January 15, 2002

JEGEL 101041

REJUVASEAL EVALUATION
CFB COLD LAKE AND CFB WAINWRIGHT

Prepared For

ECHELON INDUSTRIES, INC.

By

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EXECUTIVE SUMMARY

John Emery Geotechnical Engineering Limited, Consulting Engineers (JEGEL), conducted environmental analyses to assess the Sand RejuvaSeal applications completed at CFB Wainwright and CFB Cold Lake. Sand RejuvaSeal consists of RejuvaSeal proprietary coal-tar rejuvenator sealer plus a frictional sand (angular, clean, durable fine aggregate such as fine boiler slag or nonferrous slag). The work was completed at the request of Bill Vandemark of Echelon Industries, Inc.

Evaluations of the Sand RejuvaSeal applications at CFB Wainwright and CFB Cold Lake have been performed by JEGEL and others, including the Department of National Defence. These evaluations include: compositional analyses of RejuvaSeal and sweeper samples supplied to Echelon Industries, Inc. by DND; sweeper dust and snow/sweepings sampling by Jacques Whitford and Associates Limited; and hydrocarbon/PAH analyses of a water sample supplied by DND to Norwest Labs. A work plan was developed by JEGEL and implemented to investigate potential environmental impacts of the Sand RejuvaSeal, and is also described.

The results of the Sand RejuvaSeal evaluations are briefly summarized in the following paragraphs.

Compositional Analyses of RejuvaSeal and Sweeper Samples – Two samples of sweeper dust and a sample of the RejuvaSeal rejuvenator sealer were analysed to determine both organic and inorganic constituents. The analyses consisted of general composition by pyrolysis @ 550°C to determine the proportion of organic and inorganic constituents; volatile organic constituents by gas chromatograph (RejuvaSeal sample only) and non-volatile constituents by infrared spectrometer; and analysis of the inorganic residue for metallic oxides by plasma spectrometer (ICAP Total Oxide Analysis). The analyses indicate that the volatile organic constituents (solvents) consist of a mixture of hydrocarbon fractions containing both aliphatic and aromatic compounds similar in composition to Varsol. The infrared analysis results for the non-volatile organic constituents (resins) of the sealer indicated that the sample consisted of a mixture of

hydrocarbon polymers, mostly aliphatic compounds. The analyses of the non-volatile constituents of the two sweepings samples indicated that the two samples were identical in composition and consisted of a mixture of hydrocarbon polymers containing aromatic and aliphatic rubber-like compounds. It is speculated that the presence of rubber-like compounds may be attributable to rubber build-up from aircraft tires. DND provided a sample of a typical aircraft tire for comparative compositional analysis, but the results of the comparative analysis were not conclusive.

Jacques Whitford Sweeper Dust and Snow/Sweepings Sampling – On February 23/01, samples of the sweeper dust and snow/sweepings were obtained at CFB Cold Lake by Jacques Whitford. A summary report describing this site visit, RejuvaSeal inspection and sampling details has been prepared, and includes photographs of the runway surfaces, snow banks, and the sweeper equipment and equipment maintenance facilities. A total of 6 liquid and 7 solid samples were taken, representing sweeper residue (dust) and melt water from snow banks. Upon receipt at JEGEL, it was determined that the individual snow samples, once melted, did not provide sufficient liquid to permit individual analyses of the organic constituents to be completed. Samples of the snow melt were submitted for inorganic analysis.

Hydrocarbon/PAH Analysis of Water Samples – A sample(s) obtained by DND in the vicinity of Building 85 was submitted to Norwest Labs for analysis of non-halogenated aromatics (BTEX), total purgeable hydrocarbons and total extractable hydrocarbons. The precise nature of the sample is not known and DND has been contacted for additional details. The sample was also analysed for polyaromatic hydrocarbons (PAH). Comparison of the analysis results with the Canadian Council of Environment Ministers (CCME) Water Quality Guidelines for the Protection of Aquatic Life indicated several exceedances of PAH criteria.

JEGEL Field Sampling and Laboratory Testing Program - JEGEL has developed a program of field sampling in order to obtain samples of the sealed pavements at CFB Cold Lake and CFB Wainwright for laboratory evaluation of the RejuvaSeasl-treated asphalt concrete surface physical properties in accordance with the application contract requirements, and to obtain additional samples of RejuvaSeal-treated and untreated pavement for environmental testing. The field sampling (coring) work was sub-contracted to Shelby Engineering of Edmonton. The

proposed analyses included bulk analyses of major oxides, determination of volatile and non-volatile organic constituents. In addition, both distilled water and acid leach testing were carried out, both on intact cores and 'crushed' cores, for comparison purposes.

Environmental monitoring of the RejuvaSeal treatments at CFB Cold Lake and CFB Wainwright coordinated by JEGEL, with independent laboratory testing of asphalt concrete cores, sweeping material and asphalt pavement surface runoff (treated areas and untreated control areas) has shown no significant exceedances of applicable environmental criteria (CCME for instance), particularly when treated and untreated areas are compared (some natural mineral constituents and/or operational activities such as de-icing can cause exzceedances).

REJUVASEAL EVALUATION
CFB COLD LAKE AND CFB WAINWRIGHT

INTRODUCTION

At the request of Bill Vandemark of Echelon Industries, Inc., John Emery Geotechnical Engineering Limited, Consulting Engineers (JEGEL), undertook an environmental evaluation of the RejuvaSeal rejuvenator sealer material (actually Sand RejuvaSeal consisting of RejuvaSeal coal-tar rejuvenator sealer and a frictional fine aggregate (nonferrous slag)) and its application at Department of National Defence (DND) airport facilities at CFB Cold Lake and CFB Wainwright.

Sand RejuvaSeal was applied to the runway and taxiway pavements at CFB Cold Lake in September 2000. The CFB Wainwright runway and taxiway pavements had been previously sealed with RejuvaSeal in 1997. DND personnel at CFB Cold Lake expressed concern with the RejuvaSeal materials when a significant amount of the fine slag aggregate and RejuvaSeal material was apparently observed have been removed by winter snow/ice control operations (relatively aggressive 'sweeping' with heavy steel-wire brooming equipment).

This report summarizes the work completed by DND and others, previously presented by JEGEL ("Progress Report, RejuvaSeal Evaluation, CFB Cold Lake and CFB Wainwright", dated March 26, 2001), and describes the supplementary JEGEL investigation/evaluation of the CFB Cold Lake and CFB Wainwright pavements where the Sand RejuvaSeal had been applied.

PREVIOUS REJUVASEAL FIELD AND LABORATORY EVALUATIONS

Compositional Analysis Of RejuvaSeal And Sweeper Samples Supplied To JEGEL By DND

Samples of the RejuvaSeal rejuvenator sealer and sweepings from CFB Cold Lake supplied by Ray Clement of DND were submitted by JEGEL to Cambridge Material Testing Limited in Mississauga, Ontario for compositional analysis to determine both organic and inorganic constituents. One sample of the RejuvaSeal rejuvenator sealer and two samples of sweepings (described as solid/granules & dust from Sweeper #24010 and Sweeper #78132) were submitted on February 22/01. The analyses consisted of general composition by pyrolysis @ 550°C to determine

the proportion of organic and inorganic constituents; volatile organic constituents by gas chromatograph (RejuvaSeal sample only) and non-volatile constituents by infrared spectrometer; and analysis of the inorganic residue for metallic oxides by plasma spectrometer (ICAP Total Oxide Analysis). The complete results of the analyses are given in Appendix A (Cambridge Materials Testing Limited Laboratory Report No. 273760-01, dated March 9/01).

The analysis results for RejuvaSeal rejuvenator sealer indicated that the volatile organic constituents (solvents) consist of a mixture of hydrocarbon fractions containing both aliphatic and aromatic compounds similar in composition to Varsol[1]. The infrared analysis results for the non-volatile organic constituents (resins) of the sealer indicated that the sample consisted of a mixture of hydrocarbon polymers, mostly aliphatic compounds.

The analyses of the non-volatile constituents of the two sweepings samples indicated that the two samples were identical in composition and consisted of a mixture of hydrocarbon polymers containing aromatic and aliphatic rubber-like compounds. It was speculated that the rubber compounds found in the sweepings may have originated from the aircraft tire rubber built up on the runway surface. Subsequently, a sample of CF-18 aircraft tire was supplied by DND for comparative analysis. The results of the aircraft tire analysis (Appendix D) showed the material to consist of polyurethane-type elastomer. Consequently, it does not appear that the aromatic and aliphatic rubber-like compounds found in the sweepings are the same as the CF-18 aircraft tire rubber sample supplied; however, there are apparently other types of tires used at CFB Cold Lake that could potentially be a source of the rubber compounds identified in the sweepings.

Jacques Whitford Sweeper Dust And Snow/Sweepings Sampling – February 23/01

Samples of the sweeper dust and snow/sweepings were also obtained at CFB Cold Lake on behalf of Echelon Industries, Inc. by Jacques Whitford and Associates Limited, Calgary. Jacques Whitford has prepared a summary report describing this site visit and RejuvaSeal inspection (their Project No. ABC10632, dated February 27/01). The report (given in Appendix B) summarizes the

1 *Varsol™* refers to a premium commercial, industrial and household solvent that is commonly used as a paint thinner/cleaner and degreaser. It is a petroleum distillate of the aliphatic hydrocarbon family.

site visit and sampling details, with photographs of the runway surfaces, snow banks, and the sweeper equipment and equipment maintenance facilities. Samples were obtained on February 23/01 then shipped to JEGEL in Toronto on February 28/01 (received March 2/01). A total of 13 samples were taken, 6 liquid and 7 solid, described as:

JARS

1. From Snow Banks On Runway 04/22
2. From Snow Banks on Inner Runway, High Speed Area
3. From Snow Banks outside the Heavy Equipment Building (Bldg. No. 85) – 2 jars
4. From Sweeping Machine, while working on Hammerhead 31L on Outer Runway
5. From Sweeping Machine, Taken Outside the Heavy Equipment Building (machine just came back from sweeping job on Inner Runway)

Not Numbered: De-Icing Fluid (mainly potassium acetate) from storage tank

BAGS

Not Numbered: De-Icing Salt (mainly sodium formate) from storage

6. Dust from Machines (parked inside the Heavy Equipment Building)
7. Dust from Machine (taken outside the Heavy Equipment Building) – machine just came back from sweeping job on Inner Runway)
8. Dry Crust from Broom of Sweeping Machine (parked inside Heavy Equipment Building)
9. Dry Crust from Shop Floor of the Heavy Equipment Building (where sweeping machine was parked)
10. Sludge from Fresh Footprints in Corridor of the Heavy Equipment Building
11. Paper Cloth Wiped On (Machine plus Hand Sweeped) Surface on Inner Runway, High Speed Area (close to where Sample #2 was taken).

Upon receipt of the samples at JEGEL, the samples were inventoried and inspected for analysis potential. Of particular interest for these samples was the organic constituents, with polyaromatic hydrocarbons of main concern. It was determined through JEGEL discussion with Cambridge Materials Testing Limited that the jars did not contain sufficient liquid to permit individual analyses of the organic constituents to be completed (JEGEL advised Echelon Industries, Inc. of this on March 7/01). However, three samples of the snow melt were selected by JEGEL and submitted to Cambridge for general analysis to the extent possible given the small samples size:

1. From Snow Banks On Runway 04/22
2. From Snow Banks on Inner Runway, High Speed Area
3. From Snow Banks outside the Heavy Equipment Building (Bldg. No. 85).

These samples were submitted on March 21/01. Because of the small sample size, it was

only possible to test the samples for inorganic constituents (metals). The test results are summarized in Table 1, with the full analysis results presented in Appendix E. The test results for all three samples exhibit relatively high concentrations of potassium and sodium (near the heavy equipment building only) that are attributed to the use of potassium acetate and sodium formate de-icing chemicals.

Norwest Labs Report Of Hydrocarbon/PAH Analysis Of February 8/01 Sample

Jacques Whitford also forwarded a copy of the results of laboratory testing of a sample completed by Norwest Labs of Calgary (Appendix C). The Jacques Whitford notes states that "...to appraise possible health and environmental risks samples of the suspect material were taken on February 08, 2001" . This sample(s) had been obtained Drew Craig, Wing Environmental Technologist, 4 Wing Cold Lake and submitted for non-halogenated aromatics (benzene, toluene, ethylbenzene and total xylene), total purgeable hydrocarbons (C_5 to C_{10}) and total extractable hydrocarbons (C_{11} to C_{40+}). The sample was also analysed for polyaromatic hydrocarbons (PAH). Other than the descriptor, "Bldg 85", no details were provided indicating the type of sample(s) or its location, i.e. whether it is a sample of the RejuvaSeal itself, or snowbank meltwater containing RejuvaSeal residue/sweepings. Hand-written notes beside the individual test results indicate that there are no exceedances of non-halogenated aromatic hydrocarbons criteria for fresh water and community water. It is our understanding that the analysis results have been compared with the Canadian Council of Environment Ministers (CCME) Water Quality Guidelines for the Protection of Aquatic Life (Freshwater). Several exceedances of PAH criteria are indicated in comparison with these criteria. The PAH exceedances suggest that this testing may have been carried out on the RejuvaSeal rejuvenator sealer itself, but this should be confirmed by DND.

JEGEL FIELD SAMPLING AND LABORATORY TESTING PROGRAM

JEGEL developed a program of field sampling in order to obtain samples of the sealed pavements at CFB Cold Lake and CFB Wainwright for evaluation of the treated asphalt concrete surface physical properties (in accordance with the application contract requirements), and to obtain

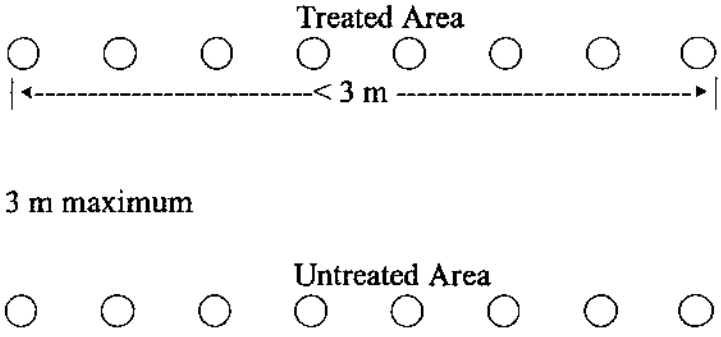
TABLE 1
SUMMARY OF SNOWBANK SAMPLE ANALYSIS RESULTS

Parameter	Analysis of Water Samples from Snowbanks, mg/L			CCME Criteria µg/L
	Runway 04/22	Inner Runway	Heavy Equipment Building	
Aluminum	0.01	0.11	0.83	5 – 100
Antimony	< 0.01	< 0.01	< 0.01	
Arsenic	< 0.01	< 0.01	< 0.01	5.0
Barium	0.08	0.12	0.15	
Beryllium	< 0.01	< 0.01	< 0.01	
Boron	< 0.01	0.01	0.16	
Cadmium	0.02	0.07	0.04	0.017
Calcium	11.54	18.29	34.07	
Chromium	< 0.01	< 0.01	< 0.01	
Cobalt	< 0.01	< 0.01	< 0.01	
Copper	< 0.01	< 0.01	< 0.01	2 – 4
Iron	0.81	3.59	1.88	300
Lead	< 0.01	< 0.01	< 0.01	1 – 7
Magnesium	2.32	2.62	0.39	
Manganese	0.29	0.05	0.02	
Molybdenum	0.05	0.07	0.08	73
Nickel	< 0.01	< 0.01	< 0.01	
Phosphorous	< 0.01	0.10	0.41	
Potassium	259.18	882.22	702.61	
Selenium	< 0.01	< 0.01	< 0.01	
Silicon	4.05	2.33	8.62	
Silver	< 0.01	< 0.01	< 0.01	
Sodium	23.50	30.22	435.59	
Strontium	0.03	0.06	0.17	
Tin	0.23	0.26	0.06	
Titanium	< 0.01	< 0.01	0.06	
Vanadium	< 0.01	0.01	< 0.01	
Zinc	0.08	0.13	0.17	
Zirconium	< 0.01	< 0.01	< 0.01	

additional samples for environmental testing. The field sampling (coring) work was sub-contracted to Shelby Engineering of Edmonton. The coring work commenced at CFB Cold Lake on March 21/01, and was completed at CFB Wainwright on April 1/01 (coring work was suspended between March 23 and March 26/01 due to extremely cold weather).

The field sampling program consisted of the following elements:

1. At each location where samples were required for asphalt properties determinations, the cores were obtained as indicated below:



Each corehole was properly reinstated using cold-mix asphalt that has been properly placed and well compacted.

2. Cores for asphalt properties testing were packaged conventionally for shipping to the JEGEL Toronto laboratory – the cores obtained for asphalt properties testing were placed in suitable-size clean cylinder moulds for shipping to prevent damage to the cores.

   Prior to obtaining core samples for environmental testing, and between core sampling locations, the core barrel was properly cleaned with acetone, then carefully rinsed with distilled water, and dried. Cores to be used for environmental testing were not placed in plastic or metal containers, but were individually wrapped in plain (uncoated) brown (unbleached) paper bags, then placed in closed cardboard boxes so that the samples were not exposed to sunlight.

The core locations for each facility are described as follows:

CFB Cold Lake Sampling

Cores for Asphalt Properties Testing

On each of the three runways, an untreated section was left open for sampling up to one year after construction. At each of these locations, samples of the untreated and treated runway surfaces were obtained as per the above sketch.

Cores for Environmental Testing

On each of the three runways and the major taxiway, ten cores were obtained from a broomed area near the centreline of the runway and ten from the adjacent edge where there has been relatively little brooming. An additional ten cores were obtained from an untreated area of the runway for comparative analysis purposes.

CFB Wainwright Sampling

Cores for Asphalt Properties Testing

On Runway 11/29, there were several untreated sections left open for sampling. Shelby Engineering, which was previously involved in coring at this facility, located the cores for asphalt properties testing close to the same location where these previous cores were obtained.

Cores for Environmental Testing

On Runway 11/29, cores were obtained from each of two locations on the runway. The runway is to be divided into two equal length sections, then one location will be selected within each section. Ten cores were obtained from an area of the runway where significant brooming has been completed, and ten cores from the adjacent edge where there has been relatively little brooming.

ENVIRONMENTAL TESTING AND ANALYSES

Selected cores from CFB Cold Lake and CFB Wainwright were submitted for environmental analyses as follows. For each facility, representative cores were selected from a Sand RejuvaSeal treated area at the centre of the runway (where pavement brooming/sweeping activity is most concentrated) and at the adjacent edge (relatively little brooming/sweeping), and from an untreated area of the runway/taxiway. After general examination in the JEGEL laboratory, the top 10 to 15 mm of the core was removed by sawcutting and then split into specimens of approximately equal mass (about 100 g each). The specimens were then submitted to Cambridge Materials Testing Limited where the following testing was carried out:

1. Samples of the cores were analyzed for general composition by pyrolysis at 550°C to determine the proportion of organic and inorganic constituents. The volatile organic constituents were analyzed by gas chromatograph, and the inorganic constituents analyzed by infrared spectrometer. The inorganic residue (ash) was also analyzed by plasma spectrometer for metal oxides (composition); and

2. Distilled water and acid leach testing were carried out, both on intact pieces of the cores and pieces that were 'crushed' in the laboratory. The current Ontario Ministry of the Environment Ontario Regulation 347 (Amended Regulation 558) leachate extraction procedure was adopted for the acid leach testing. This test procedure is similar to the US EPA Toxicity Characteristics Leachate Procedure (TCLP). In addition, distilled (pure de-ionized) water leach tests were also carried out on similar bulk and crushed samples. The results of the acid and distilled water leach tests were then compared with the CCME Environmental Water Quality Guidelines for the Protection of Freshwater Aquatic Life.

ENVIRONMENTAL ANALYSIS RESULTS

The environmental analysis results for CFB Cold Lake and CFB Wainwright core samples are presented in Table 2, Tables 3A through 3F, and in Appendix E.

The compositional analysis results for the inorganic residues for the cores, and previous results for sweeper samples supplied by DND, are summarized in Table 2 for comparison. The test results indicate that the sweepings samples contain substantially higher concentrations of iron, zinc, barium, copper, vanadium and cobalt in comparison with the core samples from CFB Cold Lake and CFB Wainwright. The main constituents of the sweeper residues are silica and iron, with

smaller quantities of calcium and zinc also present. The higher iron and zinc concentrations are most probably due to broom 'wear and tear', with the copper, vanadium and cobalt probably attributable to the nonferrous slag sand applied in conjunction with the RejuvaSeal application. The compositional analysis results for the inorganic residues for both treated and untreated surfaces at CFB Cold Lake and treated and untreated surfaces at CFB Wainwright are for all intents and purposes identical, with the major constituents being silica and smaller amounts of alumina and calcium.

The core analysis results also indicate:

- All of the Sand RejuvaSeal-treated and untreated cores tested by gas chromatography for organic composition showed either trace or no detectable concentrations of aliphatic hydrocarbons, and no detectable concentrations of polyaromatic hydrocarbons (PAH);
- The infrared analysis of the non-volatile organic constituents confirmed that the non-volatile material consists of a mixture of partially oxidized hydrocarbon resin;
- The total oxide analyses of the inorganic constituents (whole rock analyses of major oxides and metals) confirmed that the compositions of the treated and untreated cores from both CFB Cold Lake and CFB Wainwright were virtually identical, reflecting mainly the aggregate components. There was no obvious difference in the mineral compositions of the treated and untreated pavements from either facility.

The results of the leachate analyses of both bulk and 'crushed' core samples indicated the following:

- Neither the distilled water or acid leachate testing indicated the presence of polyaromatic hydrocarbons, phenols or volatile organics in the Sand RejuvaSeal treated or untreated cores;
- The leachate analyses confirmed several metals exceedances of the CCME criteria. However, in all cases, the same exceedances were generally observed for both treated and untreated cores at both facilities. In particular, the concentration of aluminum was observed to be high in almost all of the cores, and especially for the distilled water leachate testing of 'crushed' samples;
- the concentration of iron was observed to be high in almost all of the cores, and particularly for the distilled water testing of 'crushed' samples;

TABLE 2
COMPOSITIONAL ANALYSES OF INORGANIC RESIDUE (ASH)
CFB COLD LAKE AND CFB WAINWRIGHT

Constituent	Sample 1 RejuvaSeal	Building 85 – CFB Cold Lake		CFB Cold Lake			CFB Wainwright		
		Sample 2 Sweeper Residue	Sample 3 Sweeper Residue	Sample 4C Core 29 Centre/Treated	Sample 5C Core 35 Edge/Treated	Sample 6C Core 14 Untreated	Sample 7C Core 36 Centre/Treated	Sample 8C Core 42 Edge/Treated	Sample 9C Core 5 Untreated
Major Oxides, percent									
Silica	4.62	38.40	41.79	67.23	65.39	67.63	67.48	66.80	64.85
Aluminum	0.67	4.52	4.43	8.37	8.69	8.65	5.71	6.16	6.15
Iron	0.32	**28.18**	**38.64**	2.31	2.54	1.92	3.76	4.37	3.37
Calcium	0.28	6.15	8.13	4.53	4.63	4.52	6.15	6.19	6.17
Magnesium	1.88	1.00	0.97	2.27	2.13	2.04	1.44	1.25	2.56
Sodium	0.04	0.97	0.57	2.07	2.48	2.16	1.29	1.29	1.28
Potassium	0.06	2.00	1.46	2.08	2.58	2.04	1.40	1.94	1.76
Titanium	0.02	0.17	0.20	0.20	0.25	0.19	0.15	0.13	0.16
Manganese	< 0.01	0.18	0.24	0.03	0.16	0.03	0.12	0.24	0.09
Phosphorous	< 0.02	0.18	0.22	0.08	0.16	0.12	0.56	0.22	0.16
Zinc	< 0.01	**3.08**	**2.63**	-	-	-	-	-	-
Minor Constituents, µg/g									
Barium	30	**1950**	**3130**	620	730	550	510	520	500
Strontium	30	250	250	230	240	210	160	140	150
Zirconium	15	45	75	90	100	100	100	80	60
Yttrium	< 2	8	12	10	22	10	12	14	10
Scandium	< 1	2	3	4	5	4	4	4	4
Niobium	< 30	< 30	< 30	< 30	< 30	< 30	< 30	< 30	< 30
Beryllium	< 1	2	4	4	4	3	4	3	3
Nickel	< 5	25	< 5	40	30	35	45	25	35
Chromium	< 5	415	245	410	170	230	575	470	425
Copper	15	**1065**	**1655**	50	60	40	80	55	30
Vanadium	25	**95**	**155**	55	65	60	60	60	60
Cobalt	5	**80**	**65**	15	20	20	1	5	15
Zinc	-	-	-	20	90	20	90	65	30
LOI	91.90	14.59	< 0.01	10.47	9.30	10.49	11.36	10.90	12.81
Total	99.81	99.41	99.30	99.63	99.32	99.79	99.41	99.50	99.36

TABLE 3A
CORES 28 AND 29
CFB COLD LAKE – CENTRE TREATED

Parameter	O.Reg. 347 LEP, µg/L		Distilled Water LEP, µg/L		CCME Criteria µg/L
	Bulk Sample Core 28	Crushed Sample Core 29	Bulk Sample Core 28	Crushed Sample Core 29	
Aluminum	< 1	40	**1150**	**35960**	5 – 100
Arsenic	< 1	< 1	< 1	< 1	5.0
Cadmium	< 1	< 1	< 1	< 1	0.017
Chromium^{III+}	< 5	< 5	< 5	< 5	4.9
Chromium^{VI+}	< 5	< 5	< 5	< 5	8.0
Copper	< 1	< 1	< 1	< 1	2 – 4
Iron	**290**	**11210**	**360**	**12750**	300
Lead	**20**	< 1	< 1	**40**	1 – 7
Mercury	< 1	< 1	< 1	< 1	0.1
Molybdenum	< 1	< 1	< 1	< 1	73
Nickel	< 1	80	10	10	25 - 150
Selenium	< 1	< 1	< 1	< 1	1.0
Silver	< 1	< 1	< 1	< 1	0.1
Zinc	30	**60**	< 1	30	30
PAHs	< 5	< 5	< 5	< 5	
Phenols	< 1	< 1	< 1	< 1	4.0
Total VOCs	< 5	< 5	< 5	< 5	
Cyanide	< 5	< 5	< 5	< 5	5.0
Nitrate	< 10	< 10	< 10	< 10	Narrative
Nitrite	< 10	< 10	< 10	< 10	60

TABLE 3B
CORES 34 AND 36
CFB COLD LAKE – EDGE TREATED

Parameter	O.Reg. 347 LEP, µg/L		Distilled Water LEP, µg/L		CCME Criteria µg/L
	Bulk Sample Core 34	Crushed Sample Core 36	Bulk Sample Core 34	Crushed Sample Core 36	
Aluminum	**180**	40	**1560**	**29870**	5 – 100
Arsenic	< 1	< 1	< 1	< 1	5.0
Cadmium	< 1	< 1	< 1	< 1	0.017
Chromium^{III+}	< 5	< 5	< 5	< 5	4.9
Chromium^{VI+}	< 5	< 5	< 5	< 5	8.0
Copper	< 1	< 1	< 1	**20**	2 – 4
Iron	< 1	**2040**	**540**	**17520**	300
Lead	**20**	< 1	< 1	**40**	1 – 7
Mercury	< 1	< 1	< 1	< 1	0.1
Molybdenum	< 1	< 1	< 1	< 1	73
Nickel	< 1	< 1	< 1	20	25 - 150
Selenium	< 1	< 1	< 1	< 1	1.0
Silver	< 1	< 1	< 1	< 1	0.1
Zinc	< 1	20	< 1	**40**	30
PAHs	< 5	< 5	< 5	< 5	
Phenols	< 1	< 1	< 1	< 1	4.0
Total VOCs	< 5	< 5	< 5	< 5	
Cyanide	< 5	< 5	< 5	< 5	5.0
Nitrate	< 10	< 10	< 10	< 10	Narrative
Nitrite	< 10	< 10	< 10	< 10	60

TABLE 3C
CORE 14
CFB COLD LAKE – UNTREATED

Parameter	O.Reg. 347 LEP, µg/L		Distilled Water LEP, µg/L		CCME Criteria µg/L
	Bulk Sample Core 14	Crushed Sample Core 14	Bulk Sample Core 14	Crushed Sample Core 14	
Aluminum	80	< 1	**410**	**29660**	5 – 100
Arsenic	< 1	< 1	< 1	< 1	5.0
Cadmium	< 1	< 1	< 1	< 1	0.017
Chromium^{III+}	< 5	< 5	< 5	< 5	4.9
Chromium^{VI+}	< 5	< 5	< 5	< 5	8.0
Copper	< 1	< 1	< 1	**20**	2 – 4
Iron	< 1	**3300**	< 1	**14470**	300
Lead	**30**	< 1	< 1	**40**	1 – 7
Mercury	< 1	< 1	< 1	< 1	0.1
Molybdenum	< 1	< 1	< 1	< 1	73
Nickel	< 1	< 1	< 1	20	25 - 150
Selenium	< 1	< 1	< 1	< 1	1.0
Silver	< 1	< 1	< 1	< 1	0.1
Zinc	10	30	< 1	**60**	30
PAHs	< 5	< 5	< 5	< 5	
Phenols	< 1	< 1	< 1	< 1	4.0
Total VOCs	< 5	< 5	< 5	< 5	
Cyanide	< 5	< 5	< 5	< 5	5.0
Nitrate	< 10	< 10	< 10	< 10	Narrative
Nitrite	< 10	< 10	< 10	< 10	60

TABLE 3D
CORES 35 and 36
CFB WAINWRIGHT – CENTRE TREATED

Parameter	O.Reg. 347 LEP, µg/L		Distilled Water LEP, µg/L		CCME Criteria µg/L
	Bulk Sample Core 35	Crushed Sample Core 36	Bulk Sample Core 35	Crushed Sample Core 36	
Aluminum	**180**	**260**	**390**	**20520**	5 – 100
Arsenic	< 1	< 1	< 1	< 1	5.0
Cadmium	< 1	< 1	< 1	< 1	0.017
$Chromium^{III+}$	< 5	< 5	< 5	< 5	4.9
$Chromium^{VI+}$	< 5	< 5	< 5	< 5	8.0
Copper	**30**	< 1	< 1	**10**	2 – 4
Iron	90	**9490**	**710**	**24540**	300
Lead	**20**	< 1	< 1	< 1	1 – 7
Mercury	< 1	< 1	< 1	< 1	0.1
Molybdenum	< 1	< 1	< 1	< 1	73
Nickel	10	30	< 1	10	25 - 150
Selenium	< 1	< 1	< 1	< 1	1.0
Silver	< 1	< 1	< 1	< 1	0.1
Zinc	< 1	30	< 1	30	30
PAHs	< 5	< 5	< 5	< 5	
Phenols	< 1	< 1	< 1	< 1	4.0
Total VOCs	< 5	< 5	< 5	< 5	
Cyanide	< 5	< 5	< 5	< 5	5.0
Nitrate	< 10	< 10	< 10	< 10	Narrative
Nitrite	< 10	< 10	< 10	< 10	60

TABLE 3E
CORES 41 and 42
CFB WAINWRIGHT – EDGE TREATED

Parameter	O.Reg. 347 LEP, µg/L		Distilled Water LEP, µg/L		CCME Criteria µg/L
	Bulk Sample Core 41	Crushed Sample Core 42	Bulk Sample Core 41	Crushed Sample Core 42	
Aluminum	20	**160**	**280**	**29470**	5 – 100
Arsenic	< 1	< 1	< 1	< 1	5.0
Cadmium	< 1	< 1	< 1	< 1	0.017
Chromium^{III+}	< 5	< 5	< 5	< 5	4.9
Chromium^{VI+}	< 5	< 5	< 5	< 5	8.0
Copper	< 1	< 1	< 1	**10**	2 – 4
Iron	< 1	**2260**	**250**	**24520**	300
Lead	< 1	**20**	< 1	**40**	1 – 7
Mercury	< 1	< 1	< 1	< 1	0.1
Molybdenum	< 1	< 1	< 1	60	73
Nickel	10	40	< 1	20	25 - 150
Selenium	< 1	< 1	< 1	< 1	1.0
Silver	< 1	< 1	< 1	< 1	0.1
Zinc	20	< 1	< 1	10	30
PAHs	< 5	< 5	< 5	< 5	
Phenols	< 1	< 1	< 1	< 1	4.0
Total VOCs	< 5	< 5	< 5	< 5	
Cyanide	< 5	< 5	< 5	< 5	5.0
Nitrate	< 10	< 10	< 10	< 10	Narrative
Nitrite	< 10	< 10	< 10	< 10	60

TABLE 3F
CORE 5
CFB WAINWRIGHT – UNTREATED

Parameter	O.Reg. 347 LEP, µg/L		Distilled Water LEP, µg/L		CCME Criteria µg/L
	Bulk Sample Core 5	Crushed Sample Core 5	Bulk Sample Core 5	Crushed Sample Core 5	
Aluminum	< 1	80	**560**	**59940**	5 – 100
Arsenic	< 1	< 1	< 1	< 1	5.0
Cadmium	< 1	< 1	< 1	< 1	0.017
Chromium^{III+}	< 5	< 5	< 5	< 5	4.9
Chromium^{VI+}	< 5	< 5	< 5	< 5	8.0
Copper	< 1	< 1	< 1	**30**	2 – 4
Iron	< 1	**2940**	**3020**	**60290**	300
Lead	**30**	< 1	< 1	**80**	1 – 7
Mercury	< 1	< 1	< 1	< 1	0.1
Molybdenum	< 1	< 1	< 1	< 1	73
Nickel	10	20	< 1	40	25 - 150
Selenium	< 1	< 1	< 1	< 1	1.0
Silver	< 1	< 1	< 1	< 1	0.1
Zinc	< 1	10	< 1	**60**	30
PAHs	< 5	< 5	< 5	< 5	
Phenols	< 1	< 1	< 1	< 1	4.0
Total VOCs	< 5	< 5	< 5	< 5	
Cyanide	< 5	< 5	< 5	< 5	5.0
Nitrate	< 10	< 10	< 10	< 10	Narrative
Nitrite	< 10	< 10	< 10	< 10	60

- the concentration of lead was observed to be high in some of the cores, with the 'crushed' samples generally exhibiting somewhat higher concentrations than the bulk sample results; and

- occasional exceedances in the concentration of zinc were noted at both CFB Cold Lake and CFB Wainwright for 'crushed' samples only, and in the concentration of copper at CFB Wainwright only.

As similar CCME exceedances were observed for both Sand RejuvaSeal-treated and untreated cores, the high (in comparison to CCME criteria) test results are attributed to the mineral constituents or other operational activities (such as de-icing chemical application for instance), not the Sand RejuvaSeal treatments.

CLOSING REMARKS

This report on the evaluation of the Sand RejuvaSeal treatments of the CFB Cold Lake and CFB Wainwright pavements has been prepared by JEGEL and is intended for use by representatives of Echelon Industries, Inc. and the Department of National Defence.

JOHN EMERY GEOTECHNICAL ENGINEERING LIMITED

Michael H. MacKay, M.Eng., P.Eng.
Principal Geotechnical Engineer
Consulting Engineer

APPENDIX A

CAMBRIDGE MATERIALS TESTING LIMITED

COMPOSITIONAL ANALYSIS RESULTS

199232

Cambridge
materials testing limited

TSL Professional Services
6991 Millcreek Drive, Unit 13,
Mississauga, Ontario L5N 6B9
Tel: (905) 812-3856 Fax: (905) 812-3866
www.cambridgematerials.com

Report For:	John Emery Geotechnical Eng. Ltd. 109 Woodbine Downs Blvd., Unit #1, TORONTO, Ontario M9W 6Y1 Phone: 416-213-1060 Fax: 416-213-1070	**Laboratory #:**	**273760-01**
		Report Date:	March 9, 2001
		Received Date:	February 22, 2001
		Customer P.O. #:	199232-571
Attention:	David Soancs		
Specimen:	Runway Sweepings		

TEST REPORT

RE: COMPOSITIONAL ANALYSIS OF RUNWAY SWEEPINGS AND COATING MATERIAL

1.0 INTRODUCTION

On February 22, 2001, TSL Professional Services received three (3) samples of airport runway sweepings for compositional analysis to determine both organic and inorganic constituents.

The submitted samples were identified as:

Sample #1 - Rejuvenator Sealer (Liquid)/199232)

Sample #2 - Sweeper #24010 (Solid/Granules & Dust)

Sample #3 - Sweeper #78132 (Solid/Granules & Dust)

The submitted samples were first analysed for General Composition by Pyrolysis @ 550°C, to determine proportion of organic and inorganic constituents.

The Volatile Organic constituents were analysed by a Gas Chromatograph and Non-Volatile Organic constituents were analysed by an Infrared Spectrometer.

The Inorganic residue was analysed by a Plasma Spectrometer for metallic oxides. The results of analysis are detailed here.

Cambridge Materials Testing Limited

Per _____ QUALITY ASSURANCE

Per _____ TECHNICIAN

Cambridge
materials testing limited

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www.cambridgematerials.com

Laboratory #273760-01
John Emery Geotechnical Eng. Ltd.

2.0 RESULTS OF ANALYSIS

2.1 General Composition (by Pyrolysis @ 550°C)

	Sample #1 Rejuvenator Sealer #199232 (%)	Sample #2 Sweeper Solid Residue #24010 (%)	Sample #3 Sweeper Solid Residue #78132 (%)
Total Volatile Organic Compounds (Solvents)	56.21	-	-
Non-Volatile Organic Constituents (Resins)	36.98	40.30	22.25
Inorganic Residue (Ash)	7.91	59.70	77.75

2.2 Gas Chromatographic Analysis of Volatile Organic Compound (Solvents)

Note: Gas Chromatographic analysis were performed only on Sample #1 (Liquid Rejuvenator Sealer)

The resulting Gas Chromatogram showed that the volatile compound consists of a mixture of Hydrocarbon fractions containing both Aliphatic and Aromatic compounds, very similar to Varsol. (See attached Gas Chromatograph)

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Laboratory #273760-01
John Emery Geotechnical Eng. Ltd.

2.3 Infrared Analysis of Non-Volatile Organic Constituents

The Non-volatile Organic constituents were extracted with Dichloromethane and the extracts were Infrascanned for Identification.

The resulting Infragraphs showed that:

Sample #1 – Rejuvenator Sealer #199232

- The Non-Volatile Organic constituents in this sample consisted of a mixture of Hydrocarbon Polymers, containing mostly Aliphatic compounds. (See Infragraph 3273760-1)

Samples #2 and #3 – Solid Residue Material from Sweepers #24010 and #78132

- The Non-Volatile constituents in these two samples were identical in composition and consisted of a mixture of Hydrocarbon Polymers, containing Aromatic and Aliphatic Rubber-like compounds. (See Infragraph #273760-2/3)

2.4 Compositional Analysis of Inorganic Residue

The Inorganic Residue (Ash) was analysed for major and minor constituents, using Plasma Spectrometer and the results obtained are detailed in the attached report on ICAP Total Oxide analysis.

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materials testing limited

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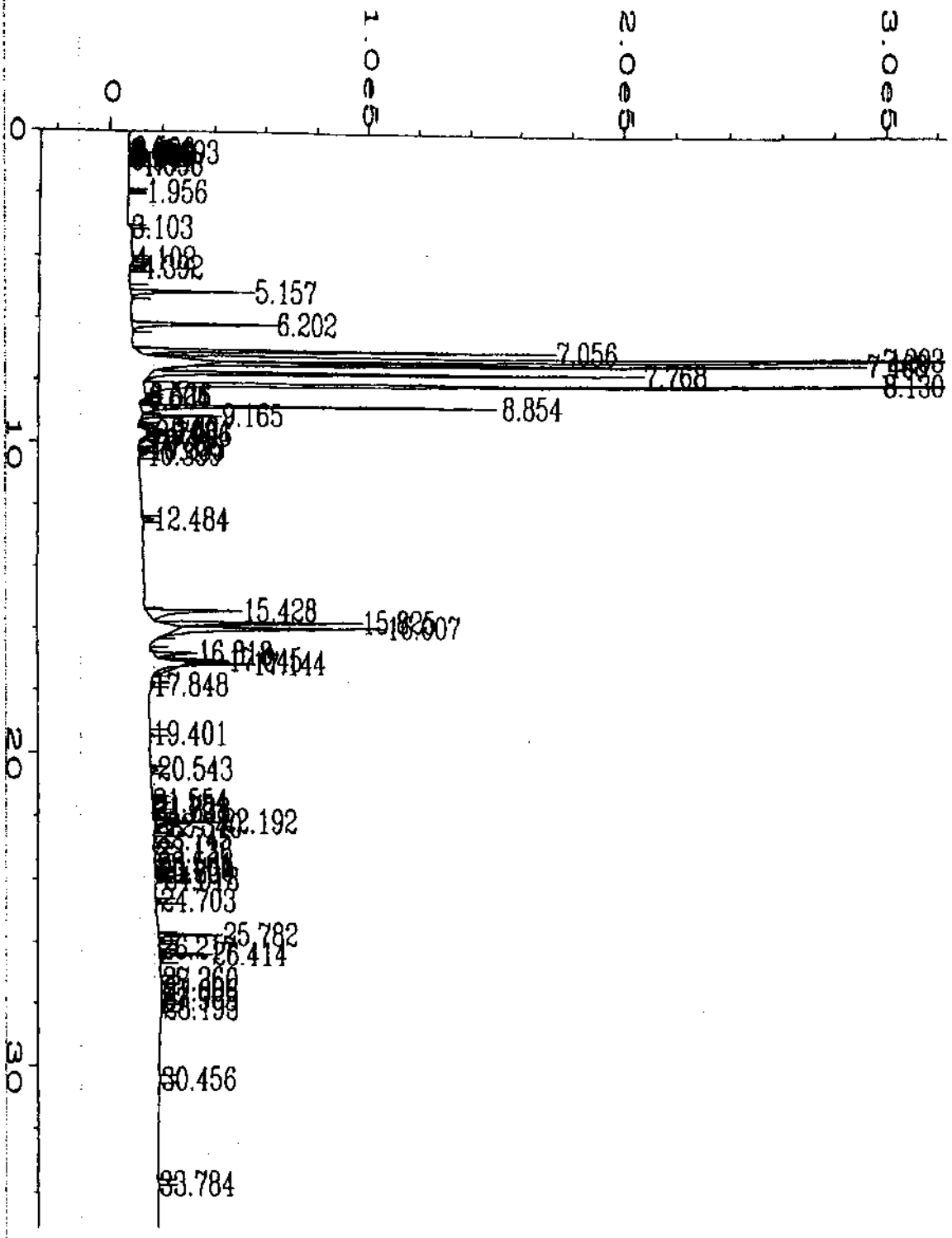
Laboratory #273760-01
John Emery Geotechnical Eng. Ltd.

I.C.A.P. TOTAL OXIDE ANALYSIS

RE: COMPOSITIONAL ANALYSIS OF INORGANIC RESIDUE (ASH)

Element as Oxide			Sample #1 Rejuvenator Sealer #199232	Sample #2 Sweeper Solid Residue #24010	Sample #3 Sweeper Solid Residue #78132
Major Constituents					
Silica	(SiO_2)	%	4.62	38.40	41.79
Aluminum	(Al_2O_3)	%	0.67	4.52	4.43
Iron	(Fe_2O_3)	%	0.32	28.18	38.64
Calcium	(CaO)	%	0.28	6.15	8.13
Magnesium	(MgO)	%	1.88	1.00	0.97
Sodium	(Na_2O)	%	0.04	0.97	0.57
Potassium	(K_2O)	%	0.06	2.00	1.46
Titanium	(TiO_2)	%	0.02	0.17	0.20
Manganese	(MnO)	%	<0.01	0.18	0.24
Phosphorus	(P_2O_5)	%	<0.02	0.18	0.22
Zinc	(ZnO)	%	<0.01	3.08	2.63
Minor Constituents					
Barium	(Ba)	ppm	30	1950	3130
Strontium	(Sr)	ppm	30	250	250
Zirconium	(Zr)	ppm	15	45	75
Yttrium	(Y)	ppm	<2	8	12
Scandium	(Sc)	ppm	<1	2	3
Niobium	(Nb)	ppm	<30	<30	<30
Beryllium	(Be)	ppm	<1	2	4
Nickel	(Ni)	ppm	<5	25	<5
Chromium	(Cr)	ppm	<5	415	245
Copper	(Cu)	ppm	15	1065	1655
Vanadium	(V)	ppm	25	95	155
Cobalt	(Co)	ppm	5	80	65
LOI		%	91.90	14.59	<0.01
TOTAL		%	99.81	99.41	99.30

273760-1 (REJUVENATOR SEALER - 199232)



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Instrument : ECD/FID
Sample Name : 273760-1 .68/100
Run Time Bar Code:
Acquired on : 01 Mar 01 01:24 PM
Report Created on: 01 Mar 01 02:04 PM

Page Number : 1
Vial Number :
Injection Number :
Sequence Line :
Instrument Method: CHARCOAL.MTH
Analysis Method : MAYNARD.MTH

Area Percent Report

Data File Name : C:\HPCHEM\2\DATA\273760\001R0101.D
Operator : Nassif Iskander
Instrument : ECD/FID
Sample Name : 273760-1 .68/100
Run Time Bar Code:
Acquired on : 01 Mar 01 01:24 PM
Report Created on: 01 Mar 01 02:04 PM

Page Number : 1
Vial Number :
Injection Number :
Sequence Line :
Instrument Method: CHARCOAL.MTH
Analysis Method : MAYNARD.MTH

Sig. 2 in C:\HPCHEM\2\DATA\273760\001R0101.D

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8	1.089	0	3153	Fsho	0.000	0.0000
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15	4.455	0	1100	Rsho	0.000	0.0000
16	5.129	0	27278	Fsho	0.000	0.0000
17	5.157	214263	47793	BB	0.068	2.1151
18	6.202	252455	55763	BB	0.069	2.4921
19	6.315	0	2616	Rsho	0.000	0.0000
20	6.445	0	87	Rsho	0.000	0.0000
21	7.056	631440	163433	BB	0.060	6.2333
22	7.293	3122474	725412	BB	0.068	30.8237
23	7.468	886310	253112	BB	0.055	8.7493
24	7.768	727700	191923	BB	0.058	7.1835
25	8.130	1913156	509883	BB	0.056	18.8859
26	8.263	0	14055	Rsho	0.000	0.0000
27	8.325	0	6569	Rsho	0.000	0.0000
28	8.462	0	155	Rsho	0.000	0.0000
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30	8.604	4557	1595	BB	0.046	0.0450
31	8.854	552398	140857	BB	0.059	5.4530
32	8.989	0	5671	Rsho	0.000	0.0000
33	9.038	0	2499	Rsho	0.000	0.0000
34	9.165	109741	30717	BB	0.055	1.0833
35	9.603	0	7559	Fsho	0.000	0.0000
36	9.621	33132	9358	BB	0.055	0.3271
37	9.708	5227	2279	BB	0.038	0.0516
38	9.796	29106	9490	BB	0.047	0.2873
39	9.978	5981	1723	BB	0.051	0.0590
40	10.235	19006	4360	BB	0.062	0.1876
41	10.288	0	1163	Rsho	0.000	0.0000
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44	15.428	244921	36980	BB	0.088	2.4178
45	15.506	0	14673	Rsho	0.000	0.0000
46	15.553	0	8718	Rsho	0.000	0.0000

Operator : Nassif Iskander
Instrument : ECD/FID
Sample Name : 273760-1 .68/100
Run Time Bar Code:
Acquired on : 01 Mar 01 01:24 PM
Report Created on: 01 Mar 01 02:04 PM

Page Number : 2
Vial Number :
Injection Number :
Sequence Line :
Instrument Method: CHARCOAL.MTH
Analysis Method : MAYNARD.MTH

47	15.633	0	4462	Rsho	0.000	0.0000
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52	16.145	0	8886	Rsho	0.000	0.0000
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64	21.838	2777	872	BB	0.046	0.0274
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67	22.735	0	1054	Fsho	0.000	0.0000
68	22.745	5767	1155	BB	0.067	0.0569
69	23.115	0	553	Fsho	0.000	0.0000
70	23.136	1031	895	BB	0.023	0.0102
71	23.561	3303	910	BB	0.047	0.0326
72	23.730	2448	1054	BB	0.038	0.0242
73	23.804	3478	1148	BB	0.043	0.0343
74	24.013	7867	2601	BB	0.047	0.0777
75	24.703	4867	1443	BB	0.049	0.0480
76	25.782	88438	24794	BB	0.055	0.8730
77	25.932	0	167	Rsho	0.000	0.0000
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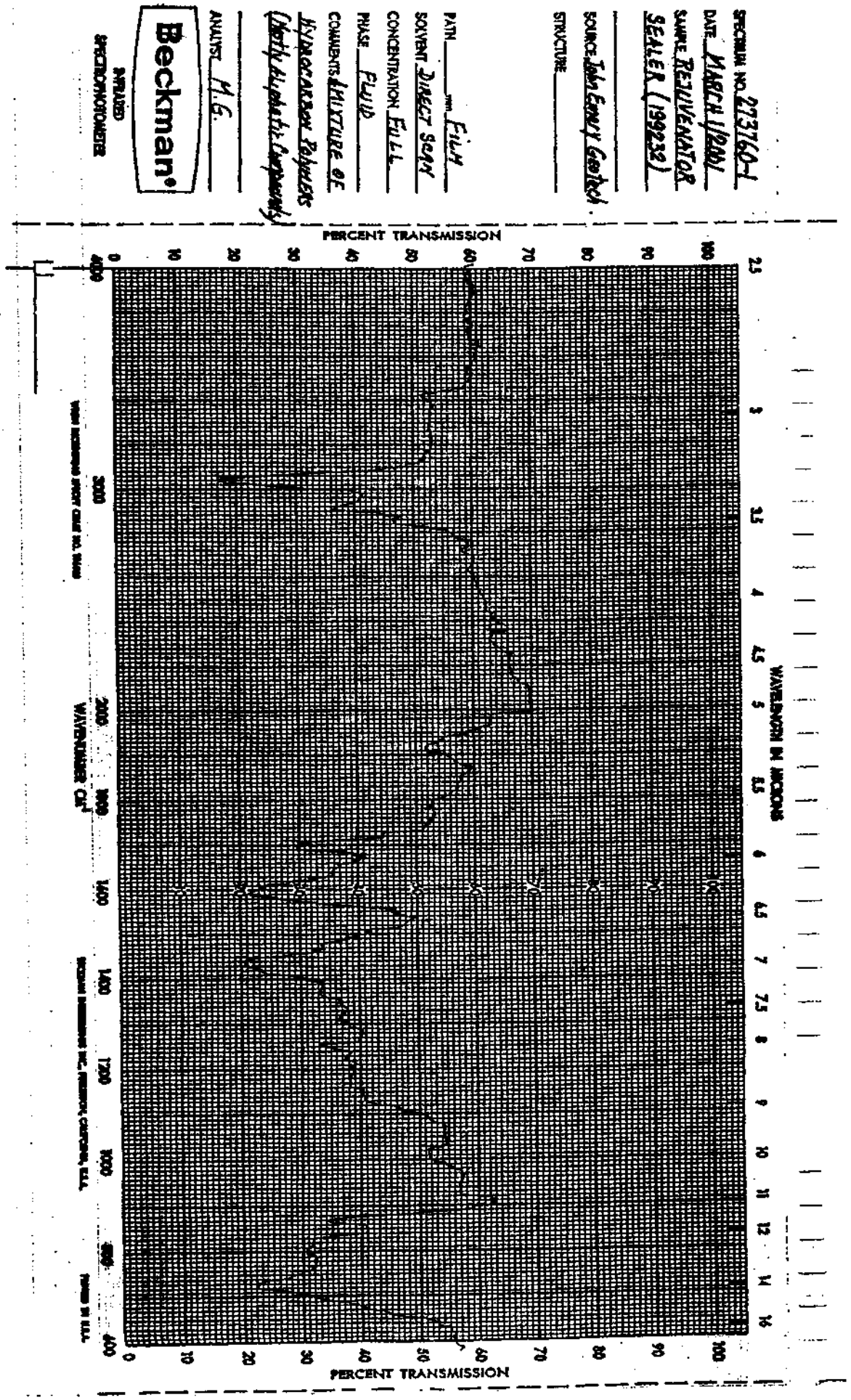
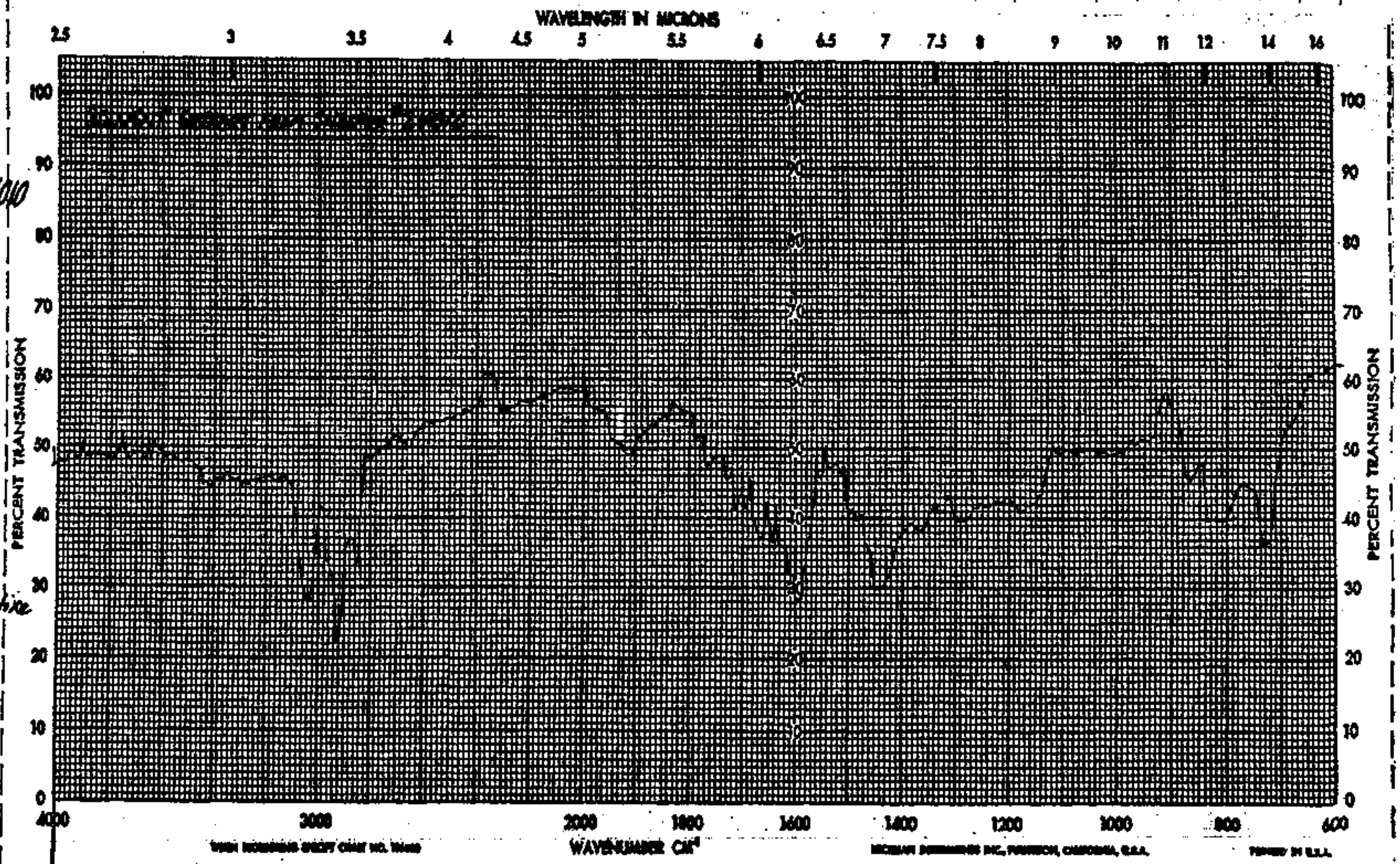
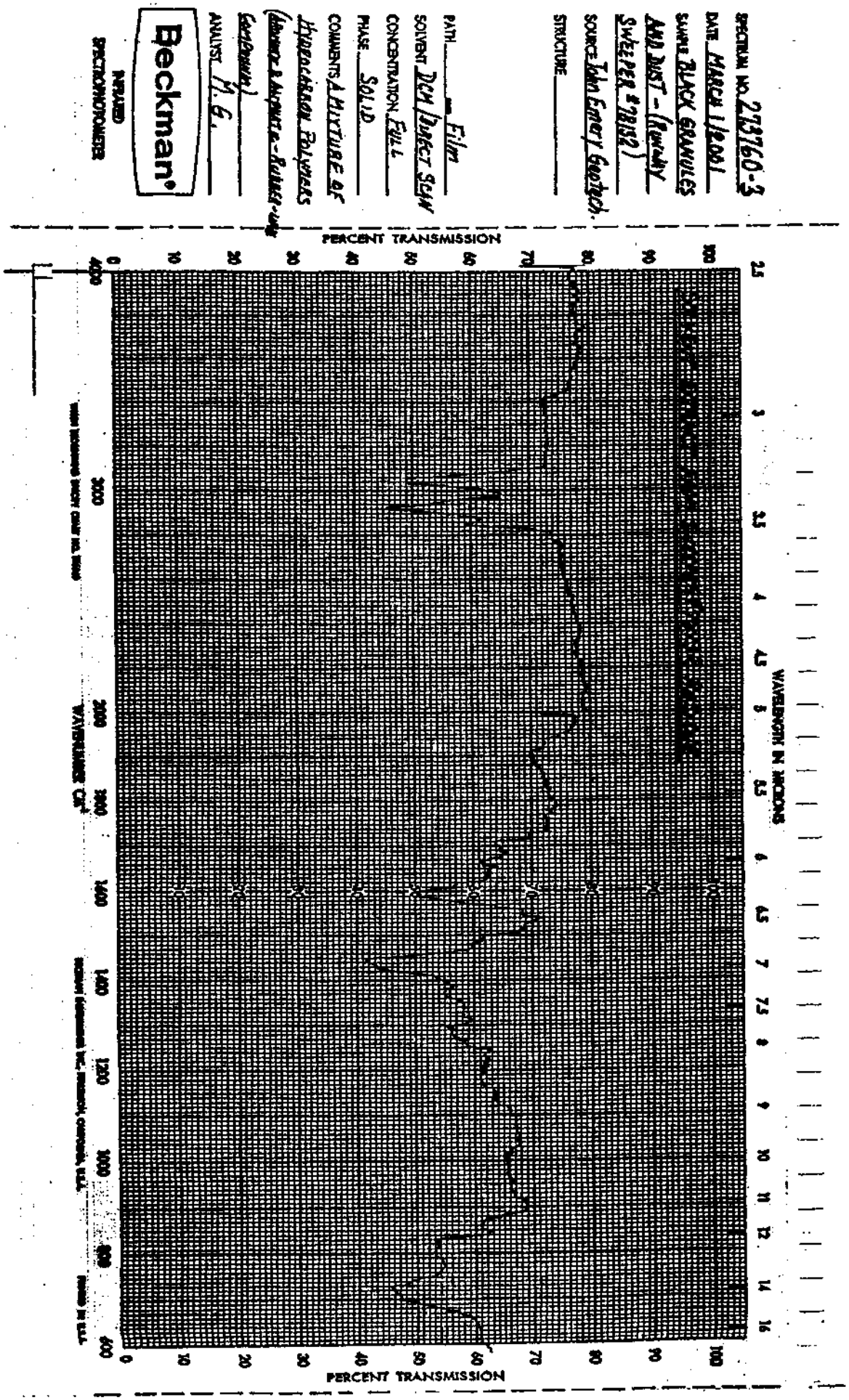

SPECTRUM NO. 273760-1
DATE MARCH 1/2001
SAMPLE REJUVENATOR SEALER (199232)
SOURCE John Emery Geotech
STRUCTURE
PATH 1mm FILM
SOLVENT DIRECT SCAN
CONCENTRATION FULL
PHASE FLUID
COMMENTS MIXTURE OF HYDROCARBON POLYMERS (Mostly Aliphatic Components)
ANALYST M.G.
Beckman
INFRARED SPECTROPHOTOMETER
PERCENT TRANSMISSION
WAVELENGTH IN MICRONS
WAVENUMBER CM-1
PERCENT TRANSMISSION

SPECIMEN NO. 273760-2
DATE March 1/2001
SAMPLE Black Granules and Dust – (Runway Sweeper #(199232) 4/24/00
SOURCE John Emery Geotech.
STRUCTURE ______

PATH ___ mm Film
SOLVENT DCM/Direct Scan
CONCENTRATION Full
PHASE Solid
COMMENTS A Mixture of Hydrocarbon Polymers (Aromatic & Aliphatic Rubber-like Compounds)
ANALYST M.G.

Beckman®
INFRARED SPECTROPHOTOMETER




SPECTRUM NO. 237760-3
DATE MARCH 1 2001
SAMPLE BLACK GRANULES AND DUST - (Rework SWEEPER #78152)
SOURCE John Emery Geotech.
STRUCTURE
PATH Film
SOLVENT DCM Direct Spray
CONCENTRATION Full
PHASE Solid
COMMENTS A Mixture of Hydrocarbon Polymers
ANALYST M. G.
Beckman
INFRARED SPECTROPHOTOMETER
PERCENT TRANSMISSION
WAVENUMBER CM-1
WAVELENGTH IN MICRONS
PERCENT TRANSMISSION

APPENDIX B

JACQUES WHITFORD ASSOCIATES LIMITED

SUMMARY REPORT OF SITE VISIT

SUMMARY NOTES

RejuvaSeal Inspection

4 WINGS CANADIAN AIRFORCE BASE
COLD LAKE, ALBERTA

Project No. ABC10632

Jacques Whitford and Associates Limited
Suite 500, 703 – 6th Avenue SW
Calgary, AB T2P 0T9
Tel: (403) 263-7113
Fax: (403) 263-7116

February 27, 2001

SUMMARY NOTES

At the request of Mr. Bill Vandemark of Echelon Industries Inc., Jacques Whitford and Associated Limited (JWAL) carried out an observation and sampling program at the airfield runways at CFB Cold Lake, Alberta.

Date:
Friday, **February 23, 2001**, between 8:00 a.m. to 2:30 p.m.

Weather Conditions:
Approx. 12...15mm fresh snow during the night and morning, Snowfall stopped about 7:30 a.m., Temperature approx. –5 °C, mainly sunny, slightly windy

Activities:
- visual inspection
- taking samples of material, dust etc.
- taking photos
- gathering additional information regarding the subject (verbal and written)

Site Contact:
The inspecting technician, Mr. Frank Herbrig of JWAL, was escorted by
Mr. Frank Wilson, Wing Hazardous Material Coordinator,
phone: (780) 840-8000, ext. 8199
cell: (780) 826-0743
on behalf of Mr. Drew Craig, Wing Environmental Technologist, ph.: (780) 840-8000, ext. 8430, cell: (780) 812-8847, who was not available on this day.

In his position Mr. Wilson was familiar with the subject and could provide the necessary information as well as some documents (see page 4). He also organized and partially accompanied Mr. Herbrig to the points of inspection.

The inspecting technician got additional information by conversation with several other employees on the site.

According to the provided information the coating, including a grid sanding, was applied in Fall 2000. The problems occurred after the first snowfall, when sweeping of the runways became necessary. It was reported that a "black dust" together with parts of the silicate grid came off.

In the machine shed ("Heavy Equipment Building", No. 85) all machinery working on the runways (sweeping machines, trucks etc.) could be seen covered with this "black dust" mixed with sand or silicate. On the brooms and floors there was a heavy black crust. When fresh, there are smeary footprints on the corridor, which cannot be removed from the vinyl. There are also smudge fingerprints from the operators on the doors etc., which appear to contain some kind of tar.

The abrasion dust (partly mixed with snow) could also be found on the machines recently coming in from the work on runways or during the work itself.

The snowbanks on the sides of the runways and streets appear cluttered with heavy black sand.

Even on a cleaned runway surface (machine cleaned plus additionally sweeped with a hand broom), abrasion dust can easily be taken on a cloth.

Samples of this "black dust" or "black Sand" were taken (see separate list).

To determine the possible influence of the use of de-icers, the following were obtained from the maintenance personnel:

- During dry weather, if there is snow or ice expected to come or to build up, an ice-preventing fluid is used. The main content is potassium acetate.
- To thaw existing ice or snow, a melting "salt' is used. This is a white granulate, which mainly consists of sodium formate.

A sample of each substance was obtained.

Important Notes:

Only a part of the coated surface is cleaned from snow during the winter, so the full extension of the damage cannot be seen before snow melting. There is no peeling of the asphalt surface reported so far, but it cannot be excluded to appear in the spring.

The CFB managers took the following precautions so far:

- The contaminated snowbanks were pushed back from manholes and catchbasins to reduce the risk of environmental impact when the snow melts (the stormwater goes into a creek which eventually discharges into the lake).
- Some equipment operators wear dust masks, especially during dry weather conditions. The management is currently discussing carrying out additional health tests.
- To appraise possible health and environmental risks samples of the suspect material were taken on February 08, 2001, on CFB's own initiative and sent to the Calgary Northwest Laboratories. The test report came back on February15, and a copy is attached to this note.

Provided Documents (Attachments):

- Layout map of the property
- Chemical description of de-icing liquid and de-icing "salt" (see "Findings")
- Report from lab test done on behalf of CFB at Northwest Laboratories Calgary on February 10 to 14, 2001 (samples from February 08, 2001)

Samples (Attachments):

- See separate listing on page 5.

Frank Herbrig

Frank Herbrig
Reporting Technologist

B-4

List of SAMPLES

A. JARS

1 - from snowbanks on Runway 04/22
2 - from snowbanks on Inner Runway, Highspeed Area
3 - from snowbanks outside the Heavy Equipment Building (Buildg. No. 85) – 2 jars from the same sample
4 - from sweeping machine, while working on hammerhead 31L on Outer Runway
5 - from sweeping machine, taken outside the Heavy Equipment Building (machine just came back from sweeping job on Inner Runway)
no No. – de-icing fluid (mainly potassium acetate) from tank

B. BAGS

no No. – de-icing "salt" (mainly sodium formate) from storage
6 - dust from machines (parked inside the Heavy Equipment Building)
7 - dust from machine (taken outside the Heavy Equipment Building) - machine just came back from sweeping job on Inner Runway
8 - dry crust from broom of sweeping machine (parked inside the Heavy Equipment Building)
9 - dry crust from shop floor of the Heavy Equipment Building (where sweeping machine was parked)
10 - sludge from fresh footprints in corridor of the Heavy Equipment Building
11 - paper cloth wiped on (machine plus hand sweeped) surface on Inner Runway, Highspeed Area (close to where sample #2 was taken)

P:\post1998\10000\10600\10632\10632_Notes.doc

List of Photos

1 - stains on shop floor of the Heavy Equipment Building (Buildg. No. 85)
2 - dry crust on shop floor of the Heavy Equipment Building ***(sample #9)***
3 - machines parked in the Heavy Equipment Building covered with "black dust"
4 - detail of "black dust" on machine ***(sample #6)***
5 - tank with 'de-icing fluid"
6 - detail of tank marking
7 - dry crust on sweeping machine parked in the Heavy Equipment Building
8 - detail of dry crust on broom of sweeper ***(sample #8)***
9 - footprint stains on corridor floor in the Heavy Equipment Building ***(sample #10)***
10 - smeary fingerprints on front door of the Heavy Equipment Building
11 - "black dust" on windshield of machine coming from work on runway
12 - another detail of "black dust" on machine coming from work on runway ***(sample #7)***
13 - black cluttered snowbanks in front oft the Heavy Equipment Building
14 - detail of snowbanks in front oft the Heavy Equipment Building ***(sample #3)***
15 - another detail of these snowbanks
16 - black cluttered snowbanks on Runway 04/22
17 - detail of these snowbanks ***(sample #1)***
18 - runway surface on hammerhead 31L on Outer Runway
19 - Outer Runway looking West
20 - cracks on Outer Runway looking West (approx. in the middle of the length)
21 - detail of former test patch on Outer Runway
22 - Inner Runway looking East ***(sample #2 from side of this runway)***
23 - detail of surface on Inner Runway, Highspeed Area ***(sample #11)***

photo # 1

photo #2

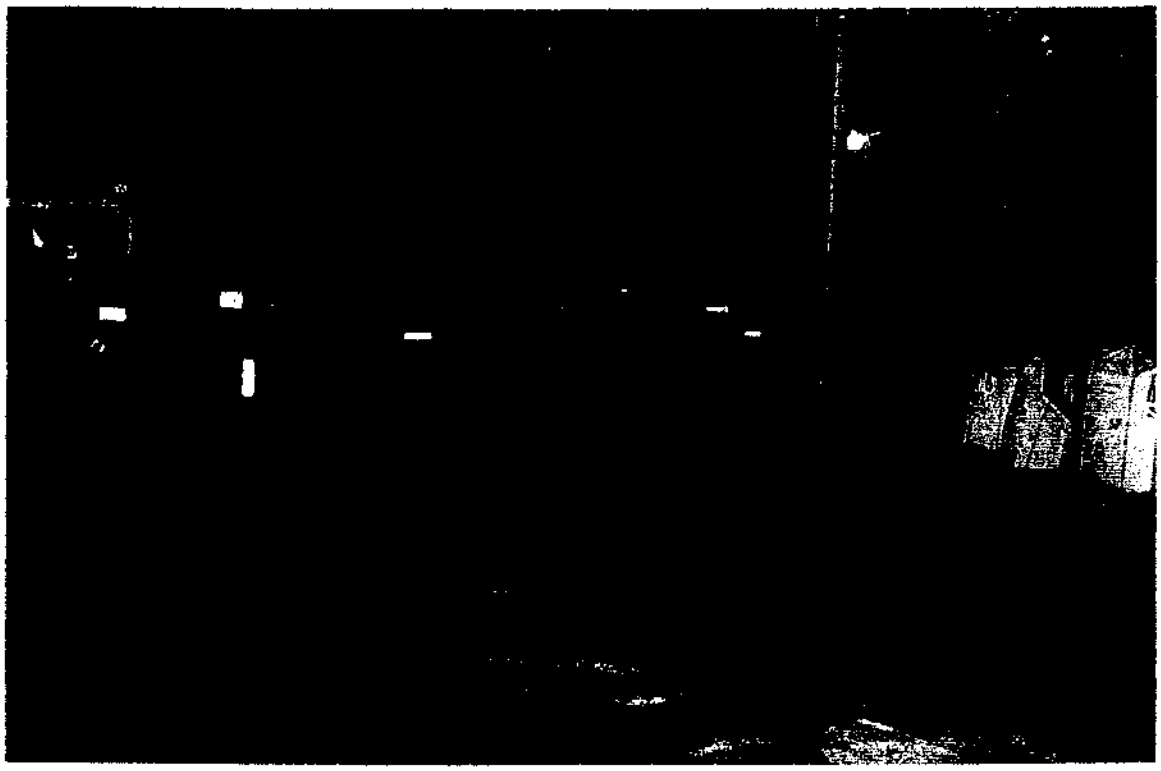
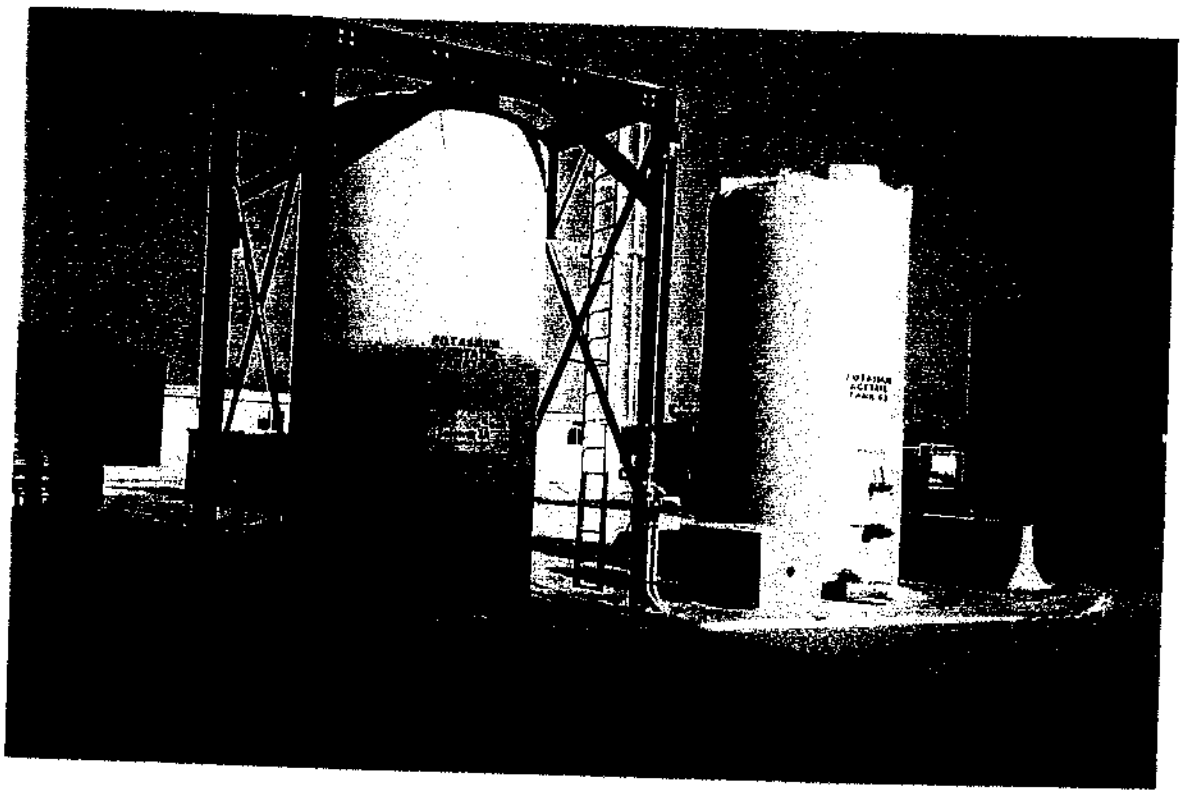


photo # 3

photo #4



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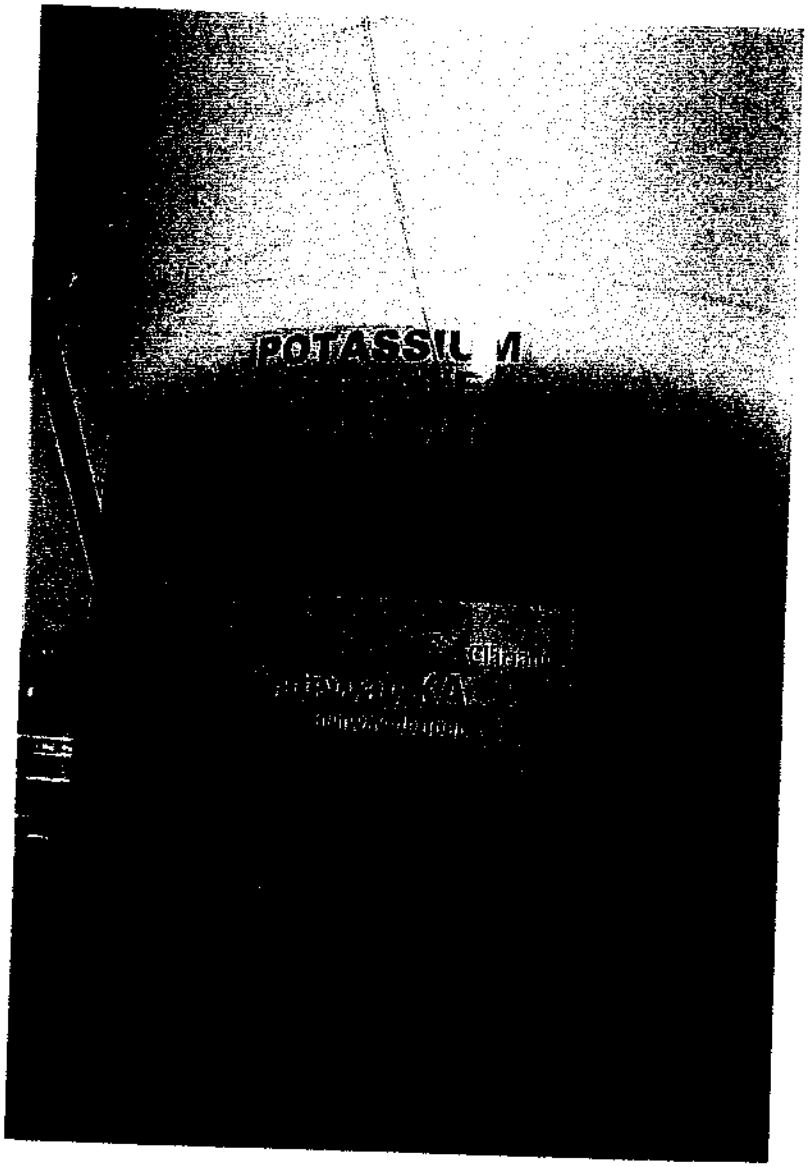

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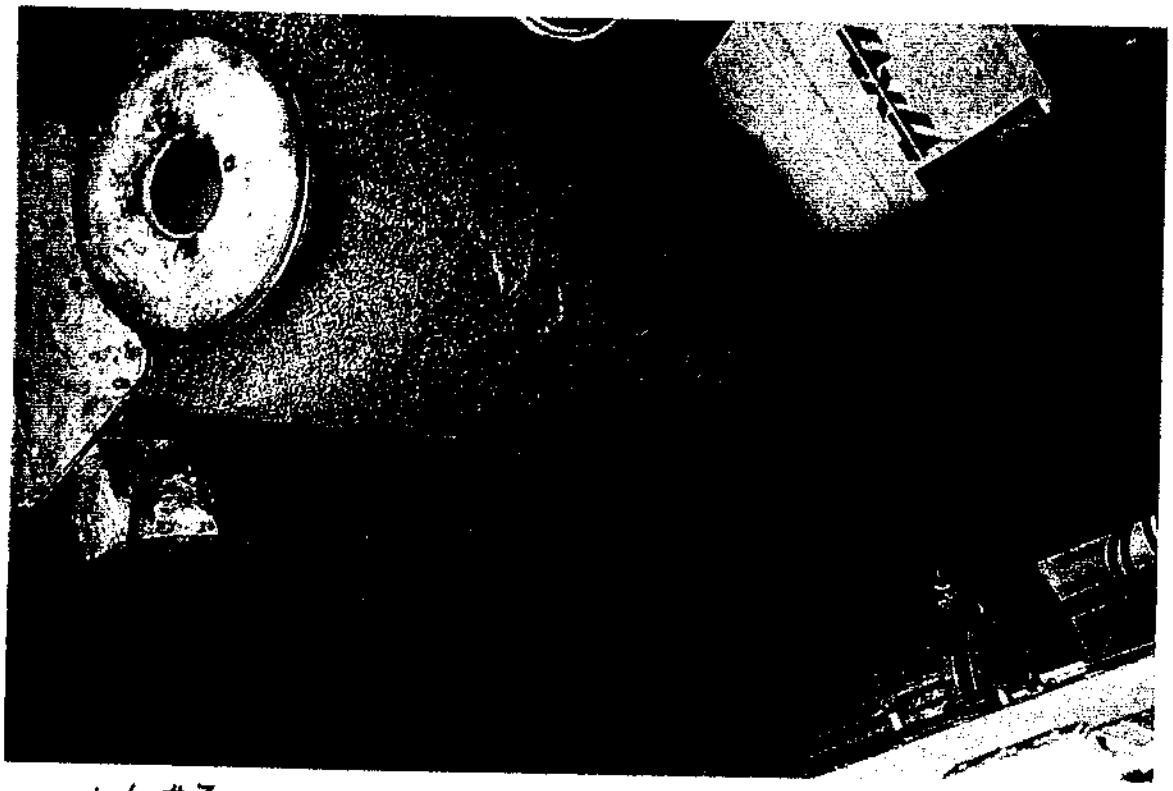
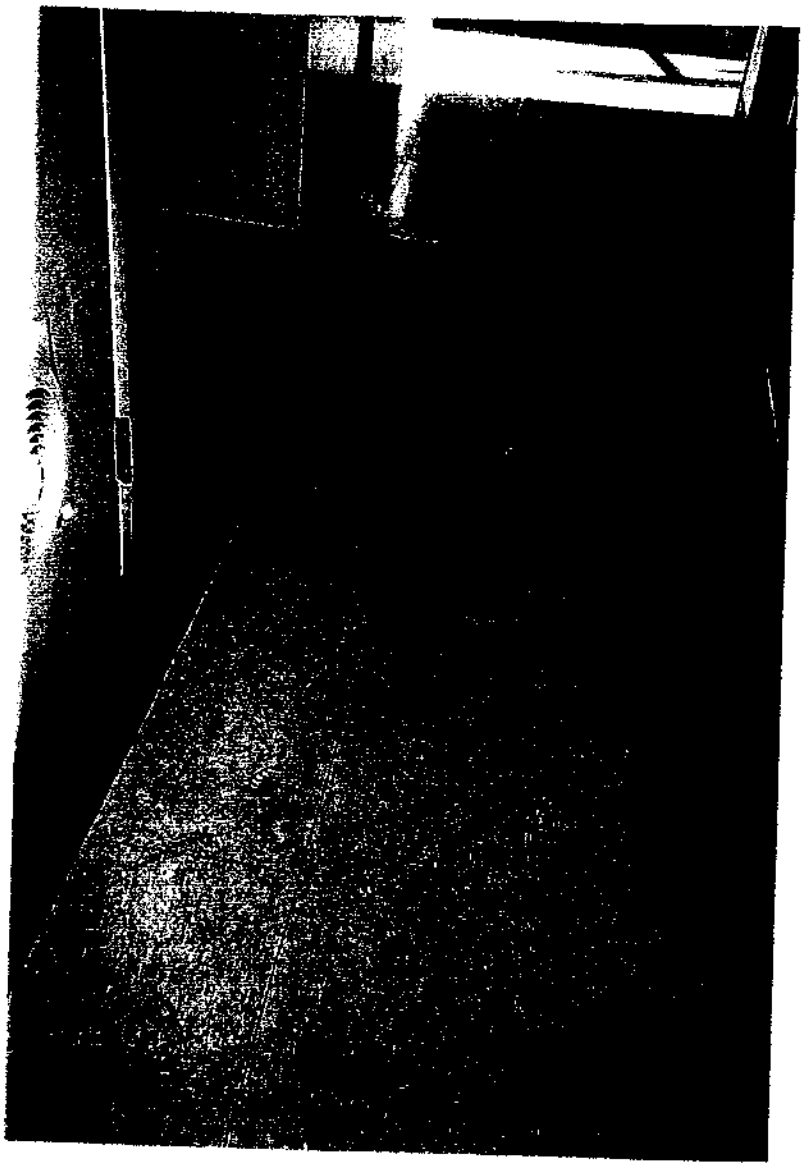


photo # 7

photo # 8



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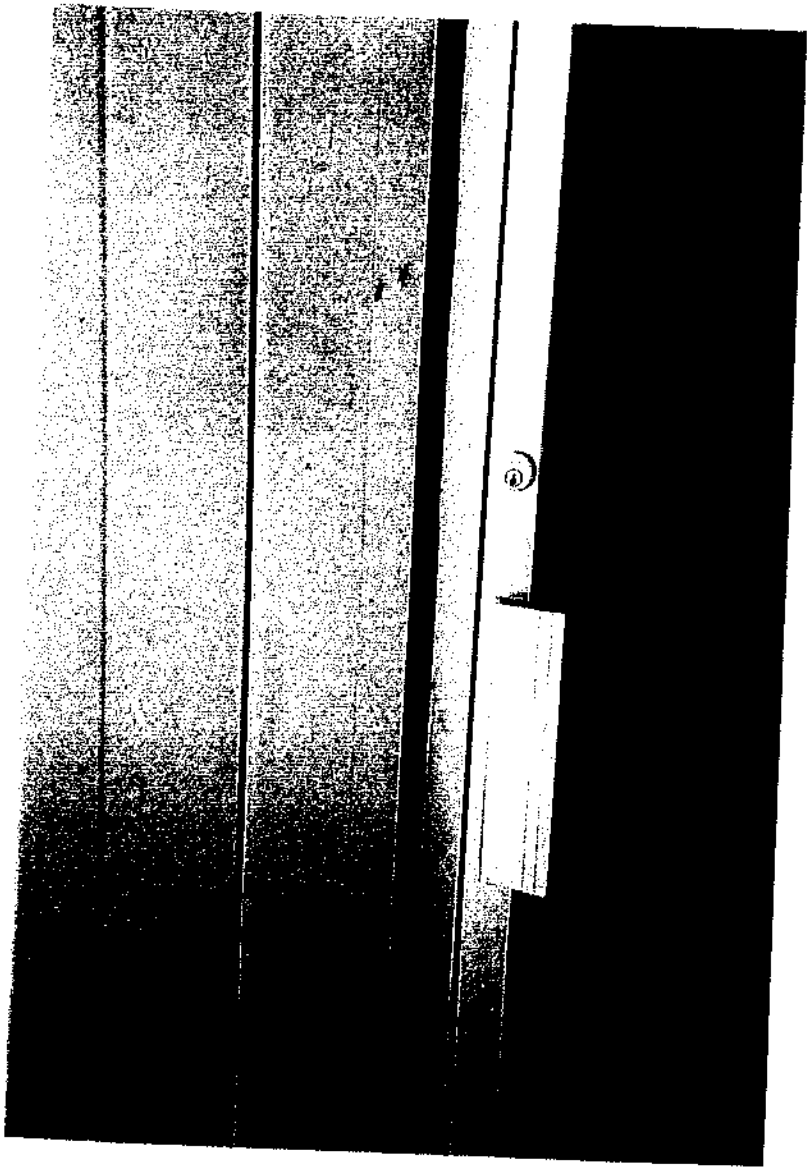

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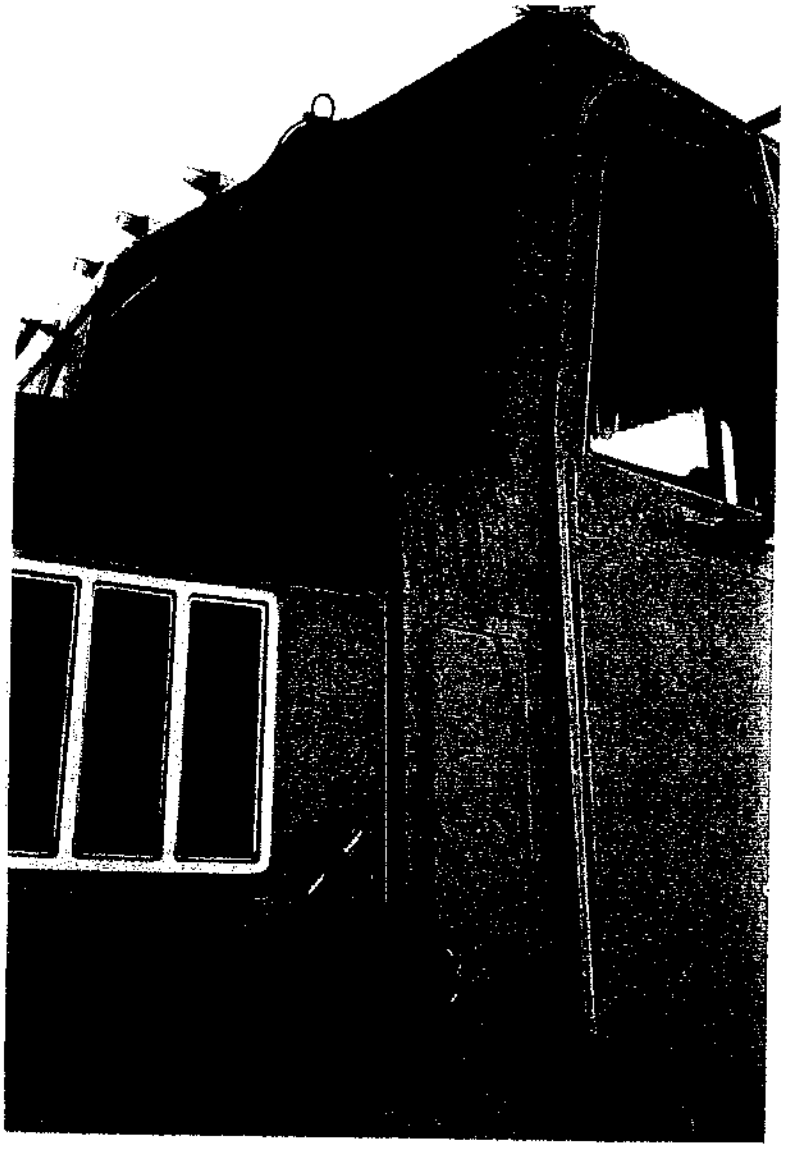


photo # 11

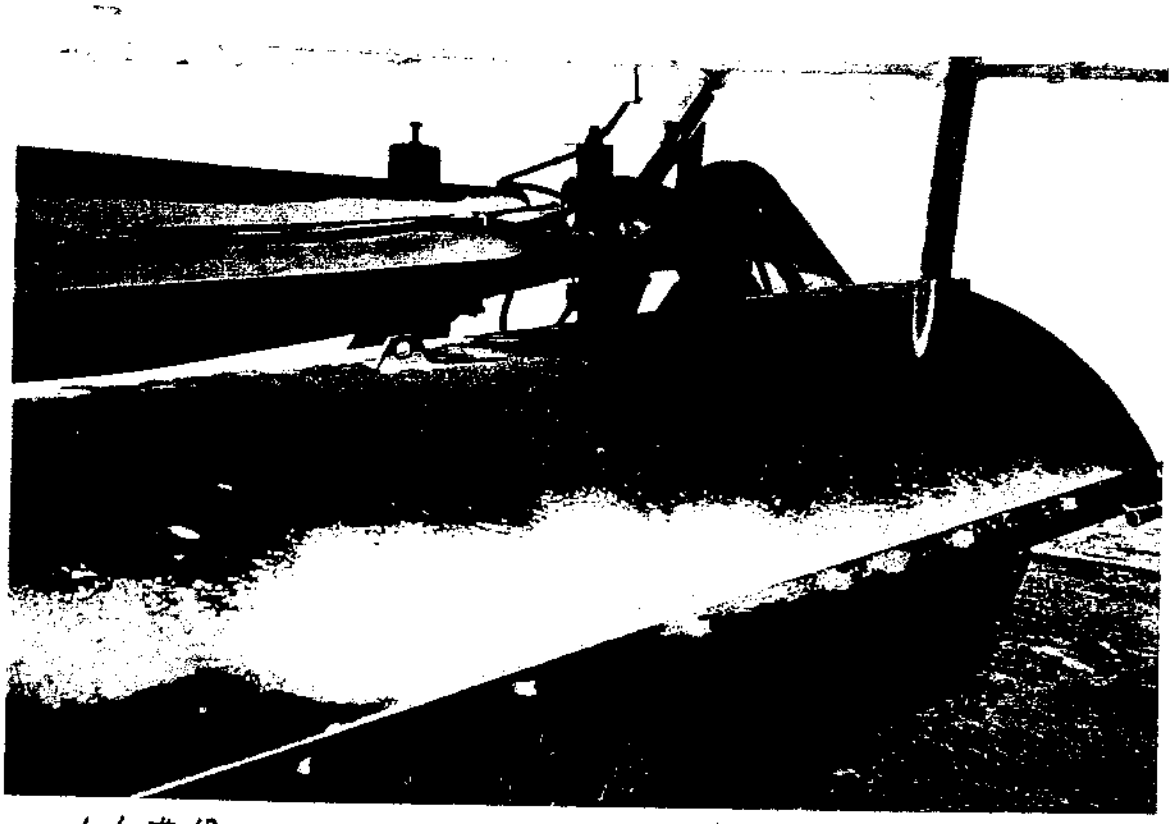


photo # 12

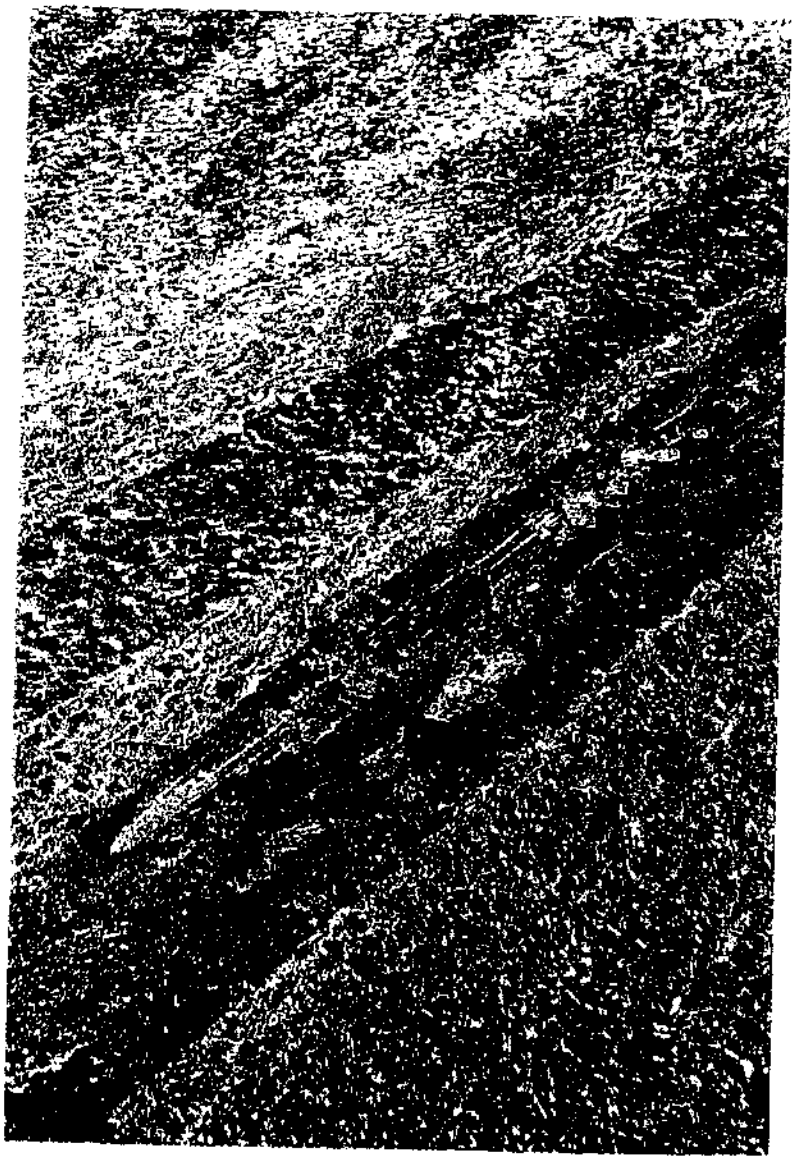
photo # 13

photo #14

photo #15

photo # 16

photo # 17



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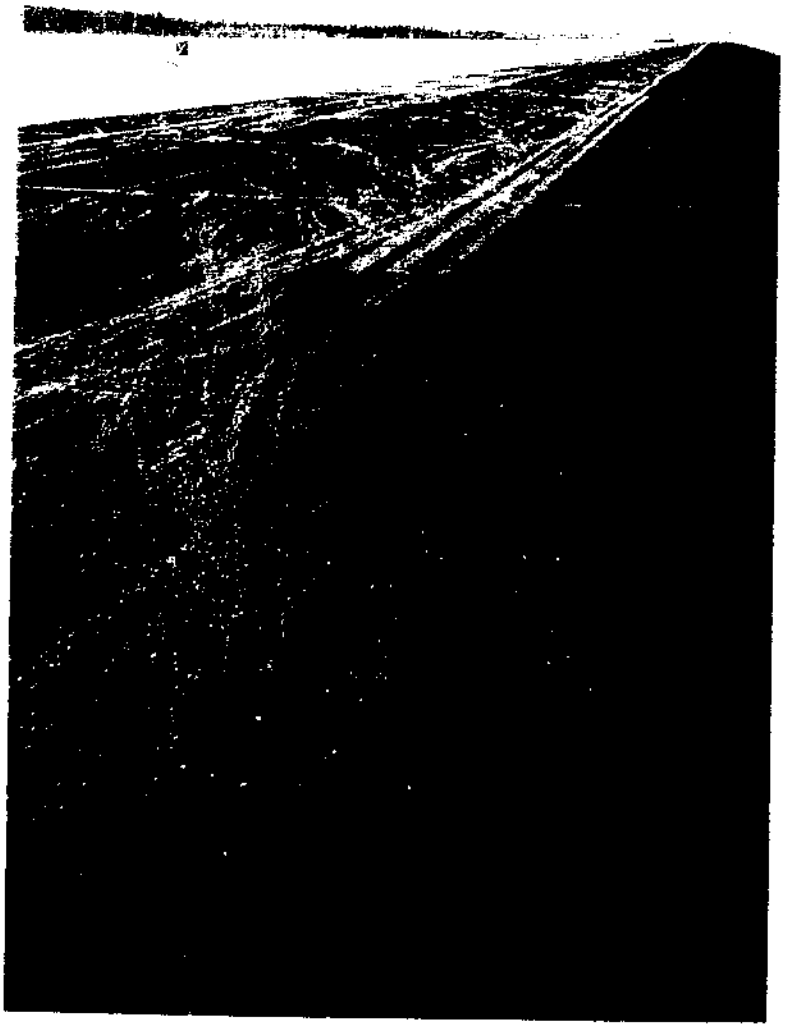

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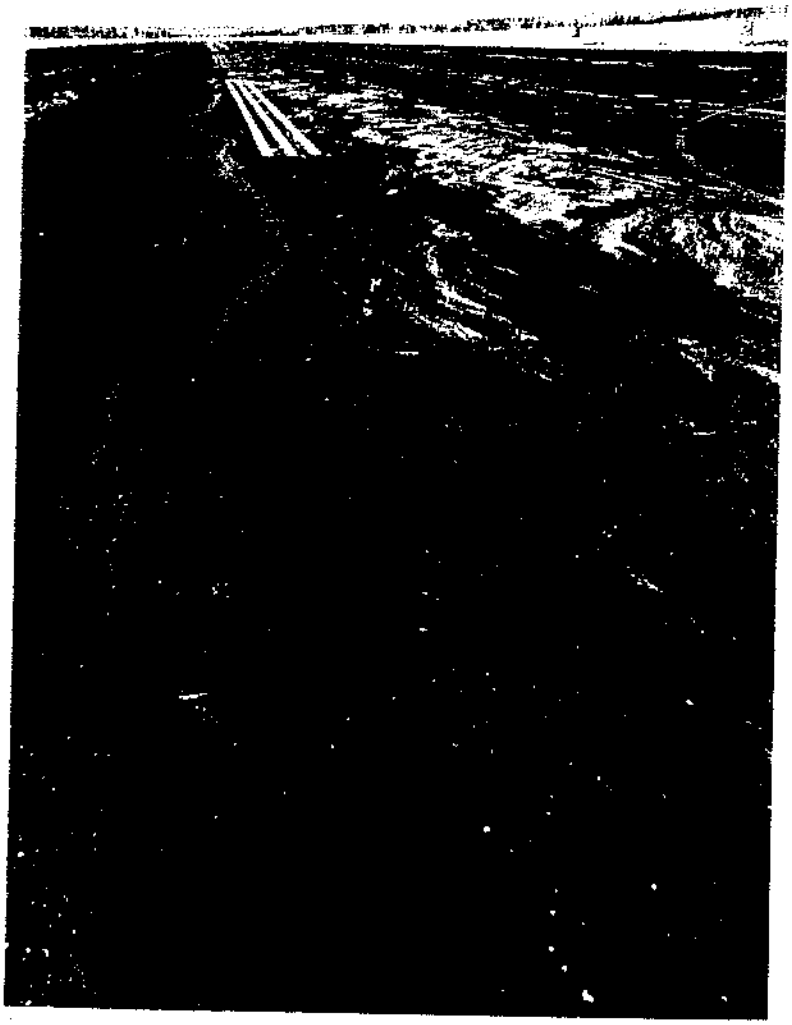


photo # 20

photo # 21

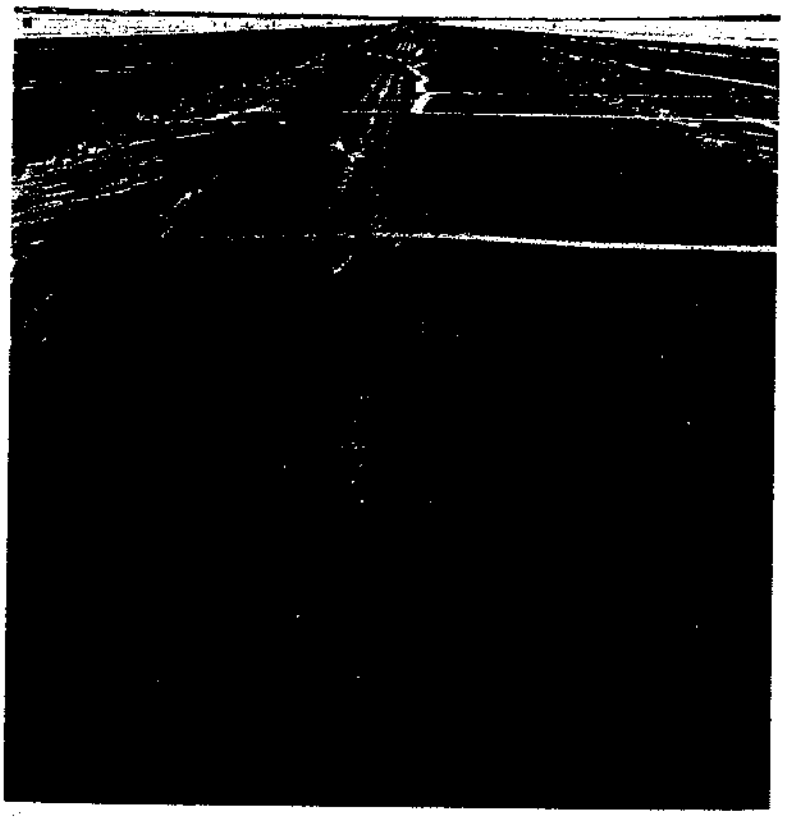


photo # 22

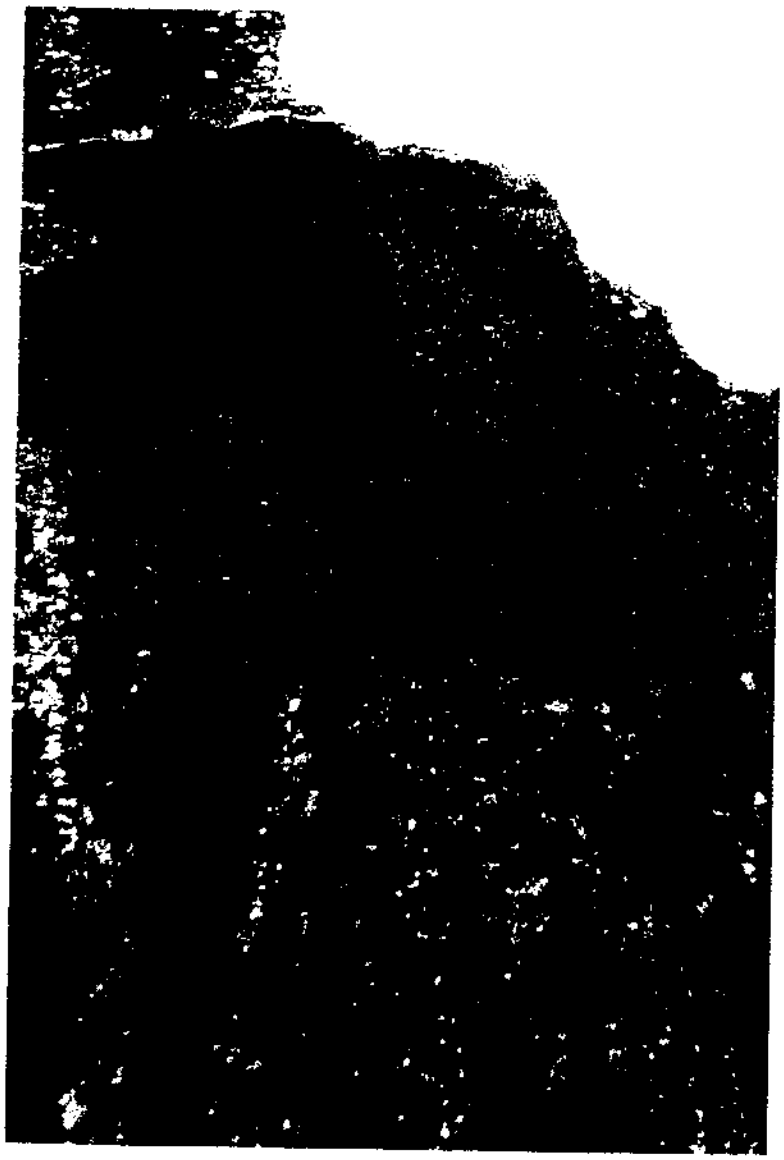
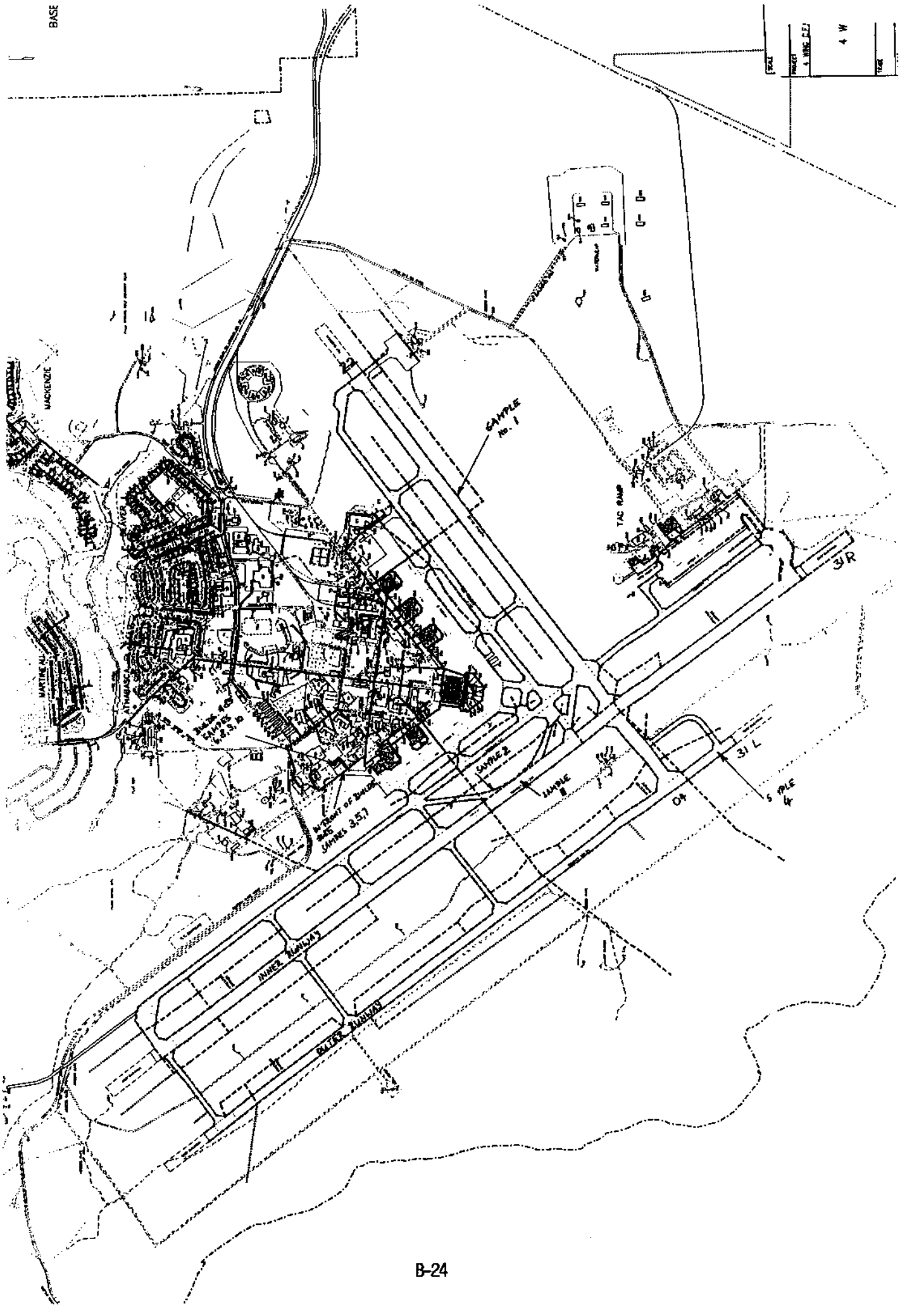


photo # 23


BASE
4 W
MACKENZIE
RIVER
CAMPSITE No. 1
TAC RAMP
31R
31L
CAMPSITE 2
CAMPSITE 3
CAMPSITE 4
INNER RUNWAY
OUTER RUNWAY

APPENDIX C

NORWEST LABS REPORT
HYDROCARBON/PAH ANALYSIS

NORWEST LABS

Fax: + 1 (403) 291-2021
Norwest Soil Research Ltd. (Calgary, Canada)
FACSIMILE TRANSMISSION

To:	***From:***
Name Drew Craig	*Name* Jennifer
Company / Institution CFB - Cold Lake	*Date:* Feb 15
Fax No 780 840 7305	*Bay 6, 2712 – 37Avenue, N.E. Calgary, Alberta, T1Y 5L3, Canada*

Total number of pages transmitted including this sheet: 8
If you do not receive all pages as indicated, please telephone + 1 (403) 291-2022

105525

NORWEST LABS

Calgary, AB Phone (403) 291-3622 Fax (403) 291-2021
Edmonton, AB Phone (780) 438-5522 Fax (780) 434-8586
Lethbridge, AB Phone (403) 329-9266 Fax (403) 327-6627
Surrey, B.C. Phone (604) 514-3322 Fax (604) 514-3323
Winnipeg, MB Phone (204) 982-8930 Fax (204) 275-6019

TO:	CFB - Cold Lake	DATE SAMPLED:	8-Feb-01
	CFB - Cold Lake	DATE RECEIVED:	10-Feb-01
ATTN:	WREMO	DATE REPORTED:	14-Feb-01
	Drew Craig	LAB FILE#:	105525
		PROJECT:	BLDG. 85
			Rejuviseal W 0134-9-CYAV/A

HYDROCARBON ASSESSMENT - WATER

LAB #	1	Detection Limit
CLIENT #	00-0590 BLDG 85	
[1]Non-Halogenated Aromatics:		
Benzene	<0.001 (freshwater 370, Community 5)	0.001
Toluene	<0.001 (90)	0.001
Ethylbenzene	<0.001 (90, ≤2.4)	0.001
Total Xylenes (o, m & p)	<0.003 (no criteria, ≤300)	0.001
[1]Total Purgeables (C_6 - C_{10})	<0.01	0.01
[2]Total Extractables (C_{11} - C_{40+})	52.9	0.1

C. Swyngedouw

C. Swyngedouw, Ph.D.
Assistant Lab Manager

Results expressed in mg/L (ppm)
[1]Assessment as per US EPA Method 8020/8015
[2]Assessment as per Alta. Env. Method A108.0

NORWEST LABS

Calgary, AB	Phone (403) 291-3022	Fax (403) 291-3021
Edmonton, AB	Phone (780) 438-5522	Fax (780) 434-8586
Lethbridge, AB	Phone (403) 320-8286	Fax (403) 327-8527
Surrey, B.C.	Phone (604) 514-3322	Fax (604) 514-3323
Winnipeg, MB	Phone (204) 982-8530	Fax (204) 275-8019

TO:	CFB - Cold Lake	DATE SAMPLED:	8-Feb-01
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ATTN:	WREMO	DATE REPORTED:	14-Feb-01
	Drew Craig	LAB FILE#:	105525
		PROJECT:	BLDG. 85
			Rejuviseal W 0134-9-CYAV/A

TOTAL EXTRACTABLE HYDROCARBONS
QUALITY ASSURANCE DATA

(This QA/QC data is representative of the lab based quality assurance program and is not to be utilized as field data.)

Calibration Check (CC)

	Actual Amt. (ng)	Detected Amt. (ng)	% Rec.
Diesel	'3352	3057.2	91

Accuracy = $\frac{\text{Ave \% Rec. MS + Ave \% Rec. MSD}}{2}$ = 102 % Accuracy

% RSD = $\frac{\text{Ave \% Rec. MS - Ave \% Rec. MSD}}{\text{\% Accuracy}}$ = 0.2 % RSD

The calculated values are based on matrix spike and duplicate recovery data performed at the time of analysis.

Date Acquired: Feb.13/2001 Analyst: PSTS-Group

NORWEST LABS
Edmonton, AB Phone (403) 291-3622 Fax (403) 291-9831
Edmonton, AB Phone (780) 438-5522 Fax (780) 434-8586
Lethbridge, AB Phone (403) 329-9266 Fax (403) 327-6527
Surrey, B.C. Phone (604) 514-3322 Fax (604) 514-3323
Winnipeg, MB Phone (204) 982-8830 Fax (204) 275-0019

TO:	WREMO 4 Wing Cold Lake	DATE SAMPLED:	08-Feb-01
ATTN:	Drew Craig	DATE RECEIVED:	10-Feb-01
		DATE REPORTED:	14-Feb-01
		LAB FILE#:	105525
		PROJECT#:	16617 (ENV)

W0134-9-CYAV/A Rejuviseal

Page 1

X = over criteria
✓ = below criteria
= no criteria

POLYNUCLEAR AROMATIC HYDROCARBONS - WATER

LAB #	1	Method	Method
CLIENT #	00-0590 BLDG 85	Blank	Detection Limit
	ug/L		
Naphthalene	X 123 1.1	<0.1	0.1
Acenaphthylene	8.6 no water criteria	<0.1	0.1
Acenaphthene	✓ 113 5.8	<0.1	0.1
Fluorene	X 140 3.0	<0.1	0.1
Phenanthrene	✓ 986 0.4	<0.1	0.1
Anthracene	X 98.3 0.012	<0.1	0.1
Acridine	X 63.5 4.4	<0.05	0.05
Fluoranthene	✓ 861 0.04	<0.1	0.1
Pyrene	X 687 0.025	<0.02	0.02
Benzo(a)anthracene	X 2230.018	<0.01	0.01
Chrysene	321 no water criteria	<0.1	0.1
Benzo(b)fluoranthenes	318 no criteria	<0.01	0.01
Benzo(k)fluoranthenes	192	<0.01	0.01
Benzo(a)pyrene	X 276 0.015	<0.01	0.01
Indeno(1,2,3-c,d)pyrene	187 no water criteria is present 0.025	<0.1	0.1
Dibenzo(a,h)anthracene	48.3	<0.01	0.01
Benzo(g,h,i)peryiene	159	<0.1	0.1

Surrogates	% Recovery		Recovery Range
Nitrobenzene-d5	N/A*	161	23-130
2-Fluorobiphenyl	N/A*	105	30-130
p-Terphenyl-d14	N/A*	132	18-137

N/A*-not available due to matrix interference&sample dilution.
Results expressed in ug/L (ppb)
Method References: based on EPA 3510,EPA 8270

C. Swyngedouw Ph.D.
Assistant Lab Manager

NORWEST LABS
Lloydminster, AB Phone (306) 291-3922 Fax (403) 891-3921
Lethbridge, AB Phone (780) 436-5532 Fax (780) 434-8586
Surrey, B.C. Phone (403) 329-8096 Fax (403) 327-8627
Winnipeg, MB Phone (604) 514-3322 Fax (604) 514-3323
Phone (204) 982-8620 Fax (204) 275-0019

TO:	WREMO	DATE SAMPLED:	08-Feb-01
	4 Wing Cold Lake	DATE RECEIVED:	10-Feb-01
ATTN:	Drew Craig	DATE REPORTED:	14-Feb-01
		LAB FILE#:	105525
		PROJECT#:	16617 (ENV)
			W0134-9-CYAV/A Rejuviseal

POLYNUCLEAR AROMATIC HYDROCARBONS - WATER
QA/QC
Calibration Check
14-Feb-01

Component	Actual Amt (ng/ml)	Recovered Amt. (ng/ml)	% Recovered	
Naphthalene	200	223	112	
Acenaphthylene	200	216	108	
Acenaphthene	200	217	109	
Fluorene	200	213	107	
Phenanthrene	200	211	106	
Anthracene	200	198	99	
Fluoranthene	200	218	109	
Pyrene	200	215	108	
Benzo(a)anthracene	200	198	99	
Chrysene	200	194	97	
Benzo(b)fluoranthene	200	193	97	
Benzo(k)fluoranthene	200	205	103	
Benzo(a)pyrene	200	187	94	
Indeno(1,2,3-c,d)pyrene	200	203	102	
Dibenzo(a,h)anthracene	200	218	109	
Benzo(g,h,i)perylene	200	216	108	
Surrogates		**% Recovery**		
Nitrobenzene-d5	200	160	80	23-130
2-Fluorobiphenyl	200	202	101	30-130
p-Terphenyl-d14	200	200	100	18-137

NORWEST LABS
Calgary, AB Phone (403) 291-3622 Fax (403) 291-3621
Edmonton, AB Phone (780) 438-5522 Fax (780) 434-8566
Lethbridge, AB Phone (403) 329-9666 Fax (403) 327-6527
Surrey, B.C. Phone (604) 514-3322 Fax (604) 514-3323
Winnipeg, MB Phone (204) 982-6830 Fax (204) 275-6019

TO:	WREMO	DATE SAMPLED:	08-Feb-01
	4 Wing Cold Lake	DATE RECEIVED:	10-Feb-01
ATTN:	Drew Craig	DATE REPORTED:	14-Feb-01
		LAB FILE#:	105525
		PROJECT#:	16617 (ENV)
			W0134-9-CYAV/A Rejuviseal

POLYNUCLEAR AROMATIC HYDROCARBONS - WATER
QA/QC
Matrix Spikes
16-Nov-00

	Added mg/L		Recovery mg/L		Recovery %	
	Matrix Spike	Matrix Dup.	Matrix Spike	Matrix Dup.	Matrix Spike	Matrix Dup.
Component						
Naphthalene	0.500	0.500	0.483	0.514	97	103
Acenaphthylene	0.500	0.500	0.389	0.413	78	83
Acenaphthene	0.500	0.500	0.542	0.555	108	111
Fluorene	0.500	0.500	0.534	0.534	107	107
Phenanthrene	0.500	0.500	0.491	0.521	98	104
Anthracene	0.500	0.500	0.361	0.382	72	76
Fluoranthene	0.500	0.500	0.391	0.390	78	78
Pyrene	0.500	0.500	0.433	0.411	87	82
Benzo(a)anthracene	0.500	0.500	0.392	0.483	78	97
Chrysene	0.500	0.500	0.554	0.503	111	101
Benzo(b)fluoranthene	0.500	0.500	0.349	0.514	70	103
Benzo(k)fluoranthene	0.500	0.500	0.344	0.439	69	88
Benzo(a)pyrene	0.500	0.500	0.310	0.420	62	84
Indeno(1,2,3-c,d)pyrene	0.500	0.500	0.399	0.417	80	83
Dibenzo(a,h)anthracene	0.500	0.500	0.383	0.410	77	82
Benzo(g,h,i)perylene	0.500	0.500	0.485	0.460	97	92
			Average =		85.5	92.1
			% Accuracy		88.8	
			% RSD		7.41	

Surrogates	% Recovery		Recovery Range
Nitrobenzene-d5	120	125	23-130
2-Fluorobiphenyl	122	121	30-130
4-Terphenyl-d14	101	100	18-137

NORWEST LABS
Edmonton, AB Phone (780) 438-5522 Fax (780) 434-8586
Lethbridge, AB Phone (403) 329-8288 Fax (403) 327-8227
Surrey, B.C. Phone (604) 514-3322 Fax (604) 514-3323
Winnipeg, MB Phone (204) 982-8530 Fax (204) 275-6019

TO:	WREMO	DATE SAMPLED:	08-Feb-01
	4 Wing Cold Lake	DATE RECEIVED:	10-Feb-01
ATTN:	Drew Craig	DATE REPORTED:	14-Feb-01
		LAB FILE#:	105525
		PROJECT#:	16617 (ENV)
			W0134-9-CYAV/A Rejuviseal

POLYNUCLEAR AROMATIC HYDROCARBONS - SOIL
QA/QC
CERTIFIED REFERENCE MATERIAL

14-Feb-01

Component	ACTUAL AMOUNT mg/Kg	REC. mg/Kg	RANGE mg/Kg	% REC.
Naphthalene	0.77	0.81	± 0.18	105
Fluorene	0.65	0.63	± 0.09	97
Phenanthrene	5.79	5.77	± 0.87	100
Anthracene	1.44	1.50	± 0.29	104
Fluoranthene	24.6	27.6	± 4.85	112
Pyrene	15.0	16.4	± 3.45	109
Benzo(a)anthracene	7.98	7.89	± 1.28	99
Chrysene	8.60	7.21	± 1.55	84
Benzo(b)fluoranthene	9.69	9.48	na	98
Benzo(k)fluoranthene	5.10	6.12	na	120
Benzo(a)pyrene	5.09	5.59	± 0.85	110
Indeno(1,2,3-c,d)pyrene	4.46	5.37	± 1.01	120
Dibenzo(a,h)anthracene	1.55	1.29	na	83
Benzo(g,h,i)perylene	3.58	3.78	± 0.93	106

na-not available

Average Recovery 103

Surrogates	% Recovery	Recovery Range
Nitrobenzene-d5	84	23-130
2-Fluorobiphenyl	133	30-130
4-Terphenyl-d14	101	18-137

APPENDIX D

CAMBRIDGE MATERIALS TESTING LIMITED

INFRARED ANALYSIS OF TIRE RUBBER

MAY 2 5 2001

Cambridge
materials testing limited

TSL Professional Services
6991 Millcreek Drive, Unit 13,
Mississauga, Ontario L5N 6B9
Tel: (905) 812-3856 Fax: (905) 812-3866
www.cambridgematerials.com

Report For:	John Emery Geotechnical Eng. Ltd. 109 Woodbine Downs Blvd., Unit#1 Toronto, Ontario M9W 6Y1 Phone: 416-213-1060 XT 225 Fax: 416-213-1070	**Laboratory #:**	279281-01
		Report Date:	May 18, 2001
		Received Date:	May 2, 2001
		Customer P.O. #:	**101041**
Attention:	Mike MacKay		
Specimen:	Tire Rubber Sample		

TEST REPORT

RE: INFRARED ANALYSIS OF TIRE RUBBER SAMPLE

On May 2, 2001, TSL Professional Services received a sample of tire rubber material for Infrared analysis to identify the type of rubber resin.

The submitted rubber sample was Infrascanned and the resulting Infragraph showed the material to consist of Polyurethane-type elastomer. (See attached Infragraph)

Cambridge Materials Testing Limited

D-1

Per _____ QUALITY ASSURANCE

Per _____ TECHNICIAN

66

SPECTRUM NO. 279281

DATE MAY 15/2001

SAMPLE TIRE RUBBER (AIRCRAFT-TYPE)

SOURCE JEGEL

STRUCTURE

PATH ___ mm FILM

SOLVENT DCM/DIRECT

CONCENTRATION FULL

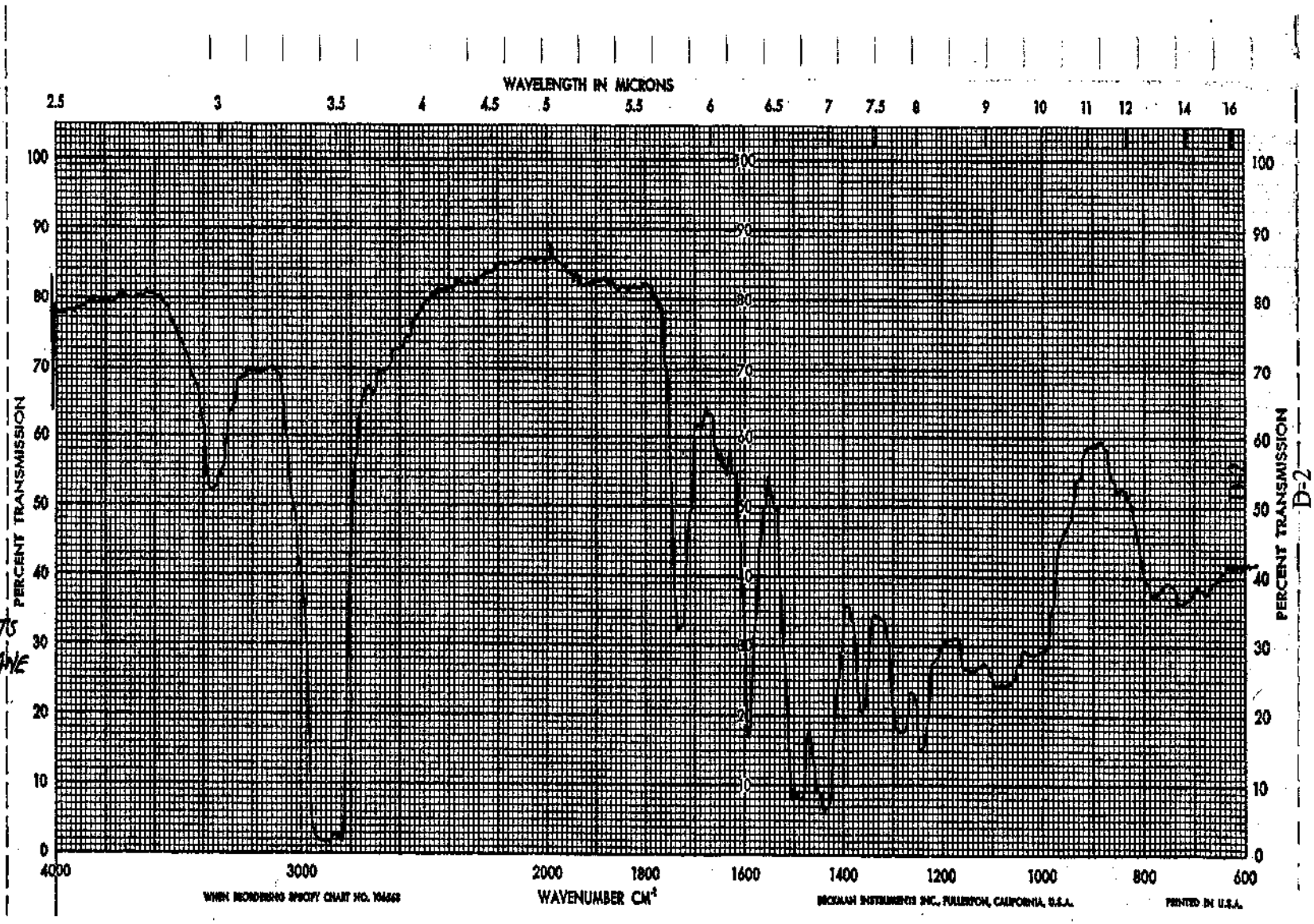
PHASE SOLID

COMMENTS THE TIRE RUBBER SAMPLE CONSISTS MOSTLY OF POLYURETHANE TYPE ELASTOMER

ANALYST M.G.

Beckman®

INFRARED SPECTROPHOTOMETER



D-2

APPENDIX E

CAMBRIDGE MATERIALS TESTING LIMITED

ENVIRONMENTAL ANALYSIS REPORT

JUN 1 1 2001

Cambridge
materials testing limited

TSL Professional Services
6991 Millcreek Drive, Unit 13,
Mississauga, Ontario L5N 6B9
Tel: (905) 812-3856 Fax: (905) 812-3866
www.cambridgematerials.com

Report For:	John Emery Geotechnical Eng. Ltd. 109 Woodbine Downs Blvd., Unit #1, TORONTO, Ontario M9W 6Y1 Phone: 416-213-1060 Fax: 416-213-1070	**Laboratory #:**	**278928-01**
		Report Date:	June 6, 2001
		Received Date:	April 25, 2001
		Customer P.O. #:	**101041-584**
Attention:	David Soancs		
Specimen:	Water and Pavement Core Samples		

TEST REPORT

RE: ENVIRONMENTAL ANALYSIS OF WATER AND PAVEMENT CORE SAMPLES

1.0 INTRODUCTION

On April 20, 2001, TSL Professional Services received samples of water (snow melt) and asphalt pavement core taken from an airport runway for testing. The requested tests is to determine if there is any environmental concerns (through leaching) associated with water run-off from the surface of the pavement where a pavement sealer (Rejuvaseal) has been applied and if there is any Health and safety concern to workers exposed to sweeping dusts.

The submitted samples were identified as follows;

Sample #1 - Water sample - Runway 04/22

Sample #2 - Water sample - Inner Runway

Sample #3 - Water sample - Snow Bank outside heavy equipment building

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Per: _____ QUALITY ASSURANCE

Per: _____ TECHNICIAN

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1.0 INTRODUCTION (cont)

The submitted water samples were directly analyzed by Inductively Coupled Argon plasma for metallic constituents.

The submitted pavement core samples pulverized and as received were subjected to two leachate preparations, using pure de-ionized water and using the Ontario Reg. 347 (Amended Reg. 558/00). The leachates were pre-concentrated before analysis of different parameters by Inductively Coupled plasma spectrometer, Gas Chromatography, Ion Chromatography and Cold Vapor atomic absorption. The leachate results of analysis were compared with the Canadian Environmental Water Quality Guidelines for the protection Freshwater Aquatic life.

The submitted core samples were further analyzed for General Composition by Pyrolysis @ 550°C, to determine proportion of organic and inorganic constituents. The Volatile Organic constituents were analyzed by a Gas Chromatography and Non-Volatile Organic constituents were analyzed by an Infrared Spectrometer. The Inorganic residue was analyzed by a Plasma Spectrometer for metallic oxides.

The results of analysis are tabulated below.

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1.0 INTRODUCTION (cont)

The submitted core samples were identified as follows:

Sample #4A – Site #1 Location 1 – Core 28	– Leachate 347 (558) as is
Sample #4B – Site #1 Location 1 – Core 28	– Leachate DI water as is
Sample #4C – Site #1 Location 1 – Core 29	– Leachate 347 (558) pulverized (crushed)
Sample #4D – Site #1 Location 1 – Core 29	– Leachate DI water pulverized (crushed)
Sample #5A – Site #1 Location 2 – Core 34	– Leachate 347 (558) as is
Sample #5B – Site #1 Location 2 – Core 34	– Leachate DI water as is
Sample #5C – Site #1 Location 2 – Core 35	– Leachate 347 (558) pulverized (crushed)
Sample #5D – Site #1 Location 2 – Core 35	– Leachate DI water pulverized (crushed)
Sample #6A – Site #1 Location 3 – Core 14	– Leachate 347 (558) as is
Sample #6B – Site #1 Location 3 – Core 14	– Leachate DI water as is
Sample #6C – Site #1 Location 3 – Core 14	– Leachate 347 (558) pulverized (crushed)
Sample #6D – Site #1 Location 3 – Core 14	– Leachate DI water pulverized (crushed)
Sample #7A – Site #2 Location 1 – Core 35	– Leachate 347 (558) as is
Sample #7B – Site #2 Location 1 – Core 35	– Leachate DI water as is
Sample #7C – Site #2 Location 1 – Core 36	– Leachate 347 (558) pulverized (crushed)
Sample #7D – Site #2 Location 1 – Core 36	– Leachate DI water pulverized (crushed)
Sample #8A – Site #2 Location 2 – Core 41	– Leachate 347 (558) as is
Sample #8B – Site #2 Location 2 – Core 41	– Leachate DI water as is
Sample #8C – Site #2 Location 2 – Core 42	– Leachate 347 (558) pulverized (crushed)
Sample #8D – Site #2 Location 2 – Core 42	– Leachate DI water pulverized (crushed)
Sample #9A – Site #2 Location 3 – Core 5	– Leachate 347 (558) as is
Sample #9B – Site #2 Location 3 – Core 5	– Leachate DI water as is
Sample #9C – Site #2 Location 3 – Core 5	– Leachate 347 (558) pulverized (crushed)
Sample #9D – Site #2 Location 3 – Core 5	– Leachate DI water pulverized (crushed)

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2.0 RESULTS OF ANALYSIS

2.1 Analysis of Water Samples — I.C.A.P. PLASMA SCAN

Element		Sample #1 Runway 04/22 (ppm)	Sample #2 Inner Runway (ppm)	Sample #3 Heavy Equip. Bldg. (ppm)
Snow Bank Outside				
Aluminum	(Al)	0.01	0.11	0.83
Antimony	(Sb)	<0.01	<0.01	<0.01
Arsenic	(As)	<0.01	<0.01	<0.01
Barium	(Ba)	0.08	0.12	0.15
Beryllium	(Be)	<0.01	<0.01	<0.01
Boron	(B)	<0.01	0.01	0.16
Cadmium	(Cd)	0.02	0.07	0.04
Calcium	(Ca)	11.54	18.29	34.07
Chromium	(Cr)	<0.01	<0.01	<0.01
Cobalt	(Co)	<0.01	<0.01	<0.01
Copper	(Cu)	<0.01	<0.01	<0.01
Iron	(Fe)	0.81	3.59	1.88
Lead	(Pb)	<0.01	<0.01	<0.01
Magnesium	(Mg)	2.32	2.62	0.39
Manganese	(Mn)	0.29	0.05	0.02
Molybdenum	(Mo)	0.05	0.07	0.08
Nickel	(Ni)	<0.01	<0.01	<0.01
Phosphorus	(P)	<0.01	0.10	0.41
Potassium	(K)	259.18	882.22	702.61
Selenium	(Se)	<0.01	<0.01	<0.01
Silicon	(Si)	4.05	2.33	8.62
Silver	(Ag)	<0.01	<0.01	<0.01
Sodium	(Na)	23.50	30.22	435.59
Strontium	(Sr)	0.03	0.06	0.17
Tin	(Sn)	0.23	0.26	0.06
Titanium	(Ti)	<0.01	<0.01	0.06
Vanadium	(V)	<0.01	0.01	<0.01
Zinc	(Zn)	0.08	0.13	0.17
Zirconium	(Zr)	<0.01	<0.01	<0.01

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2.2 Analysis of Core Samples

2.2.1 Ontario Reg. 347 Leachate (Amended Reg. 558/00) As Is (Site #1 – Location #1, 2, 3)

		Sample #4A Core 28 (ppb)	Sample #5A Core 34 (ppb)	Sample #6A Core 14 (ppb)	CCME Water Quality Guidelines for the Protection Aquatic Life	
PAH's		<5	<5	<5		
Phenols		<1	<1	<1	4.0	ppb
Total Volatile Organic		<5	<5	<5		
Free Cyanide	(CN^-)	<5	<5	<5	5.0	ppb
Nitrate	(NO_3^-)	<10	<10	<10	Narrative	
Nitrite	(NO_2^-)	<10	<10	<10	60	ppb
Aluminum	(Al)	<1	**180**	80	5-100	ppb
Arsenic	(As)	<1	<1	<1	5.0	ppb
Cadmium	(Cd)	<1	<1	<1	0.017	ppb
Chromium $^{3+}$	(Cr)	<5	<5	<5	4.9	ppb
Chromium $^{6+}$	(Cr)	<5	<5	<5	8.0	ppb
Copper	(Cu)	<1	<1	<1	2-4	ppb
Iron	(Fe)	**290**	<1	<1	300	ppb
Lead	(Pb)	**20**	**20**	**30**	1-7	ppb
Mercury	(Hg)	<1	<1	<1	0.1	ppb
Molybdenum	(Mo)	<1	<1	<1	73	ppb
Nickel	(Ni)	<1	<1	<1	25-150	ppb
Selenium	(Se)	<1	<1	<1	1.0	ppb
Silver	(Ag)	<1	<1	<1	0.1	ppb
Zinc	(Zn)	30	**<1**	10	30	ppb

REMARKS

The results highlighted in bold do not meet the CCME Water Quality Guidelines for the Protection of Aquatic Life.

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2.2.1.1 Ontario Reg.347 Leachate (Amended Reg. 558/00) As Is (Site #2 – Location #1, 2, 3)

		Sample #7A Core 35 (ppb)	Sample #8A Core 41 (ppb)	Sample #9A Core 5 (ppb)	CCME Water Quality Guidelines for the Protection Aquatic Life	
PAH's		<5	<5	<5		
Phenols		<1	<1	<1	4.0	ppb
Total Volatile Organic		<5	<5	<5		
Free Cyanide	(CN^-)	<5	<5	<5	5.0	ppb
Nitrate	(NO_3^-)	<10	<10	<10	Narrative	
Nitrite	(NO_2^-)	<10	<10	<10	60	ppb
Aluminum	(Al)	**180**	20	<1	5-100	ppb
Arsenic	(As)	<1	<1	<1	5.0	ppb
Cadmium	(Cd)	<1	<1	<1	0.017	ppb
Chromium $^{3+}$	(Cr)	<5	<5	<5	4.9	ppb
Chromium $^{6+}$	(Cr)	<5	<5	<5	8.0	ppb
Copper	(Cu)	**30**	<1	<1	2-4	ppb
Iron	(Fe)	90	<1	<1	300	ppb
Lead	(Pb)	**20**	<1	**30**	1-7	ppb
Mercury	(Hg)	<1	<1	<1	0.1	ppb
Molybdenum	(Mo)	<1	<1	<1	73	ppb
Nickel	(Ni)	10	10	10	25-150	ppb
Selenium	(Se)	<1	<1	<1	1.0	ppb
Silver	(Ag)	<1	<1	<1	0.1	ppb
Zinc	(Zn)	<1	20	<1	30	ppb

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2.2.2 DI Water Leachate As Is (Site #1 – Location #1, 2, 3)

		Sample #4B Core 28 (ppb)	Sample #5B Core 34 (ppb)	Sample #6B Core 14 (ppb)	CCME Water Quality Guidelines for the Protection Aquatic Life	
PAH's		<5	<5	<5		
Phenols		<1	<1	<1	4.0	ppb
Total Volatile Organic		<5	<5	<5		
Free Cyanide	(CN^-)	<5	<5	<5	5.0	ppb
Nitrate	(NO_3^-)	<10	<10	<10	Narrative	
Nitrite	(NO_2^-)	<10	<10	<10	60	ppb
Aluminum	(Al)	**1150**	**1560**	**410**	5-100	ppb
Arsenic	(As)	<1	<1	<1	5.0	ppb
Cadmium	(Cd)	<1	<1	<1	0.017	ppb
Chromium $^{3+}$	(Cr)	<5	<5	<5	4.9	ppb
Chromium $^{6+}$	(Cr)	<5	<5	<5	8.0	ppb
Copper	(Cu)	<1	<1	<1	2-4	ppb
Iron	(Fe)	**360**	**540**	<1	300	ppb
Lead	(Pb)	<1	<1	<1	1-7	ppb
Mercury	(Hg)	<1	<1	<1	0.1	ppb
Molybdenum	(Mo)	<1	<1	<1	73	ppb
Nickel	(Ni)	10	<1	<1	25-150	ppb
Selenium	(Se)	<1	<1	<1	1.0	ppb
Silver	(Ag)	<1	<1	<1	0.1	ppb
Zinc	(Zn)	<1	<1	<1	30	ppb

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2.2.2.2 DI Water Leachate As Is (Site #2 – Location #1, 2, 3)

		Sample #7B Core 35 (ppb)	Sample #8B Core 41 (ppb)	Sample # 8B Core 5 (ppb)	CCME Water Quality Guidelines for the Protection Aquatic Life	
PAH's		<5	<5	<5		
Phenols		<1	<1	<1	4.0	ppb
Total Volatile Organic		<5	<5	<5		
Free Cyanide	(CN^-)	<5	<5	<5	5.0	ppb
Nitrate	(NO_3^-)	<10	<10	<10	Narrative	
Nitrite	(NO_2^-)	<10	<10	<10	60	ppb
Aluminum	(Al)	**390**	**280**	**560**	5-100	ppb
Arsenic	(As)	<1	<1	<1	5.0	ppb
Cadmium	(Cd)	<1	<1	<1	0.017	ppb
Chromium $^{3+}$	(Cr)	<5	<5	<5	4.9	ppb
Chromium $^{6+}$	(Cr)	<5	<5	<5	8.0	ppb
Copper	(Cu)	<1	<1	<1	2-4	ppb
Iron	(Fe)	**710**	**250**	**3020**	300	ppb
Lead	(Pb)	<1	<1	<1	1-7	ppb
Mercury	(Hg)	<1	<1	<1	0.1	ppb
Molybdenum	(Mo)	<1	<1	<1	73	ppb
Nickel	(Ni)	<1	<1	<1	25-150	ppb
Selenium	(Se)	<1	<1	<1	1.0	ppb
Silver	(Ag)	<1	<1	<1	0.1	ppb
Zinc	(Zn)	<1	<1	<1	30	ppb

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2.2.3 Ontario Reg. 347 Leachate (Amended 558/00) Pulverized (Site #1 – Location #1, 2, 3)

		Sample #4C Core 29 (ppb)	Sample #5C Core 35 (ppb)	Sample #6C Core 14 (ppb)	CCME Water Quality Guidelines for the Protection Aquatic Life	
PAH's		<5	<5	<5		
Phenols		<1	<1	<1	4.0	ppb
Total Volatile Organic		<5	<5	<5		
Free Cyanide	(CN^-)	<5	<5	<5	5.0	ppb
Nitrate	(NO_3^-)	<10	<10	<10	Narrative	
Nitrite	(NO_2^-)	<10	<10	<10	60	ppb
Aluminum	(Al)	40	<1	<1	5-100	ppb
Arsenic	(As)	<1	<1	<1	5.0	ppb
Cadmium	(Cd)	<1	<1	<1	0.017	ppb
Chromium $^{3+}$	(Cr)	<5	<5	<5	4.9	ppb
Chromium $^{6+}$	(Cr)	<5	<5	<5	8.0	ppb
Copper	(Cu)	<1	<1	<1	2-4	ppb
Iron	(Fe)	**11210**	**2040**	**3300**	300	ppb
Lead	(Pb)	<1	<1	<1	1-7	ppb
Mercury	(Hg)	<1	<1	<1	0.1	ppb
Molybdenum	(Mo)	<1	<1	<1	73	ppb
Nickel	(Ni)	80	<1	<1	25-150	ppb
Selenium	(Se)	<1	<1	<1	1.0	ppb
Silver	(Ag)	<1	<1	<1	0.1	ppb
Zinc	(Zn)	**60**	20	30	30	ppb

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2.2.3.1 Ontario Reg. 347 Leachate (Amended 558/00) Pulverized (Site #2 – Location #1, 2, 3)

		Sample #7C Core 36 (ppb)	Sample #8C Core 42 (ppb)	Sample #9C Core 5 (ppb)	CCME Water Quality Guidelines for the Protection Aquatic Life	
PAH's		<5	<5	<5		
Phenols		<1	<1	<1	4.0	ppb
Total Volatile Organic		<5	<5	<5		
Free Cyanide	(CN^-)	<5	<5	<5	5.0	ppb
Nitrate	(NO_3^-)	<10	<10	<10	Narrative	
Nitrite	(NO_2^-)	<10	<10	<10	60	ppb
Aluminum	(Al)	**260**	**160**	80	5-100	ppb
Arsenic	(As)	<1	<1	<1	5.0	ppb
Cadmium	(Cd)	<1	<1	<1	0.017	ppb
Chromium $^{3+}$	(Cr)	<5	<5	<5	4.9	ppb
Chromium $^{6+}$	(Cr)	<5	<5	<5	8.0	ppb
Copper	(Cu)	<1	<1	<1	2-4	ppb
Iron	(Fe)	**9490**	**2260**	**2940**	300	ppb
Lead	(Pb)	<1	20	<1	1-7	ppb
Mercury	(Hg)	<1	<1	<1	0.1	ppb
Molybdenum	(Mo)	<1	<1	<1	73	ppb
Nickel	(Ni)	30	40	20	25-150	ppb
Selenium	(Se)	<1	<1	<1	1.0	ppb
Silver	(Ag)	<1	<1	<1	0.1	ppb
Zinc	(Zn)	<1	<1	10	30	ppb

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2.2.4 DI Water Leachate Pulverized (Site #1 – Location #1, 2, 3)

		Sample #4D Core 29 (ppb)	Sample #5D Core 35 (ppb)	Sample #6D Core 14 (ppb)	CCME Water Quality Guidelines for the Protection Aquatic Life	
PAH's		<5	<5	<5		
Phenols		<1	<1	<1	4.0	ppb
Total Volatile Organic		<5	<5	<5		
Free Cyanide	(CN^-)	<5	<5	<5	5.0	ppb
Nitrate	(NO_3^-)	<10	<10	<10	Narrative	
Nitrite	(NO_2^-)	<10	<10	<10	60	ppb
Aluminum	(Al)	**35960**	**29870**	**29660**	5-100	ppb
Arsenic	(As)	<1	<1	<1	5.0	ppb
Cadmium	(Cd)	<1	<1	<1	0.017	ppb
Chromium $^{3+}$	(Cr)	<5	<5	<5	4.9	ppb
Chromium $^{6+}$	(Cr)	<5	<5	<5	8.0	ppb
Copper	(Cu)	<1	**20**	**20**	2-4	ppb
Iron	(Fe)	**12750**	**17520**	**14470**	300	ppb
Lead	(Pb)	**40**	**40**	**40**	1-7	ppb
Mercury	(Hg)	<1	<1	<1	0.1	ppb
Molybdenum	(Mo)	<1	<1	<1	73	ppb
Nickel	(Ni)	10	20	<1	25-150	ppb
Selenium	(Se)	<1	<1	<1	1.0	ppb
Silver	(Ag)	<1	<1	<1	0.1	ppb
Zinc	(Zn)	30	**40**	**60**	30	ppb

REMARKS

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2.2.4.1 DI Water Leachate Pulverized (Site #2 – Location #1, 2, 3)

		Sample #7D Core 36 (ppb)	Sample #8D Core 42 (ppb)	Sample #9D Core 5 (ppb)	CCME Water Quality Guidelines for the Protection Aquatic Life	
PAH's		<5	<5	<5		
Phenols		<1	<1	<1	4.0	ppb
Total Volatile Organic		<5	<5	<5		
Free Cyanide	(CN^-)	<5	<5	<5	5.0	ppb
Nitrate	(NO_3^-)	<10	<10	<10	Narrative	
Nitrite	(NO_2^-)	<10	<10	<10	60	ppb
Aluminum	(Al)	**20520**	**29470**	**59940**	5-100	ppb
Arsenic	(As)	<1	<1	<1	5.0	ppb
Cadmium	(Cd)	<1	<1	<1	0.017	ppb
Chromium $^{3+}$	(Cr)	<5	<5	<5	4.9	ppb
Chromium $^{6+}$	(Cr)	<5	<5	<5	8.0	ppb
Copper	(Cu)	**10**	**10**	**30**	2-4	ppb
Iron	(Fe)	**24540**	**24520**	**60290**	300	ppb
Lead	(Pb)	<1	**40**	**80**	1-7	ppb
Mercury	(Hg)	<1	<1	<1	0.1	ppb
Molybdenum	(Mo)	<1	60	<1	73	ppb
Nickel	(Ni)	10	20	40	25-150	ppb
Selenium	(Se)	<1	<1	<1	1.0	ppb
Silver	(Ag)	<1	<1	<1	0.1	ppb
Zinc	(Zn)	30	10	**60**	30	ppb

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2.3 Analysis of Core samples

2.3.1 General Composition

	% Moisture & Volatile Organics	Non-Volatile Organic (@ 550°C)	% Inorganic (@ 120°C)
Sample #1 – 4A, Site #1, Loc. 1 – Core 28	0.28	6.27	93.45
Sample #2 – 5A, Site #1, Loc. 2 – Core 34	0.20	6.11	93.69
Sample #3 – 6A, Site #1, Loc. 3 – Core 14	0.22	7.47	92.31
Sample #4 – 7A, Site #2, Loc. 1 – Core 35	0.47	7.56	91.97
Sample #5 – 8A, Site #2, Loc. 2 – Core 41	0.44	6.64	92.92
Sample #6 – 9A, Site #2, Loc. 3 – Core 5	0.37	6.29	93.34

2.3.2 Gas Chromatographic analysis of Volatile Organic Compounds

Head Space Gas Chromatography technique analysis were performed on the samples as received for Total Volatile Organic (Sample # 4A to 9A).

The resulting chromatogram showed either trace or no detectable concentrations of Aliphatic Hydro Carbons and no detectable concentrations of Poly Aromatic Hydrocarbons (PAH's). (Please see attached Gas Chromatograph)

2.3.3 Infra-Red Analysis of Non-Volatile Organic Constituents

The Non-Volatile Organic constituents was analysed on sample #4D to sample #9D by Infrared spectrometer by initially performing extraction using Dichloromethane and the extracts were scanned for identification.

The resulting Infragraphs showed that, the non-volatile material does consists of a mixture of partially oxidized Hydrocarbon resin.

2.3.4 Compositional Analysis of Inorganic Residue

The Inorganic residue (ash) was analysed for major and minor composition using Inductively Coupled plasma spectrometer and the results obtained are in the attached report on ICAP total oxide analysis.

Cambridge
materials testing limited

TSL Professional Services
6991 Millcreek Drive, Unit 13,
Mississauga, Ontario L5N 6B9
Tel: (905) 812-3856 Fax: (905) 812-3866
www.cambridgematerials.com

Laboratory #278928-01
John Emery Geotechnical Eng. Ltd.

I.C.A.P. TOTAL OXIDE ANALYSIS

RE: COMPOSITIONAL ANALYSIS OF INORGANIC RESIDUE

Element as Oxide

Major Constituents			4C – Core 29	5C Core 35	6C Core 14
Silica	(SiO_2)	%	67.23	65.39	67.63
Aluminum	(Al_2O_3)	%	8.37	8.69	8.65
Iron	(Fe_2O_3)	%	2.31	2.54	1.92
Calcium	(CaO)	%	4.53	4.63	4.52
Magnesium	(MgO)	%	2.27	2.13	2.04
Sodium	(Na_2O)	%	2.07	2.48	2.16
Potassium	(K_2O)	%	2.08	2.58	2.04
Titanium	(TiO_2)	%	0.20	0.25	0.19
Manganese	(MnO)	%	0.03	0.16	0.03
Phosphorus	(P_2O_5)	%	0.08	0.16	0.12
Minor Constituents					
Barium	(Ba)	ppm	620	730	550
Strontium	(Sr)	ppm	230	240	210
Zirconium	(Zr)	ppm	90	100	100
Yttrium	(Y)	ppm	10	22	10
Scandium	(Sc)	ppm	4	5	4
Niobium	(Nb)	ppm	<30	<30	<30
Beryllium	(Be)	ppm	4	4	3
Nickel	(Ni)	ppm	40	30	35
Chromium	(Cr)	ppm	410	170	230
Copper	(Cu)	ppm	50	60	40
Vanadium	(V)	ppm	55	65	60
Cobalt	(Co)	ppm	15	20	20
Zinc	(Zn)	ppm	20	90	20
LOI		%	10.47	9.30	10.49
TOTAL		%	99.63	99.32	99.79

Cambridge
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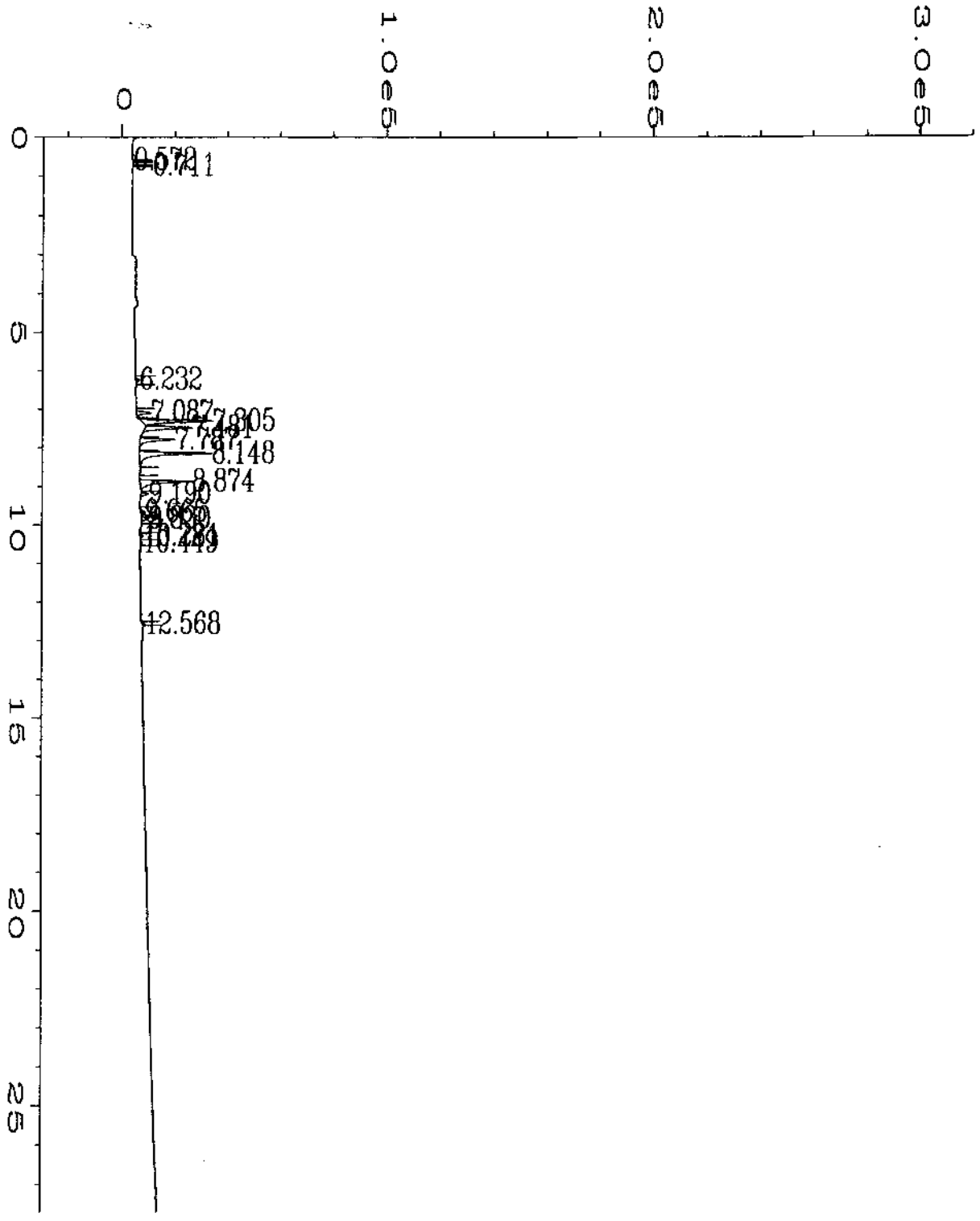
Laboratory #278928-01
John Emery Geotechnical Eng. Ltd.

I.C.A.P. TOTAL OXIDE ANALYSIS

RE: COMPOSITIONAL ANALYSIS OF INORGANIC RESIDUE

Element as Oxide

Major Constituents			7C Core 36	8C Core 42	9C Core 5
Silica	(SiO_2)	%	67.48	66.80	64.85
Aluminum	(Al_2O_3)	%	5.71	6.16	6.15
Iron	(Fe_2O_3)	%	3.76	4.37	3.37
Calcium	(CaO)	%	6.15	6.19	6.17
Magnesium	(MgO)	%	1.44	1.25	2.56
Sodium	(Na_2O)	%	1.29	1.29	1.28
Potassium	(K_2O)	%	1.40	1.94	1.76
Titanium	(TiO_2)	%	0.15	0.13	0.16
Manganese	(MnO)	%	0.12	0.24	0.09
Phosphorus	(P_2O_5)	%	0.56	0.22	0.16
Minor Constituents					
Barium	(Ba)	ppm	510	520	500
Strontium	(Sr)	ppm	160	140	150
Zirconium	(Zr)	ppm	100	80	60
Yttrium	(Y)	ppm	12	14	10
Scandium	(Sc)	ppm	4	4	4
Niobium	(Nb)	ppm	<30	<30	<30
Beryllium	(Be)	ppm	4	3	3
Nickel	(Ni)	ppm	45	25	35
Chromium	(Cr)	ppm	575	470	425
Copper	(Cu)	ppm	80	55	30
Vanadium	(V)	ppm	60	60	60
Cobalt	(Co)	ppm	1	5	15
Zinc	(Zn)	ppm	90	65	30
LOI		%	11.36	10.90	12.81
TOTAL		%	99.41	99.50	99.36



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nstrument	: ECD/FID	Vial Number	:
ample Name	: 278928-4A	Injection Number	:
un Time Bar Code:		Sequence Line	:
cquired on	: 30 May 01 09:26 AM	Instrument Method	: CHARCOAL.MTH
eport Created on:	30 May 01 11:29 AM	Analysis Method	: CHARCOAL.MTH

Area Percent Report

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Operator : N Iskander
Instrument : ECD/FID
Sample Name : 278928-4A
Run Time Bar Code:
Acquired on : 30 May 01 09:26 AM
Report Created on: 30 May 01 11:30 AM

Page Number : 1
Vial Number :
Injection Number :
Sequence Line :
Instrument Method: CHARCOAL.MTH
Analysis Method : CHARCOAL.MTH

Sig. 2 in C:\HPCHEM\2\DATA\278928\001R0101.D

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2	0.711	3724	7725	BB	0.008	0.6970
3	6.232	5728	1207	BB	0.062	1.0721
4	7.087	20612	5159	BB	0.060	3.8578
5	7.124	0	2293	Rsho	0.000	0.0000
6	7.178	0	295	Rsho	0.000	0.0000
7	7.305	121702	27125	BB	0.069	22.7781
8	7.481	73022	17879	BB	0.062	13.6670
9	7.787	56525	13014	BB	0.065	10.5794
10	8.148	127937	27362	BB	0.068	23.9451
11	8.352	0	841	Rsho	0.000	0.0000
12	8.874	87649	19795	BB	0.065	16.4047
13	8.971	0	2411	Rsho	0.000	0.0000
14	9.190	11745	2922	BB	0.060	2.1983
15	9.665	5312	1353	BB	0.054	0.9942
16	9.830	10691	2634	BB	0.057	2.0010
17	10.281	5329	1084	BB	0.062	0.9973
18	10.449	2087	543	BB	0.052	0.3906
19	12.568	1795	634	BB	0.045	0.3360

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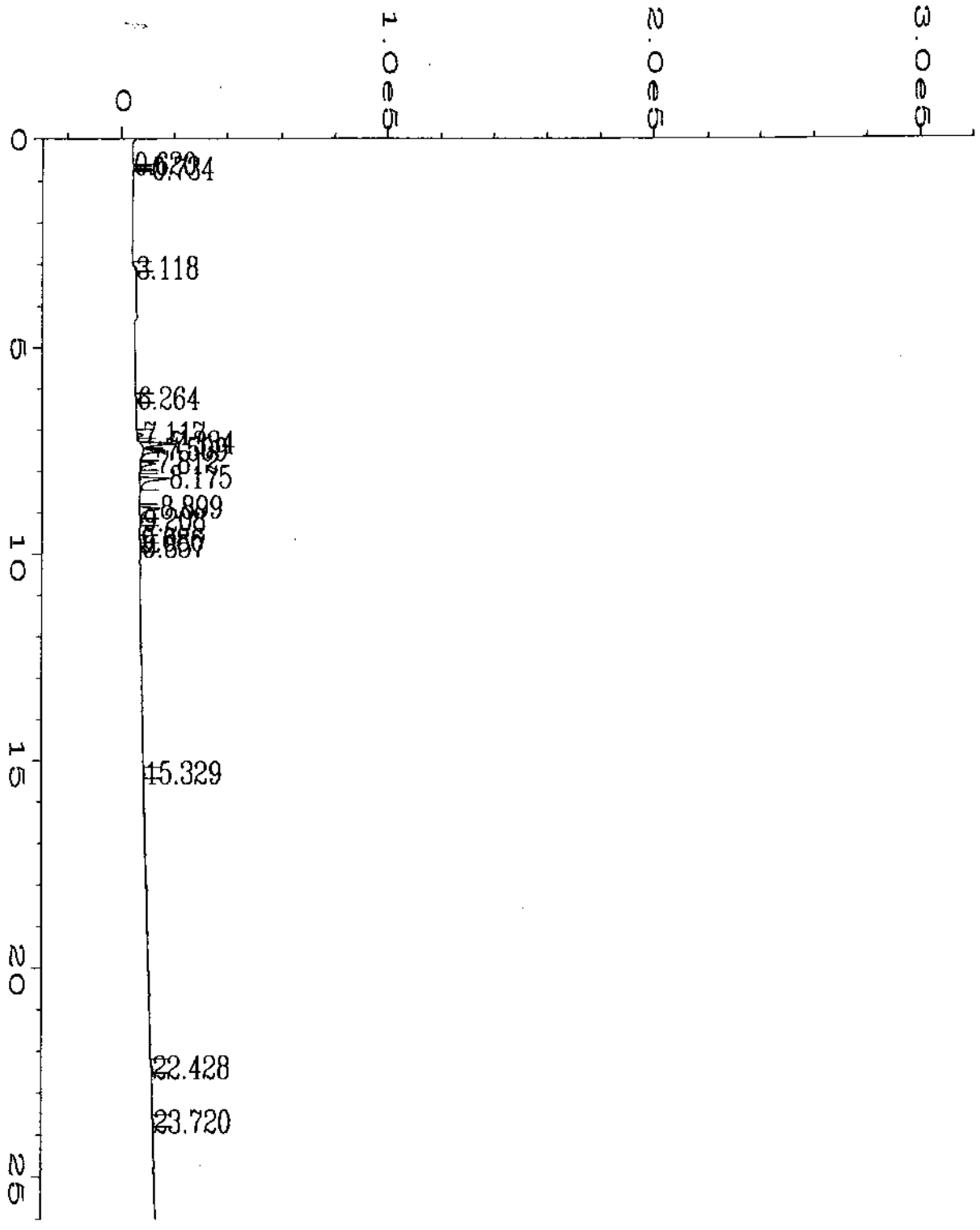

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nstrument	: ECD/FID	Vial Number	:
ample Name	: 278928-5A	Injection Number	:
un Time Bar Code:		Sequence Line	:
cquired on	: 30 May 01 08:08 AM	Instrument Method	: CHARCOAL.MTH
eport Created on	: 30 May 01 11:38 AM	Analysis Method	: CHARCOAL.MTH

Area Percent Report

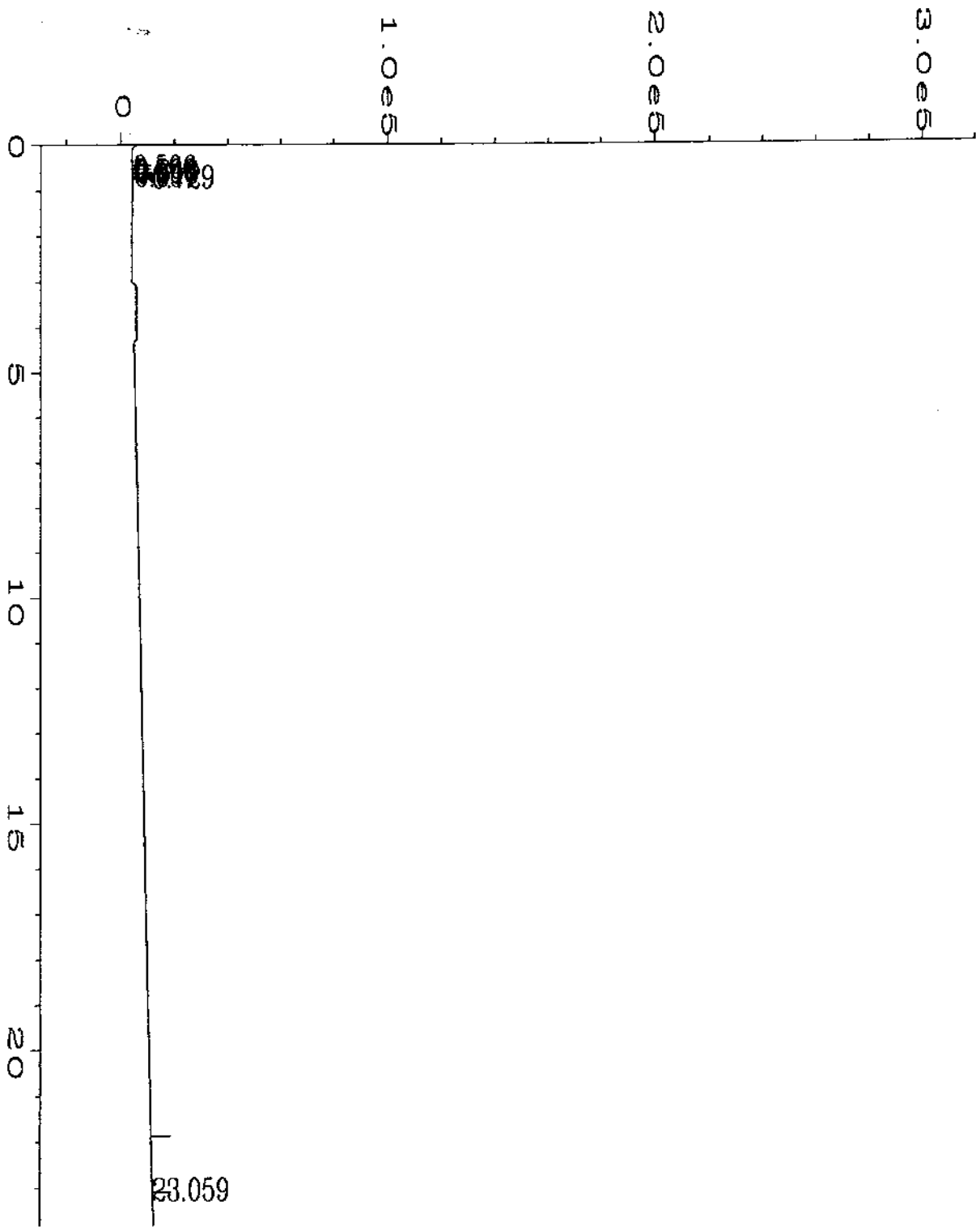
Data File Name : C:\HPCHEM\2\DATA\278928\002R0101.D
Operator : N Iskander
Instrument : ECD/FID
Sample Name : 278928-5A
Run Time Bar Code:
Acquired on : 30 May 01 08:08 AM
Report Created on: 30 May 01 11:38 AM

Page Number : 1
Vial Number :
Injection Number :
Sequence Line :
Instrument Method: CHARCOAL.MTH
Analysis Method : CHARCOAL.MTH

Sig. 2 in C:\HPCHEM\2\DATA\278928\002R0101.D

Pk#	Ret Time	Area	Height	Type	Width	Area %
1	0.620	365	667	BB	0.009	0.1483
2	0.734	4400	7528	BB	0.015	1.7893
3	3.118	979	390	BB	0.050	0.3980
4	6.264	2301	612	BB	0.057	0.9359
5	7.117	8613	2233	BB	0.059	3.5028
6	7.334	51220	11765	BB	0.066	20.8301
7	7.509	35395	8268	BB	0.063	14.3943
8	7.812	26379	5813	BB	0.068	10.7279
9	8.175	56896	11166	BB	0.073	23.1387
10	8.899	41333	7816	BB	0.075	16.8093
11	9.208	4389	1092	BB	0.057	1.7851
12	9.686	1117	399	BB	0.045	0.4542
13	9.857	4103	923	BB	0.057	1.6687
14	15.329	2557	472	BB	0.074	1.0399
15	22.428	3049	530	BB	0.086	1.2399
16	23.720	2797	463	BB	0.088	1.1376

Total area = 245893



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nstrument	: ECD/FID	Vial Number	:
ample Name	: 278928-6A	Injection Number	:
un Time Bar Code:		Sequence Line	:
cquired on	: 30 May 01 08:54 AM	Instrument Method	: CHARCOAL.MTH
eport Created on	: 30 May 01 11:42 AM	Analysis Method	: CHARCOAL.MTH

Area Percent Report

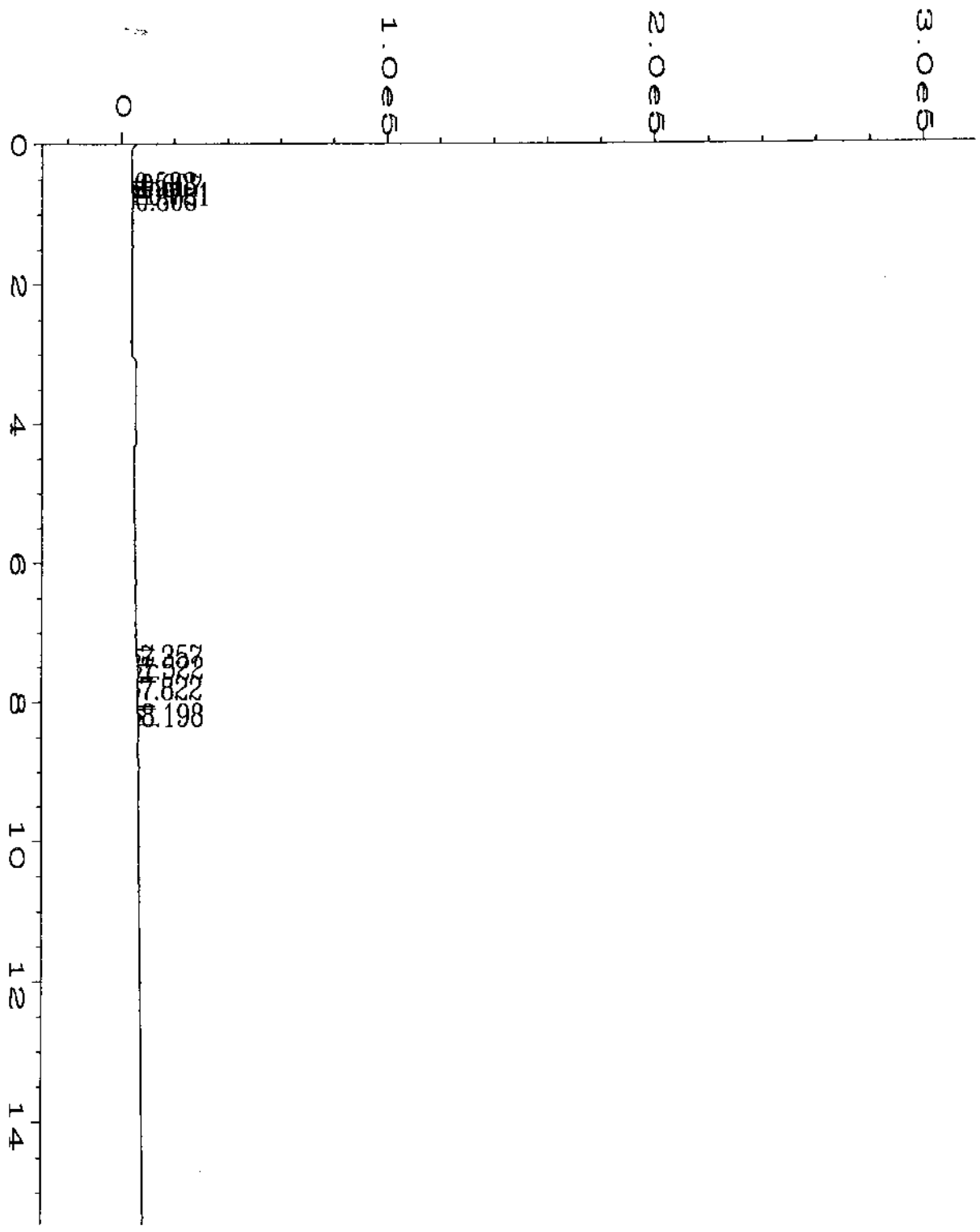
ata File Name : C:\HPCHEM\2\DATA\278928\003R0101.D
perator : N Iskander
nstrument : ECD/FID
ample Name : 278928-6A
un Time Bar Code:
cquired on : 30 May 01 08:54 AM
eport Created on: 30 May 01 11:42 AM

Page Number : 1
Vial Number :
Injection Number :
Sequence Line :
Instrument Method: CHARCOAL.MTH
Analysis Method : CHARCOAL.MTH

ig. 2 in C:\HPCHEM\2\DATA\278928\003R0101.D

Pk#	Ret Time	Area	Height	Type	Width	Area %
1	0.506	408	938	BB	0.007	5.0976
2	0.590	250	664	BB	0.006	3.1240
3	0.616	811	1388	BB	0.010	10.1391
4	0.691	200	484	BB	0.007	2.4983
5	0.729	4745	8131	BB	0.014	59.3186
6	23.059	1586	73	BB	0.364	19.8224

otal area = 8000



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Operator : N Iskander
Instrument : ECD/FID
Sample Name : 278928-7A
Run Time Bar Code:
Acquired on : 30 May 01 10:12 AM
Report Created on: 30 May 01 11:53 AM

Page Number : 1
Vial Number :
Injection Number :
Sequence Line :
Instrument Method: CHARCOAL.MTH
Analysis Method : CHARCOAL.MTH

Area Percent Report

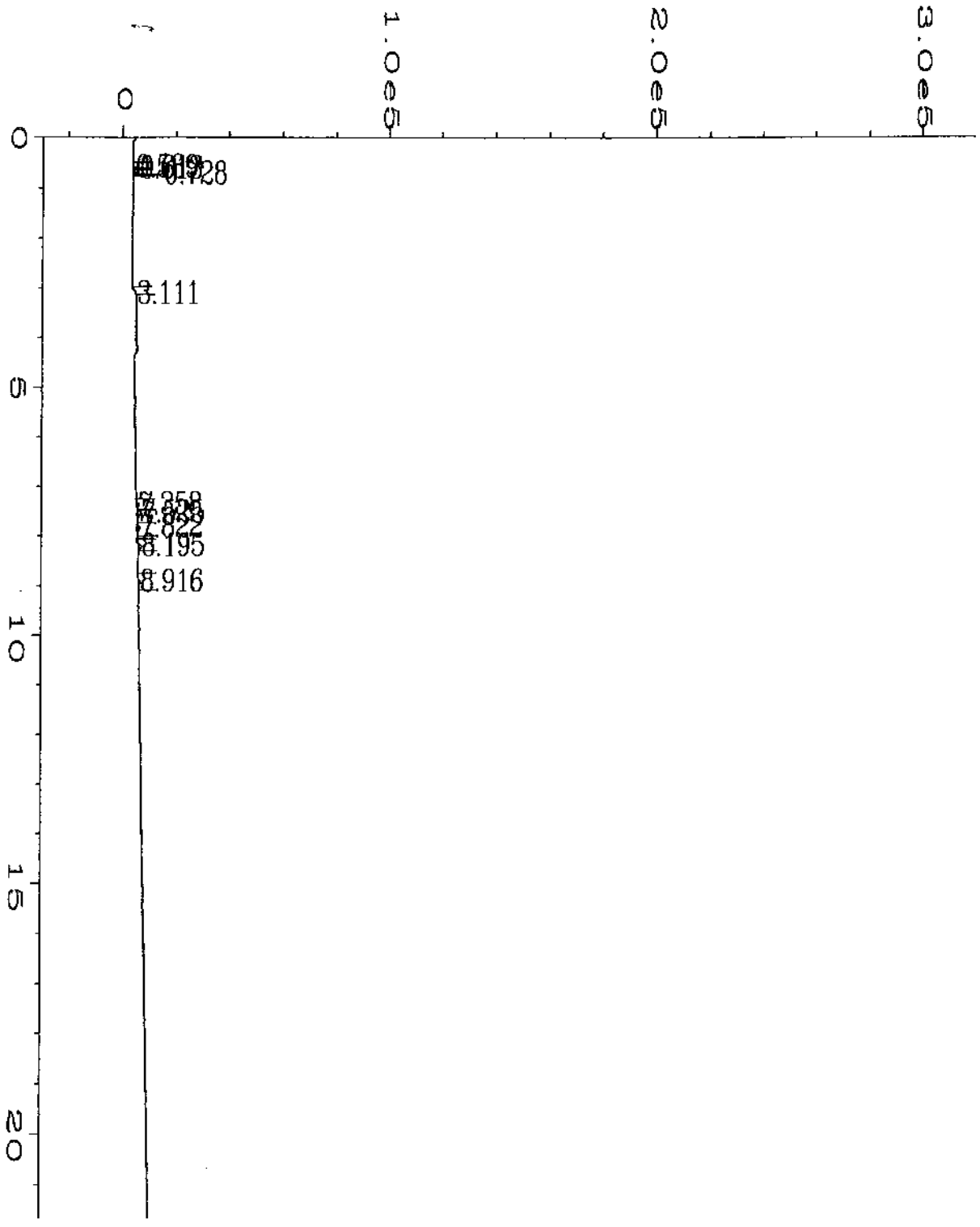
Data File Name : C:\HPCHEM\2\DATA\278928\004R0101.D
Operator : N Iskander
Instrument : ECD/FID
Sample Name : 278928-7A
Run Time Bar Code:
Acquired on : 30 May 01 10:12 AM
Report Created on: 30 May 01 11:53 AM

Page Number : 1
Vial Number :
Injection Number :
Sequence Line :
Instrument Method: CHARCOAL.MTH
Analysis Method : CHARCOAL.MTH

Sig. 2 in C:\HPCHEM\2\DATA\278928\004R0101.D

Pk#	Ret Time	Area	Height	Type	Width	Area %
1	0.583	726	974	BB	0.012	2.3500
2	0.607	1779	3009	BB	0.010	5.7573
3	0.721	4687	6014	BB	0.013	15.1699
4	0.805	1043	914	BB	0.018	3.3762
5	7.338	0	1046	Fsho	0.000	0.0000
6	7.357	5425	1191	BB	0.059	17.5583
7	7.511	0	1221	Fsho	0.000	0.0000
8	7.522	6258	1359	BB	0.063	20.2551
9	7.822	5298	882	BB	0.083	17.1465
10	8.198	5681	1247	BB	0.066	18.3865

Total area = 30896



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nstrument : ECD/FID
ample Name : 278928-8A
in Time Bar Code:
cquired on : 30 May 01 10:35 AM
eport Created on: 30 May 01 11:59 AM

Page Number : 1
Vial Number :
Injection Number :
Sequence Line :
Instrument Method: CHARCOAL.MTH
Analysis Method : CHARCOAL.MTH

Area Percent Report

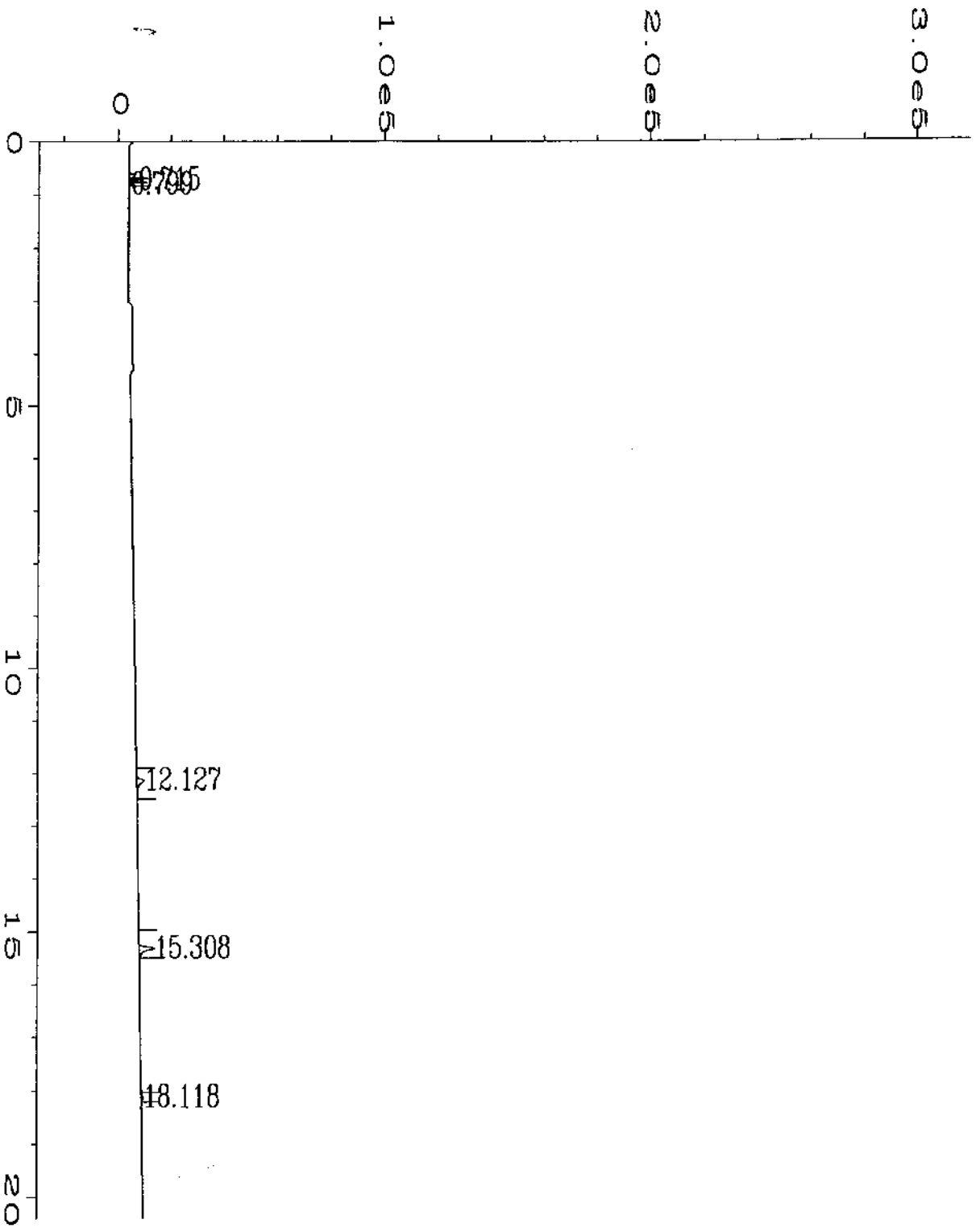
Data File Name : C:\HPCHEM\2\DATA\278928\005R0101.D
Operator : N Iskander
Instrument : ECD/FID
Sample Name : 278928-8A
Run Time Bar Code:
Acquired on : 30 May 01 10:35 AM
Report Created on: 30 May 01 12:00 PM

Page Number : 1
Vial Number :
Injection Number :
Sequence Line :
Instrument Method: CHARCOAL.MTH
Analysis Method : CHARCOAL.MTH

Sig. 2 in C:\HPCHEM\2\DATA\278928\005R0101.D

Pk#	Ret Time	Area	Height	Type	Width	Area %
1	0.589	488	1373	BB	0.006	1.3622
2	0.613	1590	2831	BB	0.009	4.4343
3	0.728	7810	11823	BB	0.017	21.7830
4	3.111	683	288	BB	0.033	1.9059
5	7.358	3609	817	BB	0.062	10.0672
6	7.525	8017	1490	BB	0.073	22.3613
7	7.822	5069	893	BB	0.080	14.1373
8	8.195	4461	1213	BB	0.055	12.4426
9	8.916	4125	752	BB	0.074	11.5060

Total area = 35853



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ample Name : 278928-9A
in Time Bar Code:
cquired on : 30 May 01 11:07 AM
eport Created on: 30 May 01 12:06 PM

Page Number : 1
Vial Number :
Injection Number :
Sequence Line :
Instrument Method: CHARCOAL.MTH
Analysis Method : CHARCOAL.MTH

Area Percent Report

ata File Name : C:\HPCHEM\2\DATA\278928\006R0101.D
perator : N Iskander
nstrument : ECD/FID
ample Name : 278928-9A
un Time Bar Code:
cquired on : 30 May 01 11:07 AM
eport Created on: 30 May 01 12:07 PM

Page Number : 1
Vial Number :
Injection Number :
Sequence Line :
Instrument Method: CHARCOAL.MTH
Analysis Method : CHARCOAL.MTH

ig. 2 in C:\HPCHEM\2\DATA\278928\006R0101.D

Pk#	Ret Time	Area	Height	Type	Width	Area %
1	0.715	2567	3865	BB	0.017	4.5714
2	0.799	725	598	BB	0.020	1.2912
3	12.127	21996	3076	BB	0.100	39.1728
4	15.308	27658	5852	BB	0.070	49.2557
5	15.409	0	643	Rsho	0.000	0.0000
6	18.118	3206	751	BB	0.059	5.7090

otal area = 56151

SPECTRUM NO. 278928-HO

DATE May 14/2001

SAMPLE Pavement Core Site 1, Location 1 Core 29

SOURCE John Emery Geotech

STRUCTURE

PATH mm Film

SOLVENT DCM/Direct Scan

CONCENTRATION Full

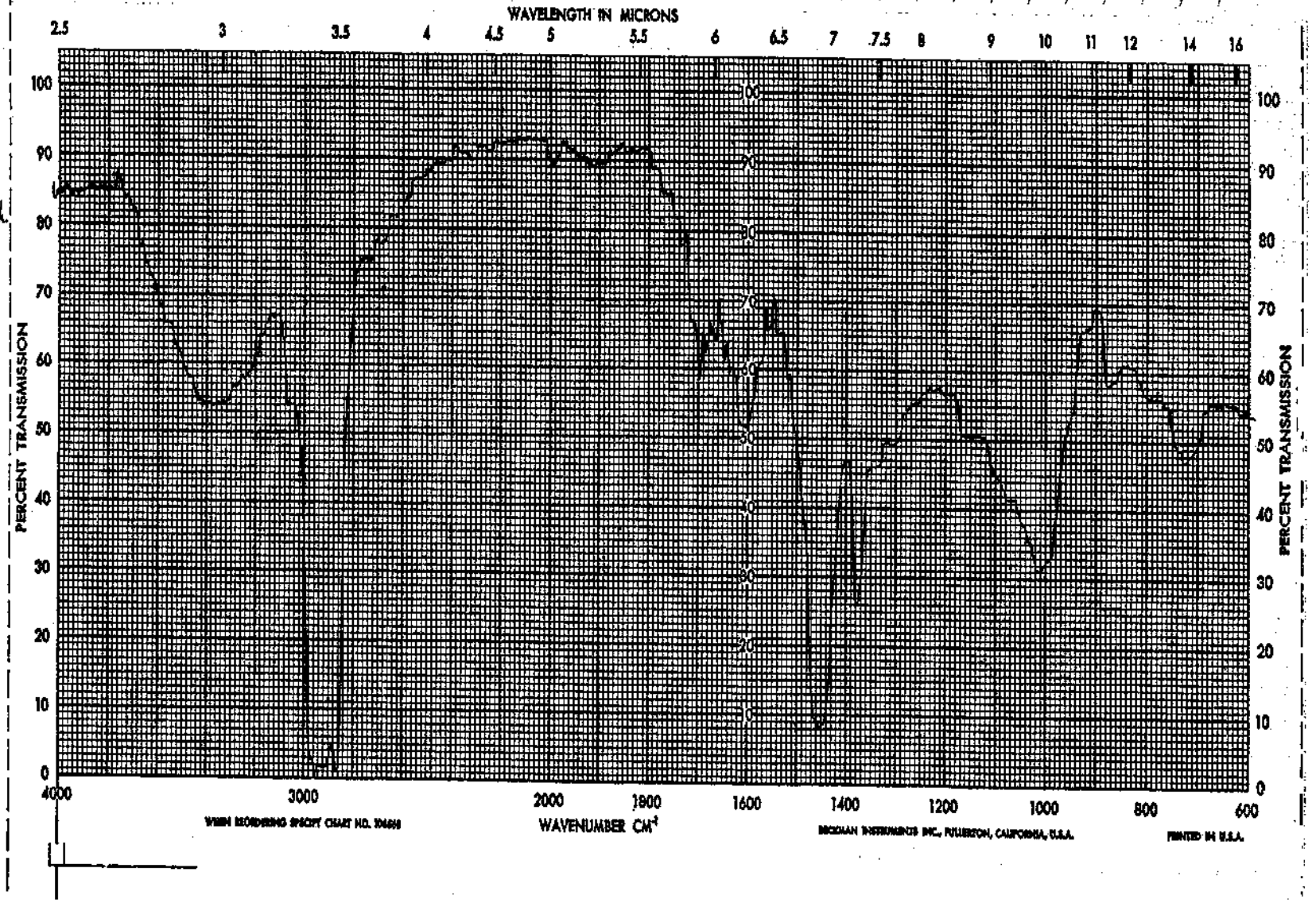
PHASE Solid

COMMENTS A mixture of partially oxidized Hydrocarbon resin.

ANALYST M.I.G.

Beckman®

INFRARED SPECTROPHOTOMETER

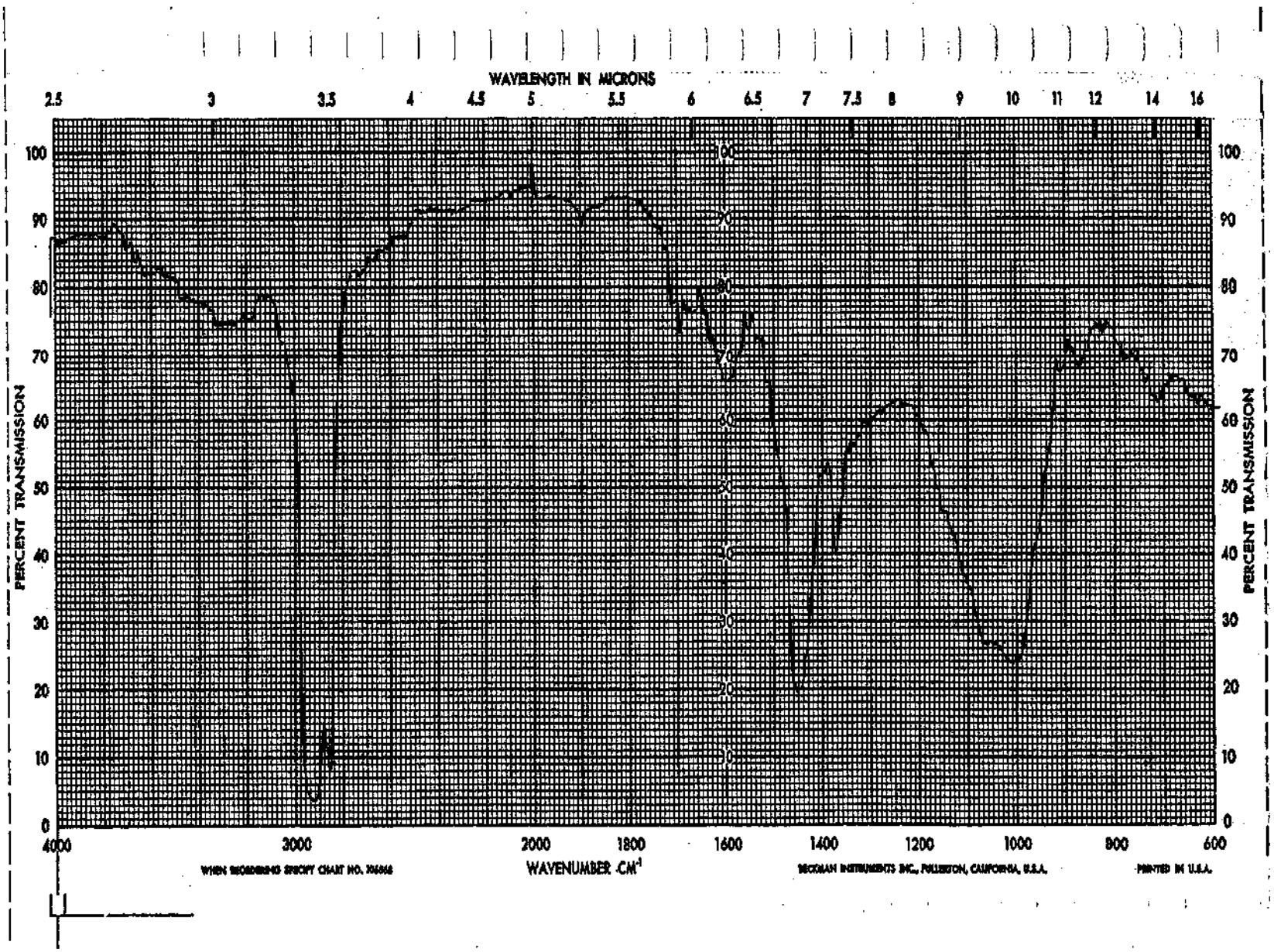


SPECTRUM NO. 278928-50
DATE May 14/2001
SAMPLE Pavement Core
Site 1, Location 2
Core 35
SOURCE John Emery Geotech
STRUCTURE

PATH mm Film
SOLVENT DCM/Direct Scan
CONCENTRATION Full
PHASE Solid
COMMENTS A mixture of partially oxidized Hydrocarbon resin.

ANALYST M.I.G.

Beckman
INFRARED
SPECTROPHOTOMETER

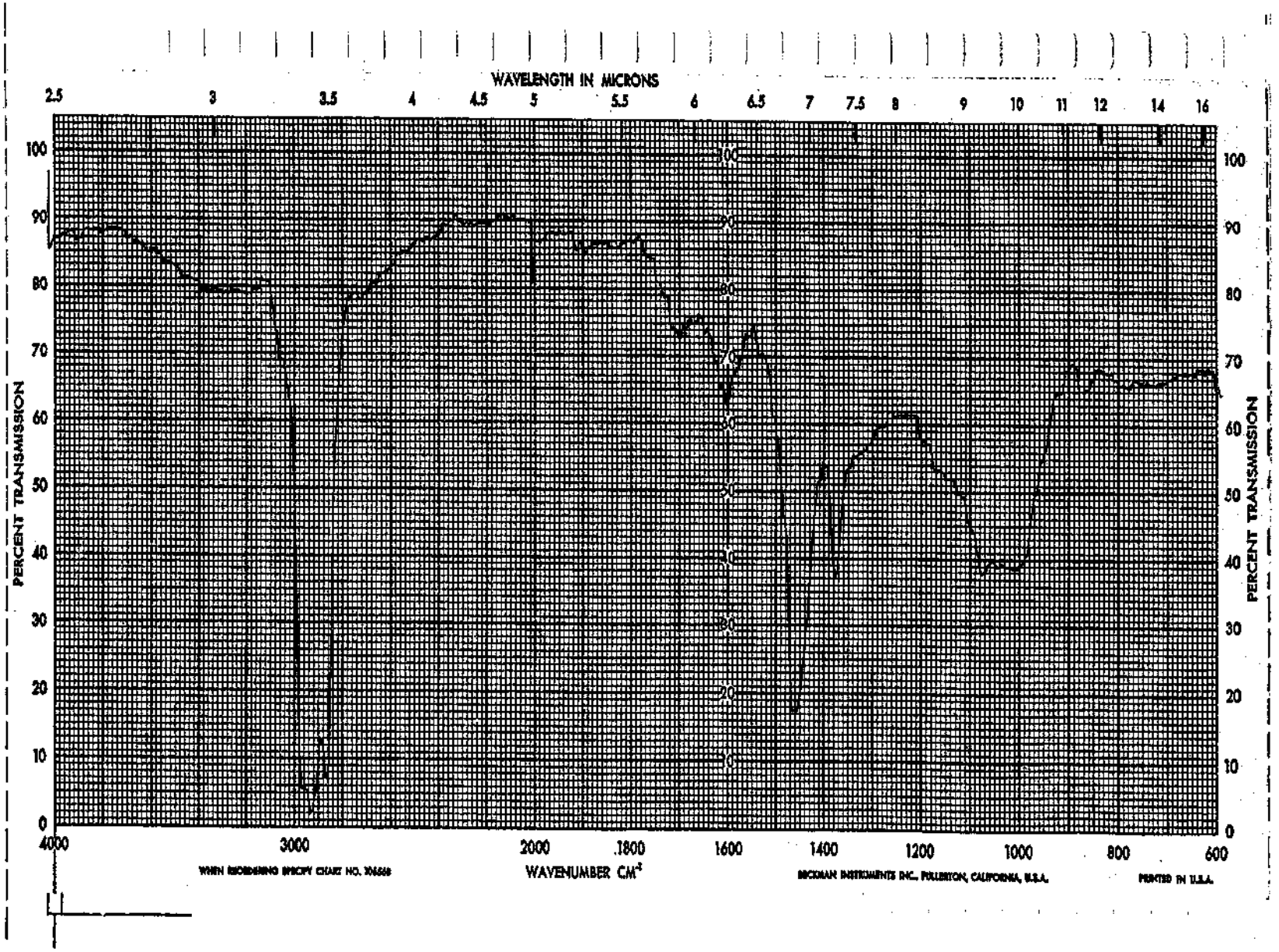


SPECTRUM NO 278928-60
DATE May 14/2001
SAMPLE Pavement Core Site 1, Location 3 Core 14
SOURCE John Emery Geotech.
STRUCTURE

PATH mm Film
SOLVENT DCM/Direct Scan
CONCENTRATION Full
PHASE Solid
COMMENTS A mixture of partially oxidized Hydrocarbon resin.

ANALYST M. I. G.

Beckman®
INFRARED SPECTROPHOTOMETER

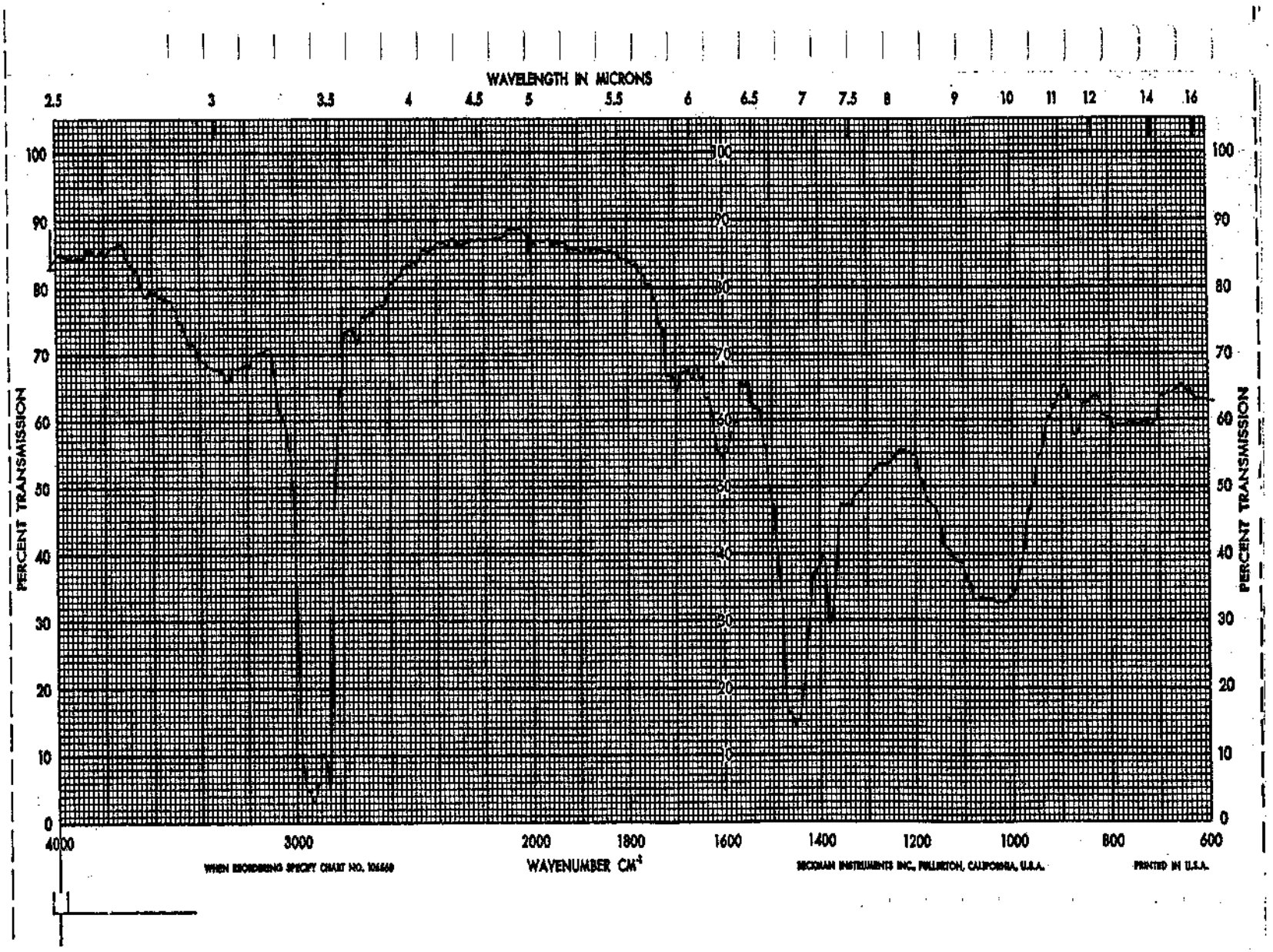


SPECTRUM NO. 278928-70
DATE May 14/2001
SAMPLE Pavement Core Site 2, Location 2 Core 36
SOURCE John Emery Geotech.
STRUCTURE

PATH ____ mm Film
SOLVENT DCM / Direct Scan
CONCENTRATION Full
PHASE Solid
COMMENTS A mixture of partially oxidized Hydrocarbon resin.

ANALYST M. T. G.

Beckman®
INFRARED
SPECTROPHOTOMETER

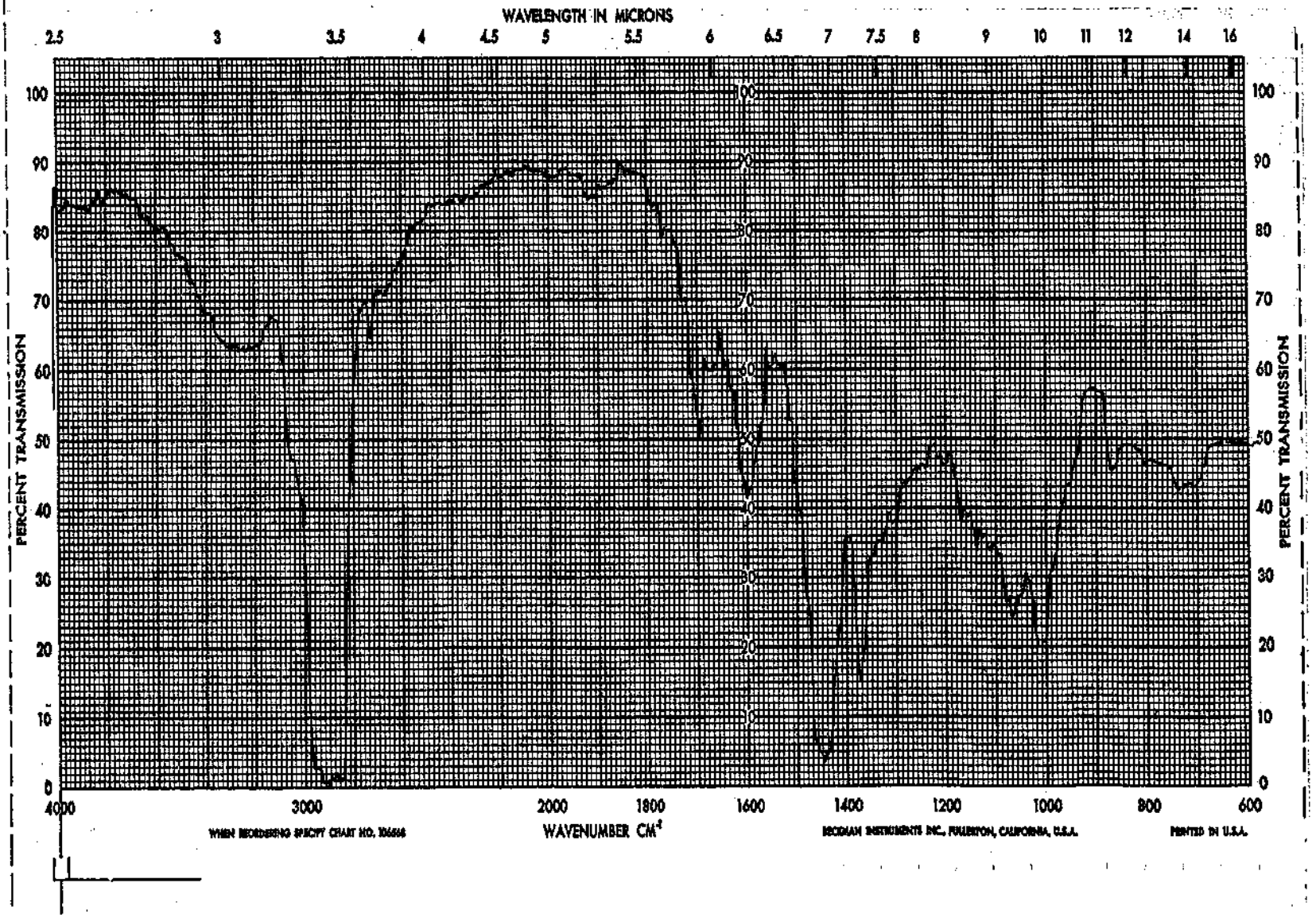


SPECTRUM NO. 278928-80
DATE May 14/2001
SAMPLE Pavement Core Site 2, Location 2 Core 42
SOURCE John Emery Geotech
STRUCTURE

PATH mm Film
SOLVENT DCM / Direct Scan
CONCENTRATION Full
PHASE Solid
COMMENTS A mixture of partially oxidized Hydrocarbon resin.

ANALYST M.T.G.

Beckman®
INFRARED
SPECTROPHOTOMETER



SPECTRUM NO. 278928-90
DATE May 14/2001
SAMPLE Pavement Core Site 2, Location 3 Core 5
SOURCE John Emery Geotech.
STRUCTURE

PATH mm Film
SOLVENT DCM / Direct Scan
CONCENTRATION Full
PHASE Solid
COMMENTS A mixture of partially oxidized Hydrocarbon resin.

ANALYST M.I.G.

Beckman®
INFRARED SPECTROPHOTOMETER