LOCAL ATMOSPHERE SALT PROFILE

Shuttle Study Task No. 0031

Addendum I

2 June 1975

Prepared by M. J. Dickinson
M. J. Dickinson
Bendix Launch Support Division

Approved C. W. Hoppesch
C. W. Hoppesch
Materials Analysis Branch,
SO-LAB-3
Kennedy Space Center

DETERMINATION OF TRACE CONCENTRATIONS OF SODIUM CHLORIDE IN THE ATMOSPHERE

INTRODUCTION

This report is presented as a supplement to the previously published "Local Atmosphere Salt Profile", Shuttle Study Task No. 0031, 8 July 1974, and includes data obtained during the period August 1974 through January 1975. Aerosol sampling and plate fallout sampling were continued during this period. In addition, a funnel-cylinder sampling apparatus was evaluated. Analysis methods were equivalent to those described in the 8 July 1974 report.

Samples were collected and analyzed on a weekly basis from the following locations:

A. Pad B - at the 360' level on the MSS.

B. CCF-39 (located approximately midway between the VAB and Pad A) - on the roof of Building K7-516.

C. VAB (High Bay #1) - at the 0 level on ML-1.

Descriptions of each of the sampling methods are given in the EXPERIMENTAL section.

RESULTS AND DISCUSSION

A. Aerosol Sampling

1. The current study (August 1974 - January 1975) gives

further evidence that sodium chloride is present in the atmosphere at the KSC at all times.

2. Previously reported results from samples taken at the 360' level of the MSS positioned at Pad B averaged 5.5 micrograms of sodium chloride per cubic meter of air (µg $NaCl/M^3$) compared with an average of 4.9 µg $NaCl/M^3$ found during this time period.
3. Aerosol samples inside the VAB averaged 3.7 µg $NaCl/M^3$. No previous data is available.
4. Additional aerosol testing is not considered to be warranted due to the consistency of results obtained during both periods.

B. Plate Sampling

1. Previous contamination problems experienced with the plates during set up were eliminated by adding feet to the bottoms of the plates.
2. Fallout on plates at the MSS exposed for 168 hours averaged 206 µg $NaCl/M^2/hr$. However, during the 24 week sampling period, four weekly fallout results in excess of 500 µg $NaCl/M^2/hr$ were obtained.
3. Fallout on plates located in the VAB averaged 58 µg $NaCl/M^2/hr$. Two of the 25 results obtained showed a fallout in excess of 150 µg $NaCl/M^2/hr$.

4. A study of long term accumulation showed that the salt build-up on plates is not additive. The average accumulation on a plate exposed for 168 hours was 43,266 µg NaCl. Plates exposed for 1008 hours showed only a slightly higher salt build-up of 58,767 µg NaCl.
5. The plates were not inspected for pitting or other local corrosion. However, the plates used for outdoor exposure were uniformly dull and discolored compared to plates used inside the VAB which retained their luster throughout the test.

C. Funnel Sampling

The funnel method yielded results approximately five times higher than the plate method. The much higher efficiency of the funnel method was expected because the funnel collects all condensation and precipitation and because the conical shape more effectively retains dried salt particles.

D. Additional Sampling Planned

Testing will be continued at the CCF-39 location on the roof of Building K7-516 using both plates and funnels. In addition, a six week funnel test is planned to evaluate accumulation efficiency. Data obtained on these tests will be reported in September 1975.

EXPERIMENTAL

Data presented in this report were obtained by analysis of weekly aerosols and plate fallout samples taken at three locations at the KSC. In addition, plates were left exposed for six weeks prior to analysis to determine fallout over extended periods. The wind velocity was obtained by averaging daily readings obtained from the KSC Weather Station for 0600 hours and for 1400 hours. No effort was made to relate wind direction to results; however, in general a land breeze existed at 0600 hours and a sea breeze at 1400 hours.

A brief description of sampling equipment and techniques utilized is given below.

Aerosol Samples

Aerosol samples were taken at Pad B and at the VAB using a 37 mm, 0.45μ HAWP membrane filter contained in an acrylic aerosol field monitor. A volume of 15 liters/min was drawn through the filter for two hours. The filter was removed from the monitor and leached with sodium-free deionized water. The leachings were analyzed for sodium by atomic absorption spectrophotometry (AA). Individual results for aerosol samples are given in Table I.

Plate Samples

Weekly horizontal plate samples were taken at Pad B and at

the VAB using stainless steel plates with approximately one-tenth square meter (0.1 M^2) surface area. Additional plate samples were allowed to remain on the 360' level of the MSS at Pad B for a period of six weeks. The plates were rinsed with sodium-free deionized water and the rinses analyzed for sodium by AA. The plates were supported by four each No. 2 rubber stoppers. This modification was found to eliminate the previously reported plate contamination problems. Individual results for weekly plate samples are given in Table I. Table II shows a comparison of weekly and six-week plate sample results.

Funnel Samples

Funnel samples were taken at the CCF-39 location using a collection apparatus which consisted of a 100 mm diameter glass funnel inserted in a 100 ml glass cylinder. The funnel surface collects salt from fallout, and the cylinder collects salt removed from the atmosphere by precipitation. Sodium-free deionized water rinses of the funnel surface were combined with the precipitation water in the cylinder, and the total liquid analyzed for sodium by AA. Individual data for funnel samples are shown in Table I.

TABLE I

ATMOSPHERIC ANALYSIS FOR SODIUM CHLORIDE

DATE (Week Ending)	WIND M/sec (Avg)	PRECIPITATION (Inches)	AEROSOL SAMPLES (µgNaCl/M³) VAB	AEROSOL SAMPLES (µgNaCl/M³) PAD B	FALLOUT SAMPLES (µgNaCl/M²/Hour) VAB Plate	FALLOUT SAMPLES (µgNaCl/M²/Hour) PAD B Plate	FALLOUT SAMPLES (µgNaCl/M²/Hour) Bldg. K7-516 Funnel
8/14/74	4	0.47	7.9	6.9	38	139	158
8/21	3	5.98	3.3	4.1	80	4	62
8/28	4	0.10	4.1	4.6	24	27	239
9/4	4	0.78	5.6	5.8	36	11	256
9/11	4	0.48	4.3	5.6	36	26	420
9/18	3	0	4.6	3.3	96	94	270
9/25	4	3.23	5.6	8.1	159	170	1157
10/2	4	1.03	3.6	5.1	78	470	660
10/9	7	4.17	2.3	4.1	152	560	6289
10/16	3	0.04	4.1		54	587	660
10/23	5	0.03	2.8	7.1	85	538	3987
10/30	4	0.02	<0.3	2.3	43	54	558
11/6	4	0.12	2.8	5.1	53	100	637
11/13	5	0.53	4.3	5.3	66	301	989
11/20	4	0.07	1.8	4.1	38	281	356
11/27	5	0.08	5.6	6.1	73	148	1771
12/4	6	0.16	1.5	2.8	28	103	1117
12/11	5	0	4.6	7.1	19	150	360
12/18	5	2.82	2.5	4.6	21	52	279
12/26	4	0.03	0.8	1.8	31	132	360
1/2/75	4	0			47	723	1573
1/8	6	0.11	5.8	2.8	94	84	6380
1/15	6	0.20	2.8	2.8	19	49	1607
1/22	4	0.02		5.6	41	140	574
1/29	5	0.26		7.1	26		474
2/5	3	0					410

TABLE II

ACCUMULATION OF SODIUM CHLORIDE ON PLATES EXPOSED FOR VARYING TIMES

DATE (Week Ending)	PRECIP-ITATION (Inches)	WEEKLY FALLOUT ($\mu gNaCl/M^2$)	SIX WEEK FALLOUT ($\mu gNaCl/M^2$)	FALLOUT RATE ($\mu gNaCl/M^2$/Hour)	
				Weekly	Six Weeks
8/21/74	5.98			4	
8/28	0.10	4484		27	
9/4	0.78	1750		11	
9/11	0.48	4265		26	
9/18	0	15693		94	
9/25	3.23	28570	10088	170	10
10/2	1.03	78958	47681	470	47
10/9	4.17	93968	58836	560	58
10/16	0.04	98533	144492	587	143
10/23	0.03	90331	188974	538	187
10/30	0.02	8995	21024	54	21
11/6	0.12	16732	44646	100	44
11/13	0.53	50524	107282	301	106
11/20	0.07	47107	75759	281	75
11/27	0.08	24879	22966	148	23
12/4	0.16	17293	38276	103	38
12/11	0	25194	88089	150	87
12/18	2.82	8749	8475	52	8
12/26	0.03	25262	37592	132	36
1/2/75	0	121431	111356	723	110
1/8	0.11	10676	16568	84	17
1/15	0.20	8120	7409	49	7
1/22	0.02	23471	28215	140	28