

Guidelines: Secondary Aluminum Works

PCFC- Entity (Business Unit) Name	:	Corporate Support Centre
Department Name	:	Environment Health and Safety Department
Section Name	:	Environment Section
Document Reference Number	:	PCFC-CSC-EHS-ENV-G14
Revision Number	:	00
Revision Date	:	January 2018
Classification	:	Public

14.1 Introduction

- These notes apply to works in which:
 - ⇒ Aluminum swarf is degreased by the application of heat; or
 - ⇒ Aluminum or aluminum alloys are recovered from aluminum or aluminum scrap fabricated metal, swarf, skimming, drosses or other residues by melting; or
 - ⇒ Aluminum is recovered from slag; or
 - ⇒ Molten aluminum or aluminum alloys are treated by any process involving the evolution of chlorine or its compounds.

The materials used in above processes or the products are treated or handled by methods which cause noxious or offensive substances to be evolved.

- The notes are intended in to provide a basis for consultation between works management and the Authority with flexibility to meet special need and circumstances.

14.2 Sampling and Measurement of Emissions

- As part of proper supervision, the owner shall make tests and inspection of the process. The results of tests and inspection shall be recorded and made available for examination by the Authority representatives. The frequency of testing shall be determined by the Authority after discussion with the works management.
- Tests shall be carried out periodically for emissions of chlorine and hydrogen chloride, where applicable.

14.3 Emission Limits and Controls

- The concentration of particulate matter in emissions to air from furnaces using salt as a flux shall not exceed one hundred fifty (150) mg/m³. Emissions shall also be substantially free from persistent mist or fume.
- The concentration of particulates in emissions to air from swarf degreasing furnaces shall not exceed one hundred fifty (150) mg/m³.
- The concentration of particulates in emissions to air from operations in which dross is treated mechanically for the recovery of metal residues shall not exceed one hundred fifty (150) mg/m³. HF/SiF₄ not to exceed twenty (20) mg/m³.
- Concentration of chlorine in emissions to air shall be as low as practicable, and in no case shall exceed ten (10) mg/m³.
- Concentration of hydrogen chloride in emissions to air shall be as low as practicable, and in no case shall exceed twenty (20) mg/m³.
- Where a wet method of gas cleaning is used, the emission from any chimney or final outlet shall be free from liquid droplets.

14.4 Operational Controls

- Treatment of Oily Swarf and Contaminated Scrap
 - ⇒ Aluminum swarf contaminated with oil-based materials shall not normally be fed to a processing furnace, but shall be treated substantially to remove the oil so as to meet the smoke limit in above paragraph. Alternatively, additional equipment, such as an afterburner, may be installed, effectively to consume smoke emissions from charging of contaminated swarf.

⇒ Charging of contaminated scrap, other than swarf to furnaces shall be controlled so as to minimize emissions to air.

- Arrestment Plant

Because of the corrosive nature of the emissions from most secondary aluminum operations, particular emphasis shall be paid to the selection of suitable materials of construction for ducting, arrestment plant and chimneys.

- Use of Chlorine

The storage, handling and use of chlorine shall be carried out with particular care to prevent emissions to atmosphere preferably to the supplier's recommendations, and to the satisfaction of the Authority. Safer alternates are recommended for use.

- Use of Fluoride Fluxes

The storage, handling and use of chlorine shall be carried out with particular care to prevent emissions to atmosphere preferably to the supplier's recommendations, and to the satisfaction of the Authority. Safer alternates are recommended for use.

- Dross Handling and Recovery

⇒ Drosses from the processing furnaces shall be handled and stored in such a manner as to prevent particulate emissions to atmosphere. Drosses shall be cooled in covered containers or tipped for cooling purposes in an enclosed building, with adequate extraction to arrestment plant if necessary in the opinion of the Authority.

⇒ Dross recovery operations shall be fully enclosed and extracted to suitable arrestment plant, and the remaining dross residues shall be discharged in a manner which produces no significant visible dust.

- ⇒ Where drosses and other materials contain compounds which emit noxious or offensive gases on the application of heat or contact with water, e.g. arsine or stibine they shall be stored under dry conditions in clearly marked bays or containers. Procedures for processing such materials shall be agreed with the Authority.

14.5 Chimneys

- Chimney heights for secondary aluminum plants shall be determined by the Authority after discussion with works management.
- The minimum chimney height for any rotary furnace using salt flux shall normally be thirty seven (37) meters and for other furnaces shall be three (3) meters above the roof ridge of the building to which it is attached or close by tallest building. The height may need to be increased to allow for local circumstances such as topography, nearby buildings and existing emissions.
- The efflux velocity shall not be less than fifteen (15) m/s at full load operation. Where a wet method of arrestment is used, the linear velocity within the chimney shall not exceed nine (9) m/s.
- For combustion process, not less than the acid dew point and in any case, not less than 80°C.

14.6 Environmental and Health Effects

Pollutants that are emitted by secondary aluminum production processes and include organic hazardous air pollutants (e.g., dioxins, furans, benzene, styrene, xylene, acrylonitrile, methylene chloride, naphthalene, and formaldehyde); inorganic hazardous air pollutants (HCl, HF, and Cl), and hazardous air pollutant metals (antimony, arsenic, lead, manganese, beryllium, cadmium, chromium, cobalt, mercury, nickel, and selenium). Emissions of these pollutants would be decreased by implementation of the proposed emission limits. Some of these pollutants are either known or probable human carcinogens when inhaled, and can cause reversible and irreversible toxic effects other than cancer following sufficient exposure. These effects include respiratory and skin irritation, effects upon the eye, various systemic effects including effects upon the liver, kidney, heart and circulatory system, neurotoxic effects, and in extreme cases, death. Following is a summary of the

potential health and environmental effects associated with exposures, at some level, to emitted pollutants that would be reduced by the standard.

These metals can cause a range of effects including irritation of the respiratory tract; gastrointestinal effects; nervous system disorders (including loss of coordination and mental retardation); skin irritation; and reproductive and developmental disorders. Additionally, these metals accumulate in the environment and several of them accumulate in the human body, and may cause adverse health effects after exposure has ceased. Cadmium, for example, is a cumulative pollutant that can cause kidney effects after the cessation of exposure. Similarly, the onset of effects from beryllium exposure may be delayed by months to years. Many of the metal compounds also are known (arsenic, chromium (VI)) or probable (cadmium, nickel carbonyl, lead, and beryllium) human carcinogens.

Effects generally associated with short-term inhalation exposure to these pollutants include irritation of the eyes, skin, and respiratory tract; central nervous system effects (e.g., drowsiness, dizziness, headaches, depression, nausea, abnormal electrocardiograms); and reproductive and developmental effects. Health effects associated with long-term inhalation exposure in humans to the organic compounds which will potentially be decreased by the proposed standard may include mild symptoms such as nausea, headache, weakness, insomnia, gastrointestinal effects, and burning eyes; disorders of the blood; toxicity to the immune system; reproductive disorders in women (e.g., menstrual irregularity or increased risk of spontaneous abortion); developmental effects; and injury to the liver and kidneys.