



Environmental Laboratory Services

Occupational Health Group



Biological Monitoring
for Trace Elements

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Introduction

Environmental Laboratory Services is one of New Zealand's leading experts in the areas of:

- Air quality monitoring
- Boiler water
- Environmental water
- Landfills
- Meat industry services
- Potable water for councils
- Sample Integrity
- Swimming pools
- Biological fluids
- Ceramicware and metal food containers
- Food and Dairy Products
- Legionella
- Metals
- Potable water for small communities
- Sewage and effluent
- Trade waste

The company has its origin as part of the Hutt City Council Laboratory and became a private enterprise in 1994. In 1998 the laboratory acquired the Wellington City Council Laboratory. In September 2001, ELS further expanded with the purchase of the Inorganic Chemistry section of AgriQuality New Zealand. This section was previously part of ESR, which before that was the DSIR.

We are based in a purpose built facility of 1450 m² at 85 Port Road, Lower Hutt. ELS is comprised of four separate laboratory areas – Instrumental Chemistry, General Chemistry, Biological Fluids, and Microbiology. The latter is further split into three separate rooms with clean, cleaner and ultra clean capabilities. The ultra clean lab is used for pathogenic bacteria determinations.

ELS is privately owned by scientific people committed to the science industry in New Zealand. We continue to be one of the few major laboratories in the country with such a broad microbiological and chemical analysis capability. We provide high quality, fast turnaround analyses at competitive prices.

Who should read this brochure?

This brochure has been prepared for all employers and workers working within industries where health can be affected by metal contamination.

Biological Monitoring for Health Reasons

The Health and Safety in Employment Act 1992 requires employers to identify and then minimise hazards that cannot be eliminated. All practicable steps are to be taken to ensure a hazard does not harm employees and others.

There are two acknowledged techniques to monitor the working environment of your premises. The first is to monitor the environment itself and therefore making the assumption that if a certain level of exposure to hazardous substances is not reached, then it must be safe for your staff to work in.

The second technique looks at each staff member working within that environment, and monitor his or her health directly. This approach treats each person as an individual and is a better way of assuring staff safety.

This biological monitoring of workers evaluates the internal exposure or internal dose of a chemical agent that each person actually ingests from their environment.

ELS specialises in the measurement of substances in blood, urine and serum samples. We provide valuable information for each worker over time frames appropriate to the substance under evaluation. We recommend routine monitoring of each worker so that current or past exposure to industrial chemicals is checked and that potential excessive exposure can be identified before health effects arise.

Monitoring each staff member overcomes variability in substance uptake due to differences in the industrial environment. Each measurement also includes non-occupational background exposure and is therefore more directly related to adverse health effects than environmental monitoring alone. We are able to analyse samples from people who are exposed to a range of industrial chemicals including metals, and Fluoride. We are able to subcontract samples to other laboratories for analysis of other chemicals.

ELS reports provide an interpretation of analytical results in relation to environmental levels and Biological Exposure Indices. We make recommendations where further monitoring should be undertaken and where workers should be suspended to avoid further exposure. We also provide advice on appropriate sampling programs and sampling procedures.

For confidentiality purposes, all data is maintained on a purposely built, separate and secure database. Access to the information is limited to the senior analysts working on the samples.

Biological Monitoring – Specific Applications

Occupational Health

The majority of our work has been concerned with occupational exposure to toxic metals. Our clients in this instance are Occupational Health Nurses and Physicians within industry and sometimes General Practitioners who become involved when their patients show symptoms that may be related to their work.

The main elements of concern are:

- Copper, Chrome and Arsenic in the timber treatment industry
- Lead from radiator repairs, cleaning of petrol tanks, and surface preparation where paints containing Lead have been involved
- Cadmium in the plastics industry
- Cobalt from grinding operations, particularly for saw-doctors
- Mercury in the gold mining and electrical industries
- Fluoride in the manufacture of fertilisers

We also perform trace metal analysis of bismuth, thallium, silver, tin, uranium and barium. A full list of elements is shown on page seven.

Clinical

The main elements requested from Hospital and Community Health Laboratories are aluminium for dialysis patients, copper as an indicator of certain illnesses, and manganese, zinc and selenium where there is a concern about dietary deficiencies.

For Toxicologists we routinely determine lithium and carry out heavy metal screens to pick up possible poisons.

Environmental Health

The main element of concern in the non-occupational environment is lead derived from old paints on houses. Those most at risk are children and people involved in home maintenance without any awareness of the hazards associated with the removal or treatment of surfaces that have been painted with lead based paints.

There are a variety of other potential problems in particular environments usually associated with a contaminated industrial site, which has passed into some other use. In New Zealand some common examples are old timber treatment sites contaminated with boron, copper, chromium and arsenic; tailings dumps from mineral extraction processes containing mercury, arsenic and other heavy metals; sites contaminated with petroleum sludges containing lead.

Saw Doctors

Cobalt is a naturally occurring element that has properties similar to those of iron and nickel. Small amounts of cobalt are naturally found in rocks, soil, water plants, and animals. Elemental cobalt is a hard, silvery grey metal. A biochemically important cobalt compound is vitamin B12, which is essential for good health in animals and humans.

Cobalt metal is usually mixed with other metals to form alloys; the cobalt makes the alloy hard or resistant to wear and corrosion. For this reason workers in the Sawdoctor and Knifegrinder industries are often exposed to cobalt. Breathing of cobalt containing dust is a known hazard in the manufacture and maintenance of hard metal alloy tools.

Wet grind processes, in particular, have been found to be the principal source of cobalt. This is because the coolants that are used in this process dissolve the cobalt binder and these coolants are recirculated, often for weeks or even months unchanged. The spray produced by these coolants during tip grinding creates aerosols rich in cobalt that are breathed in by the operators. Stellite blades, although containing much more cobalt than tungsten carbide blades, are a harder alloy and ground fines do not dissolve as readily in coolant solutions. Dry grinding produces lesser amounts of cobalt for absorption providing adequate local exhaust ventilation is used.

Oxy-acetylene brazing should not produce much exposure to cobalt as it operates at a temperature below the evaporation temperature of cobalt but if the solder contains cadmium then inhalation of cadmium fume is possible. The use of gas shielded arc welding (MAG) with satellite blades however will produce much more cobalt fume.

The Health and Safety in Employment Act 1992 requires employers to identify all hazards in the workplace and then minimise hazards that cannot be eliminated. All practicable steps are to be taken to ensure a hazard does not harm employees and others. Biological monitoring of workers using urine cobalt and cadmium analysis is an effective means of assessing worker exposure from work processes, personal habits and accumulated workplace dust. Biological monitoring results can be used to show that a safe work environment exists.

We recommend a check every 12 months for all workers, however if the first result taken is close to or exceeding the Biological Exposure Index of 15 µg/L then a repeat test should be done the following month. It is important to sample at the correct time of the week to get a representative sample of the normal work practises of each person. It is recommended that workers collect samples at the end of the day at the end of the workweek. Samples need to be collected in a clean environment to avoid contaminating the sample with dust. We recommend sampling after overalls have been removed and preferably after a shower.

Biological Monitoring Test List

The following elements are routinely available for all matrices detailed in the previous pages.

<u>Exposure/Assay</u>		<u>Sample</u>
Aluminium		Serum and urine
Antimony		Urine
Arsenic	- Inorganic	Urine
	- Total	Urine and Blood
Barium		Urine
Cadmium	- Recent	Blood
	- Body Burden	Urine
Chromium		Urine
Cobalt		Urine
Copper		Serum and Urine
Gold		Serum
Lead	- Inorganic	Blood
	- Organic	Urine
Lithium		Blood
Manganese		Blood and Urine
Mercury	- Inorganic	Urine
	- Organic	Blood
Molybdenum		Urine
Nickel		Urine
Silver		Serum
Selenium		Blood and Urine
		Urine
Thallium		Urine
Zinc		Serum and Urine
Fluoride		Urine

An environmental scan is available for urine. The sample is analysed for inorganic arsenic, cadmium, cobalt, chromium, copper, lead, mercury & nickel.

Other analytes that are available on request are beryllium, bismuth, tin, vanadium, uranium and tungsten.

Subcontracting

In the unlikely event that we are unable to perform an analysis we will subcontract it to an appropriately qualified laboratory and note this on the report.

Sampling and Reports

"The result of any test can be no better than the sample on which it is performed".

The objective of sampling is to collect a portion of material small enough in volume to be transported conveniently and handled in the laboratory while still accurately representing the material being sampled.

Sample Containers and couriers

ELS provides urine containers and Biobottles for the collection and transportation of samples as well as return courier tickets and all the relevant information that you require to collect samples.

ELS does not provide vacutainers for the collection of blood samples, please contact your local medical laboratory to collect blood samples for you. Contact ELS approximately 1 week prior to requiring containers so that they can be dispatched to you in time for sampling.

Sample Collection

It is important for the sample collection to be done at the same time each month so you can compare the results over time. Assuming that there has been continual exposure over the working day, the following sampling periods are defined by OSH:

Prior to Shift.	Following a period of 16 hours with no exposure.
End of Shift	The last two hours to immediately following the end of the working day
End of Work Week	After at least four days with exposure.

ELS recommends that you do one round of baseline monitoring, ie prior to shift to establish "normal" individual levels then regular "end of shift at the end of work week" samples.

Blood samples

Blood samples for metals should be collected in a metal free vacutainer tube containing lithium heparin, sodium heparin or EDTA. A good brand is Becton Dickinson Vacutainer Systems. The 5ml green top tubes containing lithium heparin are most commonly used by our clients but purple or blue top tubes are suitable as well.

To avoid contamination from the skin prior to taking a sample, please ensure that everything is adequately cleaned.

We need a minimum volume of 2 ml of blood per person but 3-4ml is ideal.

Tubes should be labelled with the persons name using a biro or other indelible marker that won't smudge.

Once the blood has been collected by the nurse, the tubes should be inverted several times to mix the samples and stored at room temperature until sent to us for analysis.

Placing the blood in a fridge or freezer will risk haemolysing the sample and we will not be able to measure the packed cell volume of the blood.

Urine Samples

ELS will provide you with one specimen container per person. The container provided will be clean and will not contain any preservative.

Urine samples can easily be contaminated with dust from hands, hair and clothing. Special care should be taken to avoid getting dust into the sample, so the removal of dirty overalls etc before producing a sample is advised.

The urine should be collected directly into the urine containers provided, not into something else and then transferred into the urine container.

We need a minimum volume of 40 ml. The containers hold 60 ml but please don't over fill it. The persons name and sample date needs to be written on the container with a biro or other indelible marker.

Some people seem to have trouble getting the lids on. Please make sure the lids are on securely but not cross-threaded or on so tight that the jar cracks.

Once the sample has been produced it can be stored at room temperature or in a fridge that is not used to store food or chemicals until it is ready to be sent to us for analysis.

Packaging and Sample Details

Samples should be dispatched to us as soon as possible after collection. Our laboratory is open to receive samples on Monday through Friday from 8am to 5pm except public holidays.

Samples must be returned to our laboratory in the bio-bottles that we will provide for you. The samples should be placed in the plastic bio-bottle containers and packaged so they won't break in transit. Use paper towels or bubble wrap to keep the samples from breaking, especially the blood tubes. Place the lid securely on the bio-bottle and put inside the cardboard box.

Please complete the sample form. The individual names should be listed on the back of the ELS form. This information will be used on the report. For traceability reasons, please list a surname and either an initial or given name. A date of birth is optional, but is often a good idea also. The paper work should not be put inside the bio-bottle in case the samples leak. It should be put between the box and the bottle.

Transporting samples to ELS

ELS has an easy to use courier system in place with NZ Couriers using approved transport containers (Biobottles) and NZ Courier charge labels. Please check that a company with the correct licence to transport diagnostic samples within New Zealand carries the samples.

Attach the enclosed NZ Couriers charge label to the outside of the bio-bottle box.

Swap the address cards around so the "To" pocket contains the ELS address card. If the pocket is loose please put a piece of tape across it to stop the card falling out.

Contact your nearest NZ Courier office to collect a parcel. Please note that a courier must send samples. They must not be sent by post.

Our delivery address is:

Occupational Health
Environmental Laboratory Services
85 Port Road
LOWER HUTT

Reporting

Reports will be sent to the person nominated by you to receive confidential information. The original report will be sent by post and urgent results may be faxed or e-mailed if required.

Reference figures and normal levels will be reported where available. We can issue the reports as one sample per report, with or without the 'normal values' information, or in a format that prints all the results in one report with or without the normal values.

Where it is applicable we will report the test values against OSH workplace guidelines.

The format of the report is dependent on the final user of the data.

Quality Assurance

Quality control samples will be analysed with each batch of samples submitted.

ELS participates in a monthly Inter-laboratory Comparison Program (ILCP) in which many laboratories all analyse the same sample. Results are compared across the laboratories so that labs can monitor their progress and identify any problems.

Turn around times

Our standard turn around time is 7-10 working days from receipt of the samples.

If the samples are going to be sub contracted to another laboratory we will issue a preliminary report once our work is complete and a full report once their results are received.

Urgent samples can be accommodated.

Contact Details

Please feel free to contact ELS by any one of the methods shown below.

TELEPHONE

Main lines to Central Services

Main Telephone	(04) 576-5016
Facsimile	(04) 576-5017
Free Phone	(0800) 576-5016

Direct Lines

Joanne	Accounts	(04) 568-1205
Rob Deacon	General Manager	(04) 568-1203
Sue Meiklen	Occupation Health	(04) 568-1207
Sunita Raju	Microbiology	(04) 568-1206
Terry Manning	Managing Director	(04) 568-1204
Tracy Morrison	Instrumental Chemistry	(04) 568-1200
Jacinta Hira	General Chemistry	(04) 568-1209

Email can be directed to staff using "first initial last name"@els.co.nz

COURIER

85 Port Road, Seaview, Lower Hutt, New Zealand.

MAIL

P.O. Box 36-105, Moera, Lower Hutt, New Zealand.

EMAIL

General Information: solutions@els.co.nz

WEB

www.els.co.nz



NZFSA Laboratory Approval Scheme
Accreditation Number 905

IANZ Accreditation Numbers:
Biological 639, Drinking Water 787,
Chemistry 414, Dairy L1921