BETZ LABORATORIES, INC.

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June 18, 1976

Mr. Joseph M. Tavano
Product Manager #31
Registration Division (WH-567)
Office of Pesticide Programs
Environmental Protection Agency
401 M Street SW
Washington, DC 20460

Subject: Air Washers

Dear Mr. Tavano:

Attached please find two copies of a study to determine the amount of entrained water droplets exiting typical air washer systems.

The copies of these studies are being forwarded to your attention at the request of Drs. G. Paynter and W. S. Woodrow. The content of this report has been discussed with Drs. Paynter and Woodrow.

As indicated in the report, the purpose of this study was to determine whether a biocide treated chilled water in an air washer will carry out into the conditioned atmosphere. An answer to this question was desired so that a judgement could be made regarding the registration of biocides for air washer systems.

The data summarized in this report shows that free droplets of water do not exit the air washer system in the temperature and humidity controlled areas.

If there are any questions concerning this report please write or call.

Sincerely yours,

BETZ LABORATORIES, INC.

B. F. Shema
Manager
Environmental & Regulatory Affairs

BFS cn
Enc.
cc: Dr. G. Paynter
Dr. W. S. Woodrow

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Purpose: To determine the amount of entrained water droplets exiting typical air washer systems.

Introduction: A judicious use of biocides in the recirculating water in air washer systems is an integral part of its efficient operation and the performance of its functions. The principle purpose of air washers is to control the temperature and the relative humidity in manufacturing as well as in other areas. For example, the textile and tobacco industries are entirely dependent upon carefully controlled temperature and relative humidity. Without this control serious manufacturing problems would result.

A schematic drawing of a typical air washer system is attached.

Since biocides are necessary and are introduced into these recirculating water systems, questions have arisen regarding the transport of this treated recirculating water into the temperature and relative humidity controlled areas.

The transport of droplets of recirculating water through the air washer unit to the conditioned areas was discussed with the manufacturers of this equipment. None of these fabricators were able to give quantitative data; however, they

suggested that the levels should be zero water entrainment because (1) the mechanical design of the unit did not permit this to occur and (2) the fact that any free water in the atmosphere would have an adverse effect upon the manufacturing process.

Since this specific data was non-existent, Betz Laboratories, Inc. initiated the following study to determine if any entrained water was present in the air leaving the air washer.

It was decided that the passage of free water thru the air washer could best be measured by the amount of sodium in the air as it leaves the unit. Sodium was chosen because it can be determined accurately at extremely low levels. Furthermore, additional sodium could be added conveniently to the recirculating water without affecting air quality.

Test Apparatus:

The R.A.C. Train Stacksamplr developed by the Emissions Testing Branch of the Office of Air Programs, E.P.A. was used as the air sampling device. It is specified in Vol. 36, Number 247 of the Federal Register under the topic "Standards of Performance for New Stationary Sources". The air quality was determined with the R.A.C. TrainStacksamplr in 2 different air washers. The data obtained from these 2 air washers is summarized in Table I.

Air Washer A had a spray flow rate of 125 GPM at a water temperature of 47°F. Air Washer B had a spray flow rate of 75 GPM at a water temperature of 44° F.

In Air Washer A Trial I the air was sampled before the spray and after the eliminator. In Trial II, after the heaters was sampled also.

In Air Washer B air samples were obtained after the heaters because previous determinations indicated this to be the most appropriate sampling point. In these tests, sodium determinations were based upon 50, 100, 250 and 500 cu. ft. of air passed thru the filters in the Stacksamplr.

All sodium determinations were made with Flame Emission Beckman DU Spectographs. Whatman No. 42 filter paper cut to 65 mm was used instead of the fritted glass.

Discussion of Results:

Trial I in Air Washer A consisted of determining the sodium content of the air prior to the sprays and after the eliminators. For these tests, 50 cu. ft. of air was passed thru the sampling device. The average sodium content of the recirculating water during this trial was 257 ppm.

The data show that there was no increase in the sodium content of the filter paper after the passage of 50 cu. ft. of air. It

should be noted that the filters before the sprays gave a reading of 46.3 μg of sodium which indicates that the incoming air has a higher sodium content than that leaving the air washer eliminators (13.0 μg).

The data for Air Washer A Trial II show that the control filter paper contains 38 μg of sodium. A test at 100 cu. ft. of air at 300 ppm sodium in the recirculating water shows that there was 70 μg of sodium present in the filter prior to the spray and 62 μg after the eliminators which again is a reduction in the amount of sodium in the air leaving the air washers.

The sodium content of recirculating water was then increased from 300 ppm to 2362 ppm with the addition of sodium chloride. It is interesting to note that when 100 cu. ft. of air is sampled during the high sodium content of the water the sodium content after the eliminators decreased to 44 μg. This value is significantly lower than the level obtained when the air was sampled when there was 300 ppm of sodium in the recirculating water.

During Trial III samples were obtained before the sprays and after the eliminators and heaters. These tests were run at a level of 2025 ppm of sodium in the recirculating water. The

filter paper controls contained 38μg of sodium. Although the values after the eliminators and heaters did not indicate any significant increase in sodium the sample prior to the spray was lower than the control. This phenomenon and the previous high results in Trial II indicated that the probe in the test device may contribute sodium because of difficulty in cleaning the unit. The use of the probe was discontinued for the studies in Air Washer B.

Three separate trials were run with Air Washer B which ranged from 100 cu. ft. to a maximum of 500 cu. ft. with a range of 46 ppm to 470 ppm of sodium in the recirculating water. From the data presented in the table it can be seen that there was no significant increase in the sodium content even after there was a tenfold increase in sodium content of the recirculating water. Therefore the data presented shows and confirms the manufacturer's premise that the mechanical design and eliminators effectively prevents any entrained water from passing thru the air washer into the conditioned areas.

This trial also confirms that the apparent anomoly in Trial II was indeed the result of the extreme sensitivity of the sodium determinations and the inability to clean the probe beyond the sensitivity of the test.

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TABLE I

AIR WASHER TESTS

SET	SAMPLE	FT^3	µg SODIUM	ppm SODIUM
Air Washer A Trial I	Filter paper control	-	11.0	
	Recirculating water			257
	Before sprays	50	46.3	
	After eliminators	50	13.0	
Air Washer A Trial II	Filter paper control	-	38	
	Recirculating water			300
	Before sprays	100	70	
	After eliminators	100	62	
	Water			2362
	After eliminators	100	44	
Air Washer A Trial III	Recirculating water			2025
	After eliminators and heaters	100	36	
	After eliminators and heaters	100	48	
	Before sprays	100	31	
	Filter paper control	-	38	

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AIR WASHER TESTS (contd.)

SET	SAMPLE	FT^3	mg SODIUM	ppm SODIUM
Air Washer B	Filter paper control	-	12.0	
	After eliminators and heaters	100	12.0	
	After eliminators and heaters	250	14.5	
	Recirculating water			46
	After eliminators and heaters	500	16.5	
Air Washer B Trial II	After sodium addition			490
	After eliminators and heaters	100	12.5	
	After eliminators and heaters	300	13.0	
Air Washer B Trial III	Recirculating water After sodium addition			470
	After eliminators and heaters	500	16.0	
	Filter paper control		9.5	

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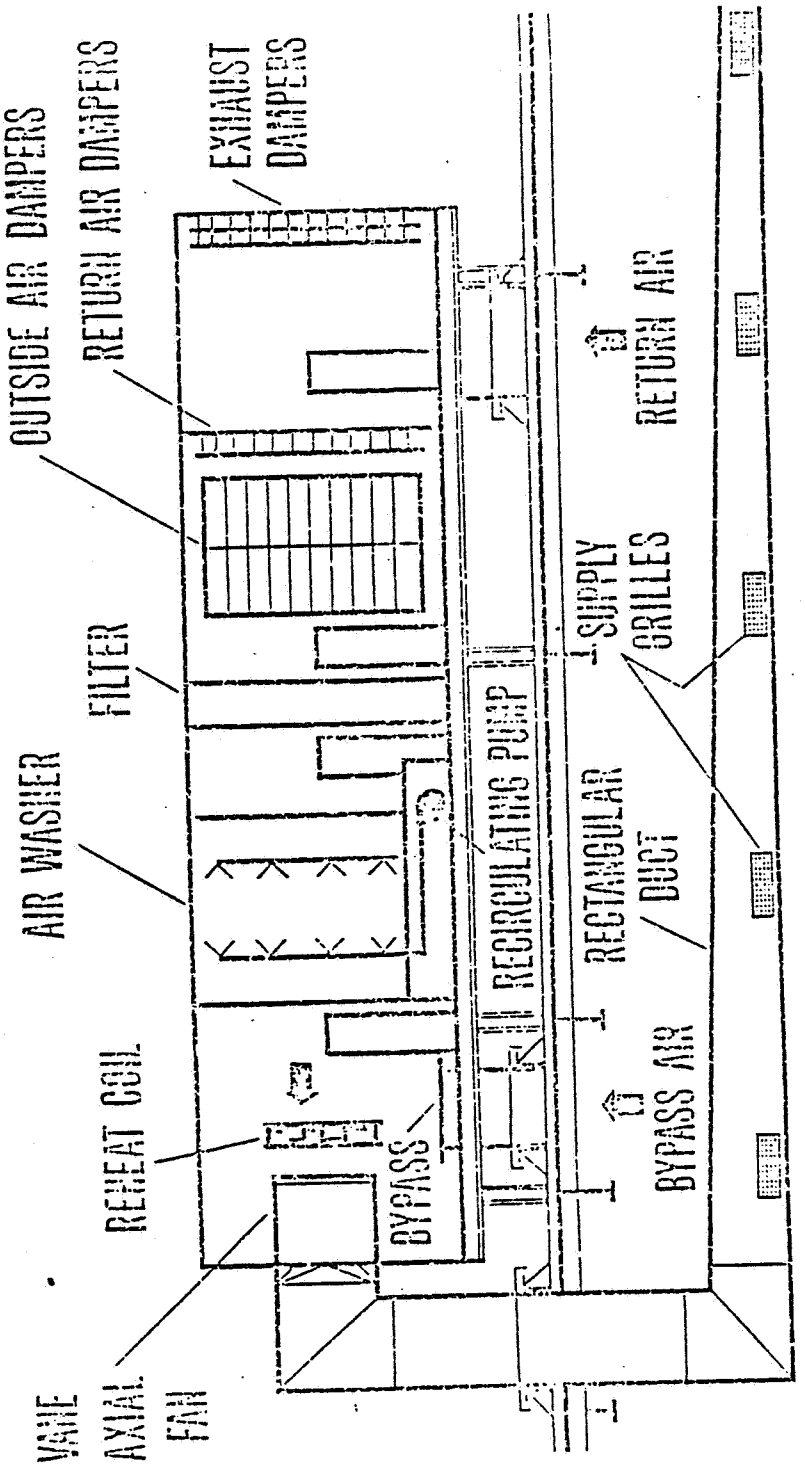
ENGINEERING DRAWING



PACKAGED AIR WASHER SYSTEM
SCHEMATIC DIAGRAM

DRAFTSMAN: Schmidt	ENGINEERING APPROVAL: RHR.	CERTIFIED BY:	FILE: None	RELEASE NUMBER:
SHEET CODE: BD219 7204	DATE: 4/17/72	DATE:		SUPERSEDES NUMBER:

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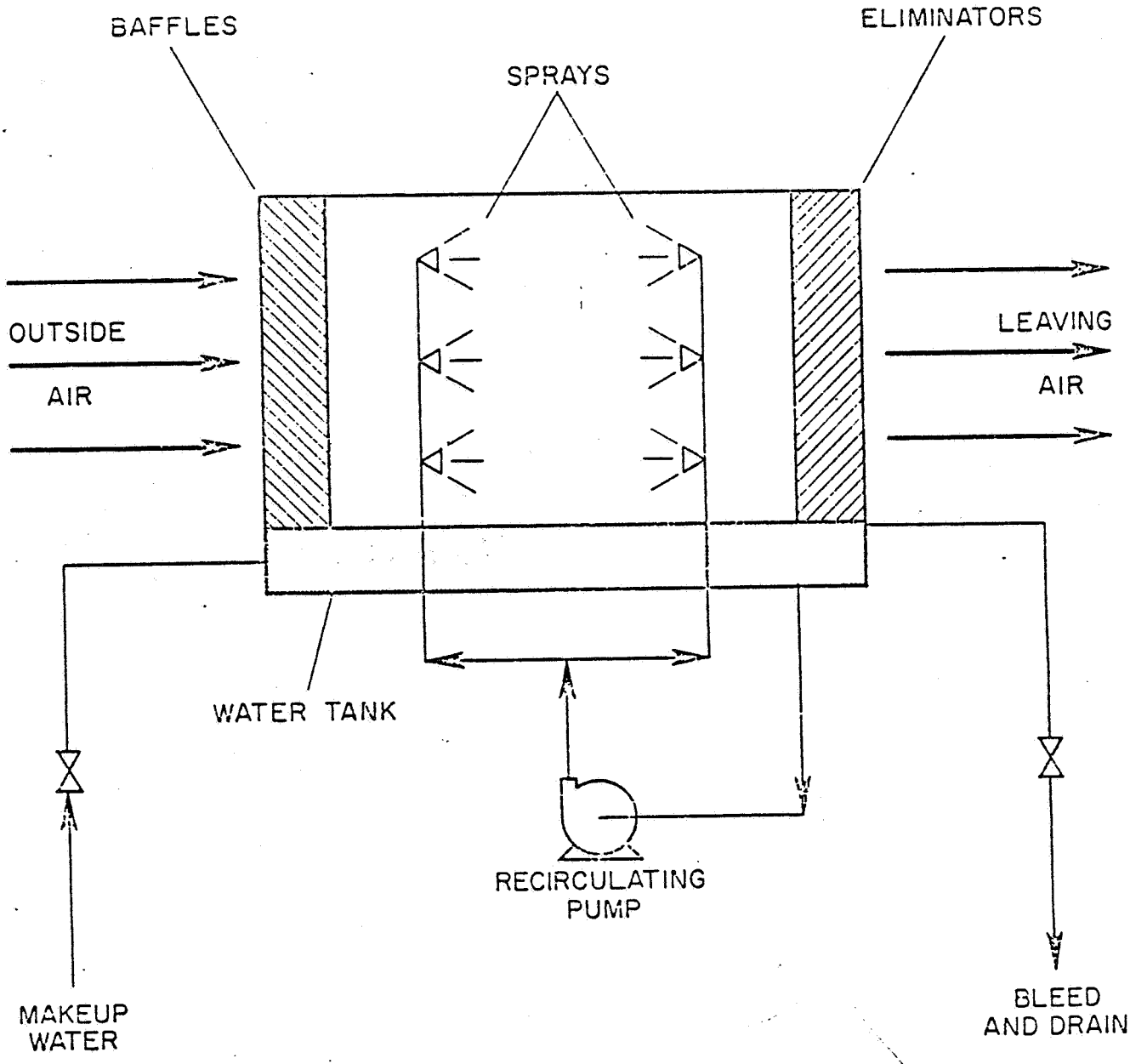
ENGINEERING DRAWING



SPRAY-TYPE AIR WASHER
SCHEMATIC DIAGRAM

DRAFTSMAN Schmit	ENGINEERING APPROVAL R.L.R.	CERTIFIED BY	SCALE NONE	REFERENCE NUMBER
SHEET CODE BD220 7204	DATE 4/17/72	DATE	REVISION	JOB ORDER NUMBER