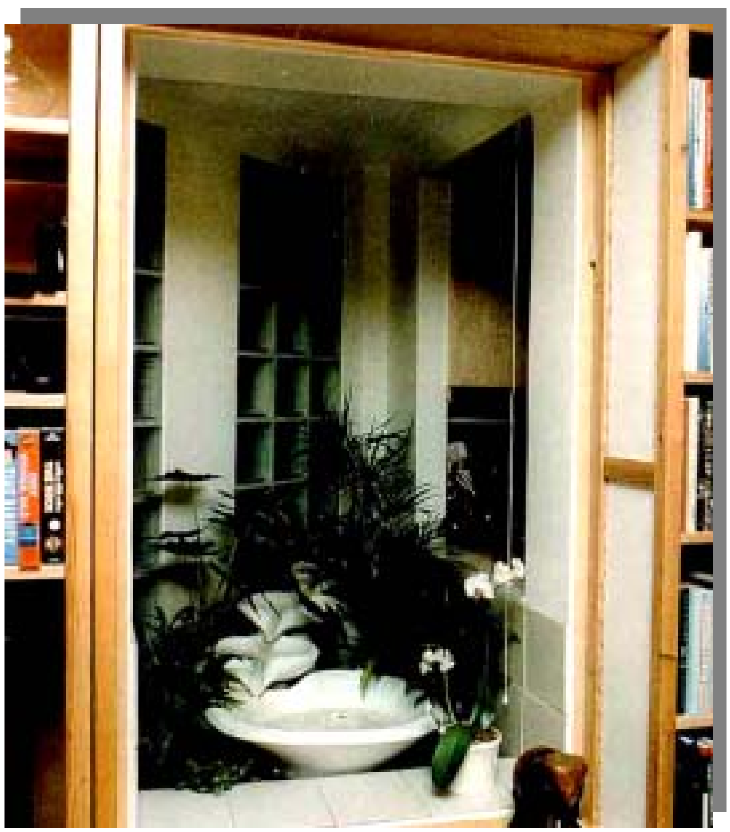
The Inspektoren Residential Area

Work Package 4.1

Kalmarhem Ltd

Interior Environment

– Report –



Kalmar, Sweden 2002

Kalmarhem Ltd - Scandiaconsult Sverige AB - BRa VVS-Konsult AB

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1. GENERAL

The Inspektoren area constitutes a rather typical residential area from the post-war era. The area, now under the administration of Kalmarhem AB, was completed in 1956 and consists of five three-storey buildings containing in total 159 flats with a living area of approximately 7000 m^2. The total land area amounts to some 15 700 m^2. Kalmarhem AB has carried out a total renovation of the residential area.

All the basic consumption parameters and respective environmental factors were measured within the framework of a selected measurement group of tenants with the aim of evaluating conditions in the area.

2. CONDITIONS

2.1 Goals regarding Interior Environment

One of the measurements made before the refurbishment was the electromagnetic fields in a number of flats. The objective of replacing the electricity installations was to reduce the electromagnetic fields in the flats.

Measurement of radon gas levels was also carried out, the goal being to reduce the annual mean value to lower than for newly built flats, i.e. less than 200 Bq/m3.
Problems with allergies were to be tackled by installing central vacuum cleaners, amongst other measures.
Draught problems were to be reduced by installing supply air units with filters and pre-heating and filtering of exterior air.
The goal set up for the reconstruction of the ventilation plant was to achieve the best interior climate with the available technology plus to minimise energy losses.

The goal for the construction process was to select low emission building materials and paint.
Noise from the adjacent streets was investigated and the goal in this respect was to decrease the interior noise levels to below the limits stipulated by replacing the windows.

3. INTERIOR ENVIRONMENT

3.1 General

A model for evaluating building materials' suitability from a recycling perspective was produced in collaboration with the Institute for Construction Ecology. The choice of materials was judged from content of renewable raw materials or recycled materials, among other factors. Recycling, the interior environment and the working environment are all taken into account.
Evaluation was based on whether a product fulfils the "Natural Steps" four system conditions:

- Does the product contain substances on the Chemical Inspectorate's list?
- Are there emissions that constitute known health risks?
- How is the used product disposed of?
- Does any environmentally hazardous waste product arise?

3.2 Interior Environment in the Inspektoren area

3.2.1 Earlier measurements and measures in the Inspektoren area

With the aim of determining the conditions in the area before refurbishment took place, a special measuring group was organized to establish the basic consumption figures and environmental factors. The objective was to create a basis for new measurements after refurbishment.

Inside the flats measurements were taken of electromagnetic fields, noise levels, radon gas and an obligatory ventilation inspection was carried out.

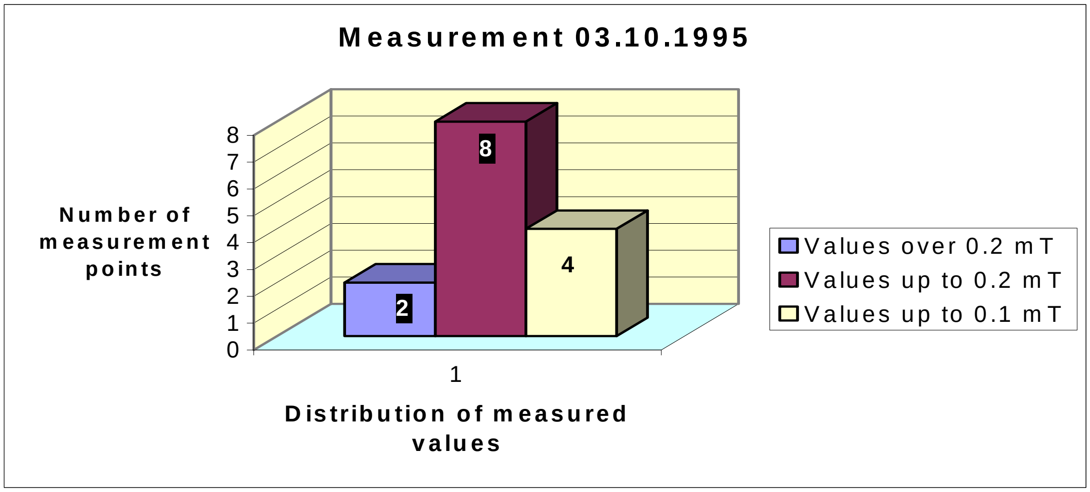

Figure 1: Levels of electromagnetic fields before refurbishment

Table 1. Calculation of noise levels

	Norra vägen Bedroom	Norra vägen Kitchen	Olandsleden Bedroom	Ölandsleden Kitchen	Kungsgårdsv Bedroom	Kungsgårdsv Living room	Kungsgårdsv Kitchen	Rec.value New building	Rec.value Exist. building
Interior Equivalent level	32	36	29	29	25	26	25	30	
Max level	41	45	35	36	43	44	43	45	
Exterior Equivalent level	57	57	58	58	58	58	58	55	65
Max level	67	67	65	65	76	76	76	70	

3.2.2 Interior Climate in Inspektoren area after refurbishment

After completion of the refurbishment work and the return of the tenants to their flats, the somewhat enlarged measurement group started their task of documenting the interior environment.

The measurement group worked according to a time plan in which all measurement areas were described. The measurement areas related to the interior environment are illustrated below together with the specific measurements that were planned.
In order to improve the interior environment, preparations were made during the refurbishment phase for the later installation of a central vacuum cleaner in each flat.

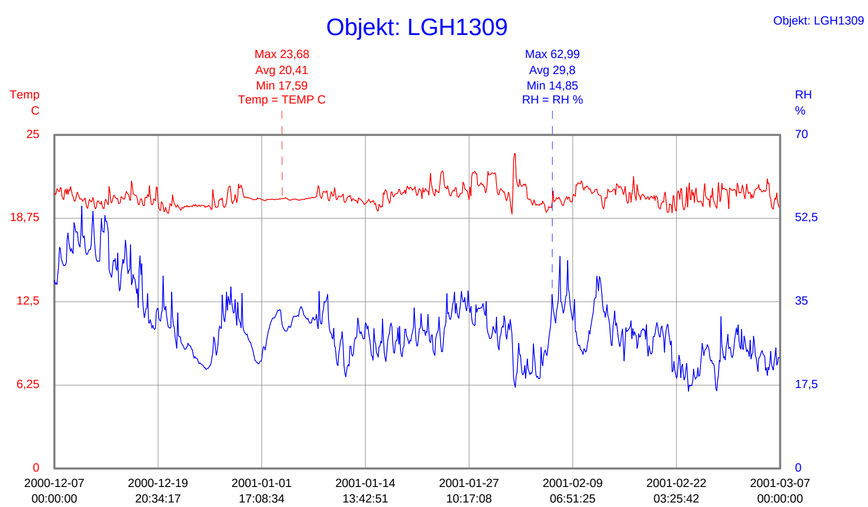

Figure 2: Temperature and relative humidity after refurbishment. Measurement period from 07-12-00 till 03-07-01.

Comfort
- Air temperature CAS, Comfort Account System: continuous logging of temperature
- Floor temperature (measurements not made)
- Air velocity (measurements not made)

Air quality
- Carbon dioxide CO^2 with gas analyser (measurements not made)
- Relative humidity

Radon
- Radon levels inside flats

Radon in the interior air according to stipulated norms must not exceed 400 Bq/m^3 radon gas annual mean values in existing houses.
The annual mean level for the flats in the Inspektoren area during the measurement period 07-12-00 to 07-03-01 was 50 – 90 Bq/m^3. For the flat shown here the value was less than 50 Bq/m^3. The measurements were made using tracer film and filter in accordance with Radiation Protection Institute.

Table 2: Radon measurements Flat no. 1309

Meter no.	Type of room	Floor	Measured value Bq/m^3
31534-1	Bedroom	2nd	40
31534-2	Bedroom	2nd	30

Ventilation
Measurements partly included in OVI (Obligatory Ventilation Inspection)
-Exterior air (measurement not made)
-Air flow
-Recycled air (measurement not made)
-Air change rate

Table 3: Measurement values from OVI Flat 1309

Type of room	OVI 1995	OVI 2000	Remarks
Kitchen	13 L/S	10/30* L/S	* Forced
Bathroom	10 L/S	15 L/S	

Air change rate increased from 1.3/h to 1.42/h after refurbishment

Noise
-Background level from waste disposal units, lifts (measurement not made)
-Footstep sound (measurement not made)
-Noise
-Echo (measurement not made)

Light
-Lighting, measurement in Lux: interior, communal parts

Table 4. Lighting measurements in Lux

Place	By lift	Landing ½	1st floor	Landing 1½
Entrance/staircase Night-time	50			
Entrance/staircase Fully illuminated	75	50	40	50
Basement corridor	Variation max. value 100 lux, min. value 25 lux			

Magnetic fields
Measurements after refurbishment showed that electromagnetic fields had decreased in general. Guideline value for flats is 0.2 mTesla.
Replacement of 4-core cables with 5-core and other changes has contributed to the good result.

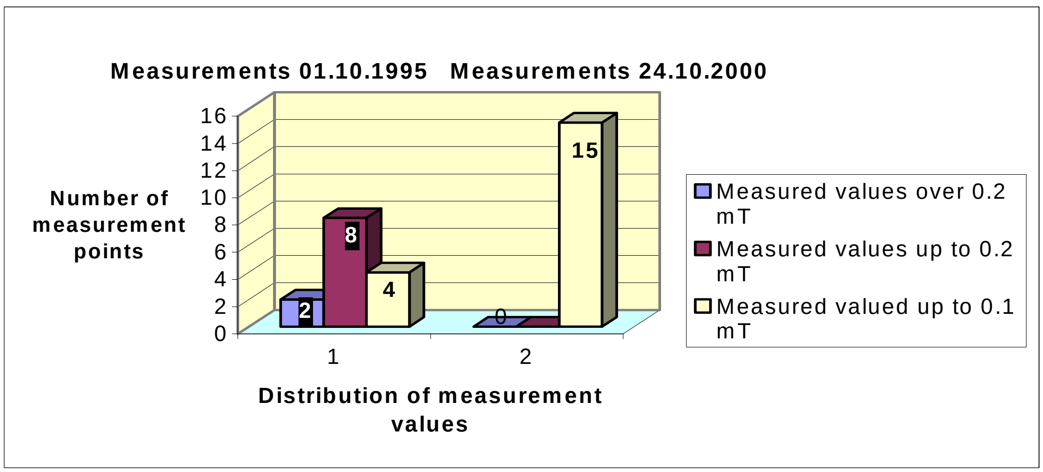

Figure 3. Comparison of electromagnetic field strength before/after refurbishment

3.3 State-of-the-art flats

One of the flats was equipped with state-of-the-art technology as a show flat.
In order to create a better interior environment the flat included technology to clean the air through the use of a plant filter.
The plants were carefully selected for air cleaning in different areas. The plants are described in the book “Cleaner air with plants” by B.C. Wolverton.

Ventilation is controlled by a humidity sensor that increases the air exchange rate when the humidity level increases.
One water container was placed in the centre of the flat to raise the quality of the air.

During the refurbishment process three state-of-the-art flats were constructed in which experience from the first flat played its part.

The plant filter in the kitchen was automatically watered with a mixture of water and urine. This lead to odour problems.

Emulsion and egg tempera paints were used without any significant side effects.

4. DISCUSSION

When the measurement group was started up there was a discussion about the scope of the measurements. The group’s ambitions developed into a time plan in which all the values to be measured were noted together with the time when they were to be made. Later it was decided to omit some of the measurements at that stage. For example, footstep sound measurements had been made during earlier refurbishments and the design of the building indicated that this would not cause any problems.

During the refurbishment, preparations were made for the installation of a central vacuum cleaner with outlets in each flat. This facility has been included on Kalmarhem’s list of options but so far only a few tenants have chosen to take advantage of it.

Several systems for measuring the interior environment were examined. None of these systems at the time of refurbishment could provide an efficient method of determining the air quality and content. Research continues to develop different systems and these are being followed with great interest by the project members.

5. SUMMARY

The complete work of the measurement group documents and verifies many of the goals that were set up before the refurbishment of the Inspektoren area.

The goals for purchasing energy, both in the form of electricity and district heating, have been achieved. This gives tangible results when seen from a wider perspective in that it decreases our reliance on oil products and so reduces emissions.

Furthermore, the work shows that the interior environment of the flats depends to a large extent on the tenants who live there.
The active participation of the tenants is needed to achieve a good interior environment.

The measurements made show that environmental goals can be achieved, but there are a number of follow-ups remaining which may influence the development of methods for measuring and evaluating interior environments.

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