplitude such as to allow access of a

foklift or the arm of a telescopic handler. The individual equipment (electrical panels, various components) or furnishings will be removed manually or with the aid of manual lifting equipment (manual winches, hoist trolley) and approached the opening created, where they will be harnessed to the lifting and transport and to remove them outside the building, where they will be further dissected, separating the materials by type. The demolition will be carried out in a sequence that does not make at any stage labile or unstable residual structures. This includes:

- ✓ identify the structural frames that are bracing to be demolished for the last, if a structure has more chassis bracing, it is required to move in order to always leave for last a braced frame.
- ✓ disconnect a structural frame at a time, demolishing the floors connecting orthogonally at the framework of the same proceeding in the demolition of the disconnected frame; operations will be repeated advancing from one side of the head towards the opposite;

In case of presence of foreign scale external metal (as the foot irons), these have to be demolished before proceeding with the demolition of the building or, at least, before the demolition of the structural portion of a building to which they are adjacent. The demolition of exterior stairways shall be carried out by hydraulic shears, first removing the galleries, then disconnecting the higher ramp stairs in the upper attachment point, then applying a force to fold the ramp down and then disconnecting the lower point of attack .

In the case of the metal structure that forms the roof of the storage of flammable materials, they will be removed by excavator of demolition special arm of adequate length and hydraulic shears for thicknesses up to 15 mm. The demolition will proceed in an orthogonal direction to the supporting frames of the structure, so as to maintain a stable portion of residual structure during the advancement of the demolition. The demolition will be performed for each span of the shed proceeding from the top downwards, with the following sequence:

- ✓ demolition of the purlins so as to release the truss;
- ✓ Once released the truss from the purlins, we will proceed with the demolition of the truss itself, sectioned before at one end, then turned to the ground (always with the aid of the shear) and sectioned at the other end;
- ✓ demolition of the head beam and walling that connects the head of the columns to those of the closest inner frame; each beam will be sheared to an extreme, then chucked with the shears and bent towards the ground, finally sheared to the bent extreme, procuring the total disconnection;
- ✓ demolition of the freed columns which will be chucked on the top and bent towards the ground, and then cut with shears to the foot, and if the thickness of the carpentry will be higher than the one sectionable with the shears, it shall execute a hot cutting with oxy-propane torch

#### *4.2.2.4 Demolition of underground works*

The demolition of the undergroud works such as fire hoses, basements and foundations of the demolished components, tunnels cable paths, will be removed and made a dig around the work to be demolished, with excavator equipped with bucket. Once brought into the open, the work will be demolished with excavator equipped with an hydraulic hammer.

The excavation will be closed in site with the soil. The slab of reinforced concrete built on the bottom of the tanks of the bioliquid will be broken with medium-sized (250-300 quintals) crawler excavator equipped with a hammer, creating large blocks that will be raised by the second medium-sized excavator equipped with bucket, reduced volumetrically and iron-removed from third medium-sized excavator equipped with crusher.

The material removed, demolished and iron-removed will gradually be removed from the site and evacuated to an area for temporary storage before being transferred at final destination.

This is a delicate operation because one of the tanks or  not under pressure basin) contains or has contained hazardous waste in the past (European Waste Code 070701*). So, before the demolition will be carried out with a remediation certification by the company called to do the work.

#### *4.2.2.5 Demolition of bund containment*

Please note that it will be used the system for procedures described in paragraphs 4.2.2 and section 4.2.2.2 and 4.2.2.3. also for the BUND and the secondary containment systems in use for the External Flammable Warehouse.

## 4.2.3 Decommissioning and remove underground tank and pipeline

Qui si possono presentare due casi:

A) The property is then sold in this case proceeds through a decommissioning plan with safety of underground tanks and elements connected to it
B) The property will be demolished because unsold then in this case will be removal of the underground tanks.

If it is decided to remove the underground tanks, Sterling will necessarily outsource the work. The companies that will offer the service also will be submitted to the judgment of the MEPA.

### *4.2.3.1 Decommissioning*

In case of decommissioning operations to be carried out to ensure the safety and protection of the environment are summarized as follows:

- Verifying the integrity of tanks and pipeline;
- Sewage removal and cleaning tank;
- Repair Insulation and protective sheath;
- Closing and inerting each pipeline by nitrogen flow

### *4.2.3.2 Decommissioning and Remove*

The procedure that will be implemented will include the following steps:

- Verifying the integrity of the tank;
- Sewage removal and cleaning tank;
- Remove the tank and pipeline;
- Samples thoroughly excavated and the walls;
- Sampling early in the neighboring areas to compare with the samples in the area of decommissioning;
- Disposal all wastes product;
- Filling the trench with certified material and repair the condition of the premises;
-

# 5. Type of potentially present waste

## 5.1 Wastes from the plant, pipes, tanks

The demolition of existing facilities will result in the production of the following types of materials classified according to the European Waste Code

| Identification types | Waste code | Potential reuse | Potential recycling |
| --- | --- | --- | --- |
| Iron demolition of metal structures, pipe racks, steel structures, piping, tanks, machinery and equipment, except electric motors and other electro-equipment | 170405 | 70 % | 70% |
| Power cables | 170411 | 0% | 80% |
| Electrical equipment | 160214 | 0% | 90% |
| Components removed from electrical equipments | 160216 | 0% | 80% |
| Piping, insulation materials and systems | 170604 o 170603* (if fibrous materials) | 0% | 0% |
| Waste engine oils and gear lubrication | 130206 | 0% | 0% |
| Insulating oils and heat transmission | 170504 | 0% | 0% |
| absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated with hazardous | 150202* | 0% | 0% |
| packaging containing residues of or contaminated by dangerous substances | 150110* | 50% | 50% |
| tanks for liquid gas | 160116 | 0% | 0% |
| discarded equipment containing chlorofluorocarbons, HCFC, HFC | 160111* | 0% | 0% |
| glass, plastic and wood containing or contaminated with dangerous substances | 170204* | 60% | 50% |
| metal waste contaminated with dangerous substances | 170409* | 60% | 80% |
| cables containing oil, coal tar or other dangerous substances | 170410* | 0% | 0% |
| Concrete | 170101 | 0% | 0% |
| mixtures of, or separate fractions of concrete, bricks, tiles and ceramics containing dangerous substances | 170106* | 0% | 0% |
| soil and stones containing dangerous substances | 170503* | 0% | 0% |
| other construction and demolition wastes (including mixed wastes) containing dangerous substances | 170903* | 90% | 10% |
| mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03 | 170904 | 90% | 10% |
| other construction and demolition waste | 170900 | 50 % | 50 % |

Table 1 Identification types of waste.

In addition to the types mentioned above there will be other minor waste, which will be labeled with appropriate EWC code and managed according to the regulations.
Except in the case of inert materials and land to be allocated to on-site reuse, the materials resulting from the insulation removal and demolition, once broken down and reduced in size, will be sent for disposal in the shortest possible time, thus avoiding excessive accumulation of material within the yard. The chosen main destination is the recovery of these materials even after a thorough clean-up. As seen from the order of execution, the dismantling of the plant will be the first as to create storage areas covered and paved such as to prevent the release of toxic substances into the environment. If this is not possible, the waste will be adequately covered by waterproofing sheets in order to prevent the destructive and destabilizing action. The effects in the environment that can generate a type of waste as described in Table 1 is as diverse as it is tied to the last type of chemical plant with which the plant parts, actually waste, they have been in contact. Particular attention should be placed in the waste of electrical and electronic equipment because they may contain substances such as heavy metals, brominated flame retardants, halogenated substances, substances harmful to the ozone. Many of these substances represent a potential danger to the environment if they are not handled or properly disposed. The activities of **treatment** provide various stages:

- ✓ safety measures or remediation, or removal of hazardous components
- ✓ removal of sub-assemblies and preliminary separation of materials
- ✓ mechanical processing for the recovery of materials.

The waste processes of recycling and treatment of the electrical and lighting allow**to recover significant quantities of material equal to about 90% of the entire product**, thus thinking in a subsequent re-entry into the market. In particular the **glass** which is at present the material with the greatest commercial potential, being able to be reused in the construction industry (**glass wool and insulation**), in the field of vitrification of **tiles** and in the future also in the production of the lamps themselves. From the different equipment, in addition, it is also possible to get iron, aluminum, copper and plastics. At the time of decommissioning of the plant, it will be compulsory the operation for the collection of such equipment because there may be the presence of mercury in modern light bulbs. The presence of mercury within the light sources varies according to the type of lamp: linear fluorescent lamps contain between 3 to 30 mg of mercury, the compact fluorescent between 5 and 10 mg, while the high-intensity discharge lamps between 20 and 50 mg of mercury. The danger of this metal is recognized by numerous studies. The separate collection of waste of the light sources avoids that they are treated as equals as the municipal solid waste. This reduces the pollution from mercury emissions, for the health of people and the environment in general.

## 5.2 Mixed construction and demolition wastes

The exact breakdown of the demolition waste is a fundamental for the correct design of the different phases of treatment. It is important to note that the presence of impurities in the feed material recovery facility (gypsum, asphalt, wood, rubber, plastic, etc.) limits the use opportunities after the treatment and/or influences the choice of technology recycling to be taken. The removal of hazardous materials is of paramount importance in order to achieve, by the process of demolition, no contaminated materials that can be easily sent for recycling. Some substances released during the demolition may in fact not only contaminate other wastes from C&D, but also penetrate into the atmosphere or into the ground, as well as expose to risk the workers performing the demolition. In a process of correct demolition, then, the potentially hazardous materials must be removed first, for two main reasons:

1. as long as the materials are recognizable and can be manually removed, the risks for the workers will be lower;

2. the removal of materials containing hazardous substances allows to have C&D waste not contaminated by harmful substances, then more easily recycled and due to the type of non-hazardous waste, with the regulatory benefits that entails.

The materials and products used in the building industry can emit highly toxic compounds (carcinogenic or allergenic), irritating compounds and compounds with unknown toxic properties. In general, the materials and building products may release the following pollutants:

- ✓ pollutants of physical nature: radon and decay products;
- ✓ volatile and semi-volatile organic compounds, in particular formaldehyde, aromatic organic solvents, and pesticides;
- ✓ organic pollutants: mushrooms, molds, bacteria;
- ✓ natural and man-made mineral fibers: glass wool, rock wool.

The types of hazards that may occur in the waste from C&D are summarized in Table 2

| | Waste | Example |
|---|---|---|
| 1 | Some waste from construction and demolition the material used are dangerous because they contain a high proportion of materials deemed to be hazardous. | tar, paint residues and conservative, adhesives, bonding agents and certain types of plastic |
| 2 | Some materials become hazardous as a result of the long persistence in the environment in which they find themselves. | Surface reaction between building materials in origin non-hazardous and chemicals transported by the pollution |
| 3 | Some waste from construction and demolition become dangerous under certain conditions. | The wood when treated with epoxy resin and subsequently burned can emit toxic gases in the air |
| 4 | Some waste from construction and demolition become dangerous if contaminated with hazardous materials are left and/or mixed into them. | Cans of lead-based paint spilled on a pile of rubble that make the latter a hazardous waste |

**Table 2 types of hazardous in construction and demolition waste.**

In Table 3 are summarized the hazardous or potentially dangerous that it is possible to encounter as a result of demolition, construction at the site of HAL FAR. The following is the analysis of the main components that can be found in hazardous waste from C&D

| Product/Material | Potentially hazardous components | Characteristic virtually hazardous | Treatments and/or options of disposal |
|---|---|---|---|
| Paints | Lead, chromium, vanadium, solvents | Flammable, toxic | If connected to the possible low impact substrate, in the form of high-impact product. Toxic fumes when burned |
| Cement Additives | Hydrocarbon solvents | Flammable | Return to supplier, recycle, remove for special disposal |
| Waterproofing, inserts | Solvents and Bitumen | Flammable, toxic | Return to supplier, recycle, remove for special disposal; Treat before disposing |
| Stickers | Solvents, bitumen | Flammable, toxic, irritant | Return to supplier, recycle, remove for special disposal; Treat before disposing; Look for less hazardous alternative products |
| Sealants | Solvents, isocyanates | Flammable, toxic | Return to supplier, recycle, remove for special disposal; Treat before disposing; Look for less hazardous alternative products; Use water |
| Treated wood | Respirable fibers | Toxic, eco-toxic, flammable | Recycling; Low impact for components |

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| | | | Hazardous related to wood; Production toxic fumes and residue incineration |
| Mineral fibers | Respirable fibers | Irritating to the skin and lungs | Remove for special disposal |
| Resin/filler | Isocyanates/anhydrous | Toxic, irritating | Return to supplier, recycle, remove for special disposal |
| Paving asphalt | Tar, asphalt, solvents | Flammable, toxic | Recycle if treated and low hazard. If there are solvents and if the hazard is high, separate for disposal |
| Plasterboard | Possible source of hydrogen sulfur | Flammable, toxic | Return to supplier, recycle, remove for special disposal |
| Concrete, bricks, tiles and ceramics | Solvents | Toxic, Irritant, Eco-toxic | Return to supplier, recycle, remove for special disposal |

**Table 3 Potentially hazardous elements in waste from construction and demolition.**

It is obvious that the first solution to reduce if not eliminate the environmental impact following the cessation of construction and possibly a demolition of the entire structure or only partially in the case of industrial restructuring is to adopt at the time of the realization of the work a clear choice on the quality of the materials. So far it has been like this since they were introduced some constraints in the choise of the materials in the design and research and development start-up:

1. Absence of lead in the entire structure, either including the number of supply pipes of the raw materials (installations) than the delivery of elements to the whole structure (for example, the sewerage plants or thermal water and steam conduction);
2. Elimination of the treated wood as a building material;
3. Minimization of mastics and glues species in the activities of structural repair;
4. Restriction of the use of paints especially in the activities of ordinary and extraordinary post-construction maintenance.

## 5.3 Creating an uncontrolled landfill

During the process of decomposition of the waste, is formed a slightly acid (pH 5,6-6) percolate containing nitrates, sulfates, chlorides, nitrites, various and heavy metals. Not to mention the high bacterial load, among the others, streptococcus and e-coli. **Percolate** is a liquid that predominantly draws from the water inlet into the mass of the waste or from the decomposition of the same. The percolate produced by landfills of municipal solid waste is a wastewater with a more or less high content of organic and inorganic pollutants, arising from the physico-chemical and biological processes within the landfill. The percolate may contain several hazardous pollutants, not excluding heavy metals. Its characteristics are mainly these: the color is brown, variable depending on the concentration, the consistency may be more or less viscous while its smell, definable as "stagnant", anyway unpleasant. It is sufficient a tiny drop to infest any environment. These waters percolating into the soil layers are subject to purification processes related to the phenomenon of ion exchange and absorption. As a result there are the creation of high rates of soil pollution and what is not filtered arrives directly into the groundwater, polluting them. The pollution comes back to the man when using the aquifer for domestic needs or indirectly (remembering that the man is at the top of the food chain) for example irrigating the fields for agricultural use.

The quantitative characterizations are influenced by the contributions of water from the outside and the hydrogeological characteristics of the area of location. Storms, solar radiation, temperature, wind conditions, the presence of surface water bodies are the major factors in the formation of the percolate. The quality depends essentially on the physical-chemical characteristics of the waste (nature of the organic compose, nutrient availability, presence of toxic substances, the initial moisture, metal content, and these characteristics in turn depend on the type of the deposited material, from the level of the applied separate collection, to any applied pre-treatment, by the mode of deposition in landfills) and by the maintaining, within the area, of a certain degree of moisture (water balance, which depends on the type of surface coverage, capacity and permeability of absorption by the rejection, possible recirculation of percolate, method of extraction of the same). The quality of the percolate suffers, also, in time, variations that follow the evolution of the biological processes that occur within the rejection.

The percolate is one of the main problems related to the management of an uncontrolled discharge, in relation to the environmental risks that it involves. For this reason it is necessary to prevent the formation of particulate removing all the waste that generate it. The company will endeavor to do so in order that none of the equipment or accessories can remain unattended outside, but each element must be reclaimed, disposed, recovered or recycled in the most environmentally friendly way possible.

## 5.4Characterisation of wastes

The destination of waste depend on the nature of the waste it can be try a recovery of the same by executing a reclamation or a disposal. On these decisions, in addition to the type of waste, it also affects the possibility of reusing of the same (strongly related to age, and years of operation) and their marketability on the market. All the equipments that have been in direct contact with dangerous substances must still be reclaimed. The destination options of this waste are:

- Recovery
- Recycling
- Disposal

Yet it is impossible at this time to define what it will be the possible target but that disposal options will be explored at the time of site closure. To note that waste sampling methodology will be in line with EN 14899. Samples are to be analyzed by laboratories that have proven experience in waste testing and preferably ISO17025 certified. Land samples shall be analyzed according to EN13137, EN13657 (or EN13656) and EN12506 and information on both the organic and inorganic constituents in the samples shall be provided. Classification of the nature of the waste is to be carried out according to SL504.37, the waste regulations and commission decision 2000/532/EC.

# 6 Restoring the initial conditions of the site

At the completion of the demolition will be drawn up an "Application Site Report (ASR)", as required by EC Directive 96/91 on integrated pollution prevention and control (IPPC), which will aim to:

- ✓ Identify, through the site characterization, the environmental conditions, in the light of the history of the plant's production;
- ✓ Identify each substance in the seabed or subsoil, whose presence can be traced to the activities of the plant;
- ✓ Identify and implement suitable measures to restore the initial conditions of the site.

The detailed and definitive characterization plan will be drawn at the time of decommissioning of the plant, particularly in view of the historical evolution of the activities of the plant.

The main activity of recovery will be made by backfilling the main excavations due to the works of demolition and partially remodeling of the site which will be agreed with Entity of authority and control, upon disposal. The fillings and restorations will be done with excavators of medium and large size, with buckets and by trucks for the transport of the materials. The filling will be carried out in layers. The quality and size of carry-over of land will be defined with
entity of authority and control. The modelling of the site will be conducted with the blades.

The environmental matrix that will be more closely associated with the work of disposal is the soil and subsoil (with aquifers that in the case of the establishment in question is present in subsurface geography). Before proceeding with the remodeling of the possibly negotiated land with the entities of authorization there shall be a snapshot of the state of soil for the assessment of any criticals due to pollutants released from the materials stored or used in the area. This "snapshot" will be carried out through:

a) Environmental surveys such as:

- ✓ Continuous core drilling rotary and percussion drilling on three levels of depth 1 meters, 8 meters and 15 meters;
- ✓ Positioning the soil cores in core boxes;
- ✓ Picking and packing the soil samples, samples that will be taken (to date pursuant to Legislative Decree no. 152/2006 Annex 2, Title V Part IV) are at least three per survey: the first from 0 to 1 m from ground level, the second in the meter which includes the capillary fringe, the third in the intermediate zone between the two samples. In the case the stratigraphy of the perforations shows horizons with evidence of contamination, it will be necessary to proceed to the taking of soil samples representing these horizons;

b) Terebration of piezometers such as:

- ✓ Continuous core drilling with rotary and percussion drilling depth of at least 6 meters;
- ✓ Installation pipes piezometric blind and slotted, the depth of the piezometrics will still affect at least the base of the first identified aquifer and still pushed for at least 5 meters inside the aquifer itself. The instrumentation will be retractable so as to ensure the sealing surface and states that can guarantee the delivery of potential pollutants;
- ✓ Purging and sampling in order to create a story that can provide information on the health status of the area; it will also be used the the existing well on the property to collect additional samples of underground water (after purging the well); during sampling it will always be in any case carried out to determine which - quantitative water, such as relief depth of the water, determination of the main physical-chemical parameters (pH, temperature, redox potential, electrical conductivity, dissolved oxygen), execution of hydro tests, analysis of the head space (not saturated).

After this preliminary analysis of the cognitive environmental situation at time zero and the relative chemical and geotechnical analysis (in particular, in addition to the chemical compounds used in the company - chemical analysis, the geotechnical analysis will focus on the water content, the particle size, density, permeability for each soil sample representative of the lithologies encountered in the subsurface. The particle size determinations in fact provide essential information to provide what is described in the stratigraphy compiled by the competent technician, they provide important input parameters for site-specific risk analysis). It will be possible to develop a conceptual model of the final site, organizing the information collected in order to determine the effects of the activity on the site and then identifying:

1. The sources of present and past contamination;
2. The dominant features of the environment with which the site interacts (shallow aquifer type, deep of the main aquifer, proximity of the river, weather and climate characteristics) related to the concentration of any contaminants acceptable for their particular solubility, volatility, biodegradability and bioavailability;
3. Detected any anomalies it is necessary to proceed to the remediation of the site through the below described activities

## 6.1 Remediation of the site in case of contamination

In case of disposal and contamination of the site there will be performed the following tasks for cleaning up:

- ✓ Excavation, removal and backfill near the "spots of contaminated soil" and where there are not detected potential sources of pollution (underground pipes);
- ✓ Reclamation plant and equipment - particularly the storage silos of the solvents used in the manufacturing process and process waste must be cleaned and disposed of with the best available techniques;
- ✓ Analysis for waste approval: In particular, there will be performed the acceptance tests of the waste produced during the decommissioning of the site, operations involving the control of the EWC code to verify that it is authorized to dispose from the regional lists;
- ✓ Waste management and disposal will have to refer only to authorized dealers by the legislation in force;
- ✓ Restoring brownfields to frame in the context in which it is immersed. In fact, the restoration of the areas means taking advantage of the existing infrastructure and reconverting the productive capacity but restoring the environmental best possible quality.

In such cases, the analysis must be repeated for the confirmation of the correct soil remediation and restoration of the original conditions.

# 7. Conclusion

At the time of the demolition, sale or disposal, it will be possible to make an assessment on the health state of the environment (with particular reference to soil and groundwater) being able to analyze the matrices and compare them with those of neighboring environments.

Although assessment will need to be carried out at the time of demolition, the results of this assessment will need to be compared with levels measured towards the beginning of operations. In this regard a land and groundwater risk assessment will need to be carried out at the earliest so as to assess whether a baseline report and monitoring strategy will need to be established. Through this evaluation it will be determined the need to create a starting profile on the physic - chemical state of the soil. Times and methods will be decided in accordance with the MEPA directions and the business needs. The same section of the project description will be updated with this indication.

In this regard Sterling will refer to make particular reference to EC Guidance 2014/C 136/03 concerning baseline reports under Article 22(2) of Directive 2010/75/EU on industrial emissions.