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1.0 INTRODUCTION

1.01 Formal Details

This report is a further investigation recommended in our earlier report (rsa/01/07/13/ecal2555/ksb) and was carried out by Dr Kartar Singh Badsha, a Principal Consultant of ECAL on the written instruction of the Client, Royal SunAlliance.

1.02 Brief

The brief was to establish whether there was a problem of pollution as covered under the insurance policy. This is not a toxicological assessment on the health implications of the tenants nor was this study commissioned to detect point source of any problem that may arise as a result of the preliminary finding. The aim was to undertake a comprehensive site investigation further to the recommendations of the earlier report. In the first report, random samples were taken at varying depth not exceeding 30cm and a composite sample analysed. For the present study, composite samples were taken randomly up the depth of the water table which varied at various sample sites.

Further, unlike the earlier study, site selection criteria were undertaken by ECAL without any input from the Clients. Data thus obtained is representative of the area in question.

Standard sampling and storage techniques were used and samples despatched to appropriate laboratories.

Unless otherwise stated all analytical methods used were those validated by USEPA.

Mr Fox, owner of the said property was given very short notice prior to visiting the site. The property in question had not been lived in.

At all times the Client's representative was present at the site. All the results are expressed as dry weight unless otherwise stated.

Equipment used to drill boreholes was undertaken by a specialist firm who were made aware of the importance of cross contamination. Equipment was cleaned after each borehole. Every effort was made to minimise any cross contamination.

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1.03 **Physical observations**

Sitting Room

The room ambient environment continued to smell strongly of "chemicals" although it was not possible to pinpoint the spot or possible type of chemicals.

Sub samples were taken randomly at varying depths up to the water table (1.7m) and stored as a composite sample.

Garden Samples

The garden appeared undisturbed since the last sampling period. Sub samples were taken at varying depths randomly and stored in glass sample bottles.

All samples were stored in a container with cold blocks and transported to the laboratories.

Labelling of samples

Sites are labelled as follows:-

A = Far end of Garden on the left side

B = Far end of the Garden on the right side

C = Garden immediately before entering the House.

D = Sample taken in the house.

All the data is presented as Mg/Kg dried weight for soils and Mg/L for water sample.

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2.0 Results

Table 1: GC MS Scan of major hydrocarbons present in the soil determined using EPA method 625

Determinand	Site / Concentrations Expressed as mg/kg			
	A	B	C	
Phenol	<0.1	<0.1	<0.1	<0.1
Bis (2-chloroethyl)ether	<0.1	<0.1	<0.1	<0.1
2-chlorophenol	<0.1	<0.1	<0.1	<0.1
1,3-Dichlorobenzene	<0.1	<0.1	<0.1	<0.1
1,4-Dichlorobenzene	<0.1	<0.1	<0.1	<0.1
Bis (2-Chlorophoisopropyl)Ether	<0.1	<0.1	<0.1	<0.1
2-Methylphenol	<0.1	<0.1	<0.1	<0.1
Hexachlororthane	<0.1	<0.1	<0.1	<0.1
3-4 Methylphenol	<0.1	<0.1	<0.1	<0.1
Nitrobenzene	<0.1	<0.1	<0.1	<0.1
Isophorone	<0.1	<0.1	<0.1	<0.1
2-Nitrophenol	<0.1	<0.1	<0.1	<0.1
2,4-Dimethylphenol	<0.1	<0.1	<0.1	<0.1
Bis (2-Chlororthox) Methane	<0.1	<0.1	<0.1	<0.1
2,4-Dichlorophenol	<0.1	<0.1	<0.1	<0.1
1,2,4-Trichlorobenzene	<0.1	<0.1	<0.1	<0.1
Naphthalene	<0.1	<0.1	<0.1	<0.1
4-Chloroanaline	<0.1	<0.1	<0.1	<0.1
Hexachlorobutadiene	<0.1	<0.1	<0.1	<0.1
4-Chloro-3-Methyl Phenol	<0.1	<0.1	<0.1	<0.1
2-methyl Naphthalene	<0.1	<0.1	<0.1	<0.1
Hexachlorocyclpentadiene	<0.1	<0.1	<0.1	<0.1
2,4,6-Trichlorophenol	<0.1	<0.1	<0.1	<0.1
2,4,5-Trichlorophenol	<0.1	<0.1	<0.1	<0.1
2-Chloronaphthalene	<0.1	<0.1	<0.1	<0.1
2-Nitroaniline	<0.1	<0.1	<0.1	<0.1
Dimethyl Phthalate	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	<0.1	<0.1	<0.1	<0.1
2,6-Dinitrotoluene	<0.1	<0.1	<0.1	<0.1
Acenaphthalene	<0.1	<0.1	<0.1	<0.1
3-Nitroaniline	<0.1	<0.1	<0.1	<0.1
2.4-Dinitrophenol	<0.1	<0.1	<0.1	<0.1
Dibenzofuran	<0.1	<0.1	<0.1	<0.1
4-Nitrophenol	<0.1	<0.1	<0.1	<0.1
2,4-Dinitrotoluene	<0.1	<0.1	<0.1	<0.1
Diethyl Phthalate	<0.1	<0.1	<0.1	<0.1
Fluorene	<0.1	<0.1	<0.1	<0.1
4-Chlorophenolphenyl Ether	<0.1	<0.1	<0.1	<0.1
4-Nitroaniline	<0.1	<0.1	<0.1	<0.1
Azobenzene	<0.1	<0.1	<0.1	<0.1
4-Bromophenylphenyl Ether	<0.1	<0.1	<0.1	<0.1
Hexachlorobenzene	<0.1	<0.1	<0.1	<0.1
Pentachlorophenol	<0.1	<0.1	<0.1	<0.1
Phenanthrene	<0.1	<0.1	<0.1	<0.1
Anthracene	<0.1	<0.1	<0.1	<0.1
Carbazole	<0.1	<0.1	<0.1	<0.1

Dibutyl Phthalate	<0.1	<0.1	<0.1	<0.1
Fluranthrene	<0.1	<0.1	<0.1	<0.1
Pyrene	<0.1	<0.1	<0.1	<0.1
Butyl Benzyl Phthalate	<0.1	<0.1	<0.1	<0.1
Benzo (a) Anthracene	<0.1	<0.1	<0.1	<0.1
Chrysene	<0.1	<0.1	<0.1	<0.1
Bis (2-Ethylheyl) Phthalate	<0.5	<0.5	<0.5	<0.5
Di-n-Octylphthalate	<0.1	<0.1	<0.1	<0.1
Benzo (B/K) Fluoranthrene	<0.1	<0.1	<0.1	<0.1
Benzo (a) Pyrene	<0.1	<0.1	<0.1	<0.1
Indeno (123-cd) Pyrene	<0.1	<0.1	<0.1	<0.1
Dibenz (ah) Anthracene	<0.1	<0.1	<0.1	<0.1
Benzo (ghi) Perylene	<0.1	<0.1	<0.1	<0.1

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Table 2: GC MS Scan of major hydrocarbons present in the soil determined using EPA method 624

Determinand	Site / Concentrations Expressed as mg/kg			
	A	B	C	
Chloromethane	<1	<1	<1	<1
Vinyl Chloride	<1	<1	<1	<1
Bromomethane	<5	<5	<5	<5
Chloroethane	<1	<1	<1	<1
Trichlorofluoromethane	<1	<1	<1	<1
1,1-Dichloroethylene	<1	<1	<1	<1
Trans-1,2-Dichloroethylene	<1	<1	<1	<1
1,1-Dichloroethane	<1	<1	<1	<1
2,2-Dichloropropane	<1	<1	<1	<1
Cis-1,2-Dichloroethylene	<1	<1	<1	<1
Chloroform	<1	<1	<1	<1
Bromochloromethane	<1	<1	<1	<1
1,1,1-Trichloroehane	<1	<1	<1	<1
1,1-Dichloropropane	<1	<1	<1	<1
Carbon Tetrachloride	<1	<1	<1	<1
1,2-Dichloroethane	<1	<1	<1	<1
Benzene	<1	<1	<1	<1
Trichloroehylene	<1	<1	<1	<1
1,2-Dichloropropane	<1	<1	<1	<1
Bromodichloromethane	<1	<1	<1	<1
Dibromomethane	<1	<1	<1	<1
Cis-1,2-Dichloropropene	<1	<1	<1	<1
1,1,2-Trichloroehane	<1	<1	<1	<1
1,3-Dichloropropane	<1	<1	<1	<1
Tetrachloroethylene	<1	<1	<1	<1
Chlorodibromoethane	<1	<1	<1	<1
1,2-Dibromoethane	<1	<1	2	<1
Chlorobenzene	<1	<1	<1	<1
Toluene	<1	<1	2	<1
Ethylbenzene	<1	<1	<1	<1
M/P Xylene	<1	<1	<1	<1
O Xylene	<1	<1	<1	<1
Styrene	<1	<1	<1	<1
Bromoform	<1	<1	<1	<1
1,1,2,2-Tetrachloroethane	<1	<1	<1	<1
1,2,3-Trichloropropane	<1	<1	<1	<1
Bromobenzene	<1	<1	<1	<1
2-Chlorotoluene	<1	<1	<1	<1
4-Chlorotoluene	<1	<1	<1	<1
1,2-Dichlorobenzene	<1	<1	<1	<1
1,3-Dichlorobenzene	<1	<1	<1	<1
1,4-Dichlorobenzene	<1	<1	<1	<1
1,2,4-Trimethylbenzene	<1	<1	49	<1
1,2,5-Trimethylbenzene	<1	<1	<1	<1

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Table 3: WHO priority PCB isomers present in the soil samples determined using GC MS technique credited by UKAS EPA method 624

	Site / Concentrations Expressed as mg/kg			
Ortho PCBs	**A**	**B**	**C**	**D**
Pentachloro, BZ#105	<0.05	<0.05	<0.05	<0.05
Pentachloro, BZ#114	<0.05	<0.05	<0.05	<0.05
Pentachloro, BZ#118	<0.05	<0.05	**<0.07**	<0.05
Pentachloro, BZ#123	<0.05	<0.05	<0.05	<0.05
Hexachloro, BZ#156	<0.05	<0.05	<0.05	<0.05
Hexachloro, BZ#157	<0.05	<0.05	<0.05	<0.05
Hexachloro, BZ#167	<0.05	<0.05	<0.05	<0.05
Heptachloro, BZ#189	<0.05	<0.05	<0.05	<0.05

	Site / Concentration Expressed as Mg/L			
Non-Ortho PCBs	**A**	**B**	**C**	**D**
Tetrachloro, BZ#81	<0.05	<0.05	<0.05	<0.05
Tetrachloro, BZ#77	<0.05	<0.05	<0.05	<0.05
Pentachloro, BZ#126	<0.05	<0.05	<0.05	<0.05
Heptachloro, BZ#169	<0.05	<0.05	<0.05	<0.05

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Table 5: Presence of various radio nuclides in soil samples expressed as Becquerel/kg (dry weight) in soil samples.

	Site / Concentrations			
Client Reference	**A**	**B**	**C**	**D**
	Becquerels/Kg	**Becquerels/Kg**	**Becquerels/Kg**	**Becquerel**
Total Alpha Activity (as U_{nat})	370 ± 40	350 ± 50	430 ± 50	520 ± 5
Total Beta Activity (as ^{137}Cs)	1300 ± 50	1300 ± 50	1600 ± 50	1500 ± !
Uranium ^{238}	8.6 ± 2.1	15 ± 3	12 ± 2	8.4 ± 2
Uranium ^{235}	<1	1.3 ± 0.8	<1	1.1 ± 0
Uranium ^{234}	8.8 ± 2.1	17 ± 3	12 ± 2	8.3 ± 2
Plutonium ^{238}	5.1 ± 3.1	7.2 ± 2.0	5.3 ± 2.6	<5.0
Plutonium $^{239/240}$	<1	1.5 ± 0.9	3.5 ± 1.9	9.0 ± 7.
Gamma Spectrometric Analysis				
Potassium ^{40}	240 ± 11	410 ± 18	690 ± 16	270 ± 1
Manganese ^{54}	<5	<5	<5	<5
Cobalt ^{57}	<1	<1	<1	<1
Cobalt ^{58}	<1	<1	1.9 ± 0.7	<1
Iron ^{59}	<1	<5	<5	<5
Cobalt ^{60}	<1	<5	<5	<5
Zinc ^{65}	<5	<5	<5	<5
Niobium ^{95}	<1	<1	<1	<1
Zirconium ^{95}	<1	<5	<5	<5
Ruthenium ^{103}	<1	<1	<1	<1
Silver ^{110m}	<1	<1	<1	<1
Antimony ^{124}	<1	<1	<1	<1
Antimony ^{125}	<5	<10	<10	<10
Caesium ^{134}	<1	<1	<1	<1
Caesium ^{137}	<1	<1	<5	<5
Cerium ^{144}	<5	<5	<5	<5
Europium ^{154}	<1	<1	<5	<5
Europium ^{155}	<5	<5	<5	<5
Actinium ^{228}	27 ± 3	26 ± 3	36 ± 3	19 ± 3
Radium ^{224}	25 ± 6	35 ± 8	50 ± 7	27 ± 6
Lead ^{212}	14 ± 1	28 ± 1	36 ± 1	16 ± 1
Bismuth ^{212}	6.7 ± 2.6	14 ±3	18 ± 3	13 ± 2
Thallium ^{208}	3.9 ± 0.9	11 ± 1	13 ± 1	7.0 ± 1.1
Thorium ^{234}	33 ± 10	57 ± 7	<40	65 ± 26
Radium ^{226}	24 ± 6	<20	51 ± 7	38 ± 6
Lead ^{214}	15 ± 2	27 ± 2	29 ± 2	16 ± 2
Bismuth ^{214}	13 ± 2	17 ± 1	25 ± 2	11 ± 1
Uranium ^{235}	<5	<5	<5	<5
Thorium ^{227}	<10	<10	<10	<10
Radium ^{223}	<5	<5	<5	<5
Americium ^{241}	<5	<5	6 ± 3	<5

Table 6 : GC MS Scan of top twenty screen present in the water presented as Mg /L

	Site / Concentration Expressed as Mg/L	
Determinand	**Sample**	**A**
Pentanone, Branched**	**GC/MS**	150
Ethylmethybenzene*	**GC/MS**	140
Trimethylbenzene*	**GC/MS**	360
Trimethylbenzene*	**GC/MS**	180
Diethylbenzene*	**GC/MS**	98
Diethylmethylbenzene*	**GC/MS**	150
Tetramethylbenzene*	**GC/MS**	97
Tetramethylbenzene*	**GC/MS**	150
Dimethylethylbenzene*	**GC/MS**	170
Benzene, branched**	**GC/MS**	96
Aliphatic Hydrocarbon, Branched**	**GC/MS**	140
Aliphatic Hydrocarbon, Branched**	**GC/MS**	100
Aliphatic Hydrocarbon, Branched**	**GC/MS**	170
Cyclic Hydrocarbon, Branched**	**GC/MS**	120
Trimethyldodacane*	**GC/MS**	140
Dimethylaphthalene*	**GC/MS**	150
Dimethylaphthalene*	**GC/MS**	100
Tridecane, Branched*	**GC/MS**	100
Teramethylpentadecane*	**GC/MS**	190
Teramethylheptadecane*	**GC/MS**	120

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Table 7 : Heavy metal concentration in soil and water samples expressed as d[redacted] weight for the soil samples. Lockhill

Elements	Sample Expressed As mg/kg			
Test Description (dry weight)	*Sample A*	*Sample B*	*Sample C*	*Sample D*
Cadmium, Total as CD	<1.7	<1.7	2.6	3.5
Chromium, Total as CR	31	42	66	83
Copper, Total as CU	14	14	30	42
Lead, Total as PB	10	16	22	96
Nickel, Total as Ni	13	21	49	41
Zinc, Total as Zn	16	27	50	234
Arsenic, Total as As	13	15	14	15
Mercury, Total as Hg	<0.05	<0.05	<0.05	0.10
Cobalt, Total as Co	14	14	30	30
Antimony, Total as Sb	<0.05	0.14	0.59	5.34
Molybdenum, Total as Mo	<1	<1	<1	2
Thallium, Total as Ti	<5	<5	<5	<5
Tellurium	<0.05	<0.05	<0.05	<0.05
Tin	1.3	1.5	2.0	3.4
Titanium	390	390	420	440

Findings of two independent laboratories.

Conclusions

Please see the remit of this report when reading the conclusions and or recommendations.

The mechanism of the oncogenic action of inorganic chemicals is little understood. As far as heavy metals are concerned Nickel is a confirmed carcinogen by all major bodies such as NTP, IARC Monographs and OSHA. Chromium is also found to be carcinogenic.. The levels found are on the high side but are not dissimilar to some contaminated waste sites in the UK for some of the elements.

Findings on radioactive metals show an interesting pattern particularly in the ratios of Plutonium^{238} and Plutonium $^{239/240}$ indicating that the source of Plutonium ^{238} to be man made. Whilst the actual values observed in the present study is lower compared to the first study, the distribution pattern would appear to be similar in the case of radio nuclides, with high values recorded from within the house. Random composite samples in the first study were obtained 30cm from the surface whilst in the present study; random composite samples were taken up to depths of 1.7 m in the house to 2.7 m outside. One explanation for the differences in the actual values between the surface samples in the first study and those observed in the present study is that there is a migration upwards in line with the movement of water levels of the water table. This in part is explained by the fact that the water table in the house was encountered at 1.7m whilst at other sites; it was possible to take samples at 2.4 to 2.7m with corresponding lower concentrations of radio nuclides observed.

Plutonium levels are some 40 times higher compared to other studies with the exception of one site which had value of 10 Becquerel/kg (Study undertaken by University of Southampton).

From Table 6, it is apparent that there is a range of radio nuclides at this site. What is little studied or documented is the "cocktail" and or "synergistic effects" at low levels of the various radio nuclides present for the residents of the house in question who are constantly exposed. The NRPB guidelines suggest criterion of 10^{-6} y^{-1} (1 in a million per year) below which exposures are deemed to be broadly acceptable and significant expenditure to reduce doses and risks is likely to be unwarranted. This does not take into account the likely "cocktail and or synergistic effects in the presence of not only a range of radio nuclides but also other pollutants.

Government regulatory bodies although created to protect the environment and the ecosystem including human population have historically spent their efforts in attempting to "cover up" incidents such as this. In this instance, its behaviour was no different. When the first report was published, all that it could raise to throw doubt in the first report was the questioning of the laboratory's QC and QA. Incidence such as BSE, came to light as a result of pressure from foreign governments and not as results of the efforts of such

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