Brief description of the criteria and areas of intervention of the Experimental Applied Research with Environmental and Health Monitoring Plan

All that has been illustrated so far can be confirmed with experimental *applied research* in ***Environmental and Health Monitoring Plans (PMAS)*** as required by various administrative authorization procedures (EIA, AIA, AUA).
Below we illustrate the numerous issues that are generally and/or can be addressed in PMAS with *Chemical-Physical-Biological Monitoring and related Toxicological-Epidemiological Risk Assessments*.

Chemical-physical toxicological monitoring for the determination of emissive-immissive sources and their environmental impact:

Emissions into the atmosphere from production plants;

Ambient air quality in the light *of the application of* ***pollutant dispersion modelling in the air*** *involved in the emission diffusion/dispersion mechanisms;*

Identification of **ambient air pollution indicators** that take into account not only the standardized parameters but also organic **and inorganic micropollutants with known toxicological and carcinogenicity characteristics and sequential Evaluation with Toxicological approach** (Risk Assessment);

Quality of water bodies *receiving* discharges; including emerging non-regulated pollutants;
Quality of the soils involved in *the deposition of pollutants* from industrial activities;
Quality of the agricultural soils involved with sludge spreading techniques used as fertilizer soil improvers;

Olfactory harassment; characterization of gaseous emissions/immissions into the atmosphere (olfactometric, chemical, toxicological, modeling);

Biological Ecotoxicological Monitoring for the determination of the health status of animal and plant organisms at different trophic levels exposed over time to environmental impact; organisms chosen from the following biological models, internationally standardized and widely used for toxicity and environmental impact studies, can be used:

Plants: *Lepidium sativum (watercress) and Sorghum saccharatum (sorghum).*

Soil worms*: Eisenia andrei. Protozoa****:*** *Dictyostelium discoideum.*

Crustaceans: *Daphnia magna.* ***Unicellular green algae:*** *Pseudokirchneriella sub capitata.*

Fish: *Zebrafish (Danio rerio);* ***Bacteria****: Vibrio fischeri.* ***Sediment worms and pore water:*** *Celegans.*

Insects: *Bee (apis mellifera)*

Climate and Noise Impact Assessment: Sound Source Analysis pertaining to the plant, including induced vehicular traffic.
Identification of the sensitive receptors potentially most exposed to emissions.

Analysis of the municipal acoustic zoning plan and identification of the acoustic class to which the sources and receptors belong. Evaluation of the acoustic climate before the construction and the acoustic climate after the construction with analysis of the compatibility of the latter with the acoustic class to which it belongs with reference to compliance with the legal limits in force (absolute limit of immission and emission, differential limit of immission).

Estimation of the effects on the health of the population in terms of incidence on pathologies sensitive to noise exposure (The correlation between noise levels and blood pressure and ischemic coronary artery disease on the one hand and depression and anxiety on the other are supported by numerous clinical studies and by the World Health Organization).

and with the elective collaboration[1] of the WG of the Department of Environment and Health of IMN for the Toxicological and Epidemiological approach

Health monitoring of a sample of the population chosen from among the non-exposed and those potentially exposed for the determination of the state of health with *an approach of prevention* of potential damage that can be assessed with "in vivo" biological monitoring and/or with the use of "in vitro" cellular exposure techniques (complementary method).

Biological Monitoring. The clinical toxicological examination, which precedes biomonitoring, must evaluate, in addition to the complete medical history of the patient, the possible sources of occupational and non-occupational exposure, their quantification, duration and extent and the potential and current health effects. The assessment of the functionality of the various systems (cardiovascular and respiratory in the first place) must be commensurate with age, gender, ethnicity, risk factors, occupation, lifestyle, nutrition, etc., and the type of exposure to which the individual is subjected. Subsequently, to ascertain the exposure, a biomonitoring action is undertaken, which is the measurement of the quantity of a chemical substance, and/or its metabolites in a biological sample of the individual. At the same time, in addition to these exposure markers, effect markers are also evaluated, which are biochemical, physiological and behavioral alterations associated with potential health effects. It is also necessary to collect data on any susceptibilities that may make the individual prone to the toxic effect of various substances, for example those with pre-existing cardiovascular and pulmonary diseases (ischemic disease and heart failure, asthma, emphysema and chronic bronchitis), diabetes, child and elderly population. The choice of biological matrices depends on the marker searched for and, although the most common are blood and urine, biomonitoring can be carried out on any matrix (***Whole blood and serum, Urine, Hair, Saliva, Breast milk, Umbilical cord blood, Breath Analysis combined with spirometry).*** In addition, ***the population should be monitored for both acute and chronic effects of exposure to airborne pollutants and noise, such as***: Nasal and laryngeal eye irritation, Wheezing and difficulty breathing, Coughing and chest tightness, Worsening of existing lung and heart problems, such as asthma exacerbation, Increased risk of heart attacks, Aggravation of lung and cardiovascular diseases, Decreased pulmonary and acoustic function, Increased frequency and severity of respiratory symptoms such as difficulty breathing and cough, Increased susceptibility to respiratory infections, Effects on the central nervous system such as impairments in behavior, memory and learning

A complementary method (inVitro) is the evaluation of the damage of cell lines exposed to the pollutant matrix (generally inhalable dust). Normally exposure occurs with human cellular models of the Respiratory, Hepatic, Blood, Neuronal and Renal systems (2D and 3D models) static and dynamic.

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with a definition of the population [in the geographical sense] potentially affected by the work, its essential demographic and social characteristics, the possible presence and relative identification/specification of groups that require special attention [e.g. because of their susceptibility];

identification and estimation of the expected effects of the plant on the health of the population [e.g. in terms of: *mortality, years of life expected / lost / gained, incidence / prevalence of diseases / disorders, consumption of health services* etc.], distinguishing acute *effects from chronic ones*, with specific reference to the different exposures of chemical origin determined by the source itself and their mode of action [*continuous, repeated, peak exposures, etc.*], indicating as far as possible the quantitative dimension [at least in terms of measurement scale] of the phenomenon [*number of expected or additional cases*];

The specific Working Group on Epidemiology is a member of the also the WG of the Research Center in Epidemiology and Preventive Medicine (EPIMED) relating to the Department of Medicine and Surgery[2] of the University of Insubria (UNINS) of Varese.

[1] Regulated by the Technical-Scientific Agreement between IMN and #Ecologja (Dec 2022) and by art.4 network contract (Oct.2022)

[2] Collaboration regulated by the framework agreement between the Department of Medicine and Surgery of the University of Insubria and the #ecologja business network, signed in February 2026.