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RESIDUES OF BIPHENYL CONTAINED IN ORANGES
SHIPPED IN BIPHENYL-TREATED
FIBERBOARD BOXES

✓ Project 1108-7-4 - *Reports for the
Registration of Biphenyl
with the U.S. Dept. Agriculture*
A Report Prepared for

THE FOURDRINIER KRAFT BOARD INSTITUTE

from data supplied by

Mr. D. R. Baesecker, Monsanto Chemical Company
Central Research Laboratory, Dayton, Ohio

By

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March 15, 1955

RESIDUES OF BIPHENYL CONTAINED IN ORANGES
SHIPPED IN BIPHENYL-TREATED
FIBERBOARD BOXES

Data Obtained by D. R. Baesecker, Central
Laboratory, Monsanto Chemical Company,
Dayton, Ohio

As indicated in the beginning of this report, at the same time shipments of oranges from California were made to The Institute of Paper Chemistry, similar shipments were made to the Dayton Laboratory of Monsanto Chemical Company. Here analyses of biphenyl residues were made, and the results reported by letter to The Institute of Paper Chemistry. There follows significant excerpts of these letters as well as the data reported.

In a letter dated July 16, 1953 from Dr. I. B. Johns of Monsanto to Mr. John Strange, The Institute of Paper Chemistry, Dr. Johns stated:

"Single analyses were run using entire peel of two oranges or the entire pulp of two oranges. Samples were taken from the side of the boxes and from the center. These are indicated on the Tables by the letters "S" and "C". Most of the boxes were not full, and accordingly the fruit may have been tumbled about during shipping and handling. This may account for the unusually high analysis of the peel from the center fruit compared to side fruit in some instances."

The data attached to that letter are contained in Table I.

TABLE I
ANALYTICAL RESULTS OF FIRST SHIPMENT

Samples from First Shipment	Fungistat	Biphenyl in Peel(ppm.)	Biphenyl in Pulp(ppm.)	Biphenyl in Whole Fruit (ppm.)	Biphenyl in Box Collar (mg/sq. in)	Box Sampled
1-S*	L	162.0	0.4	48.0	1.57	6-29-53
1-C	L	98.5	0.2	25.8		
2-S	L	138.2	0.6	35.6	1.37	6-29-53
2-C	L	93.7	0.2	23.8		
3-S	P	22.7	0.1	5.9	0.12	6-29-53
3-C	P	8.1	0.0	1.9		
4-S	P	42.1	0.4	11.1	0.23	6-29-53
4-C	P	13.8	0.4	4.0		
1-S**	L	418.0	2.1	99.8		
1-C	L	178.2	1.2	46.7		
2-S**	L	277.5	1.5	77.2		
2-C	L	150.0	1.3	34.9		
3-S**	P	44.8	0.0	11.9		
3-C	P	19.1	0.0	5.6		
5-S	L	103.8	1.6	31.8	0.90	7-9-53
5-C	L	18.4	0.6	5.7		
6-S	L	94.8	1.1	30.0	1.25	7-9-53
6-C	L	27.1	0.1	8.1		
7-S	L	106.5	0.9	31.4	1.52	7-9-53
7-C	L	94.5	1.2	23.2		
8-S	L	252.0	1.5	72.5	1.81	7-9-53
8-C	L	202.0	0.9	48.2		
9-S	P	50.2	0.2	13.7	0.13	7-9-53
9-C	P	20.4	0.1	6.5		
10-S	P	48.2	0.2	11.4	0.13	7-9-53
10-C	P	12.6	0.2	3.2		
11-S	P	53.2	0.6	16.0	0.11	7-9-53
11-C	P	52.0	0.4	12.0		
12-S	P	29.1	0.2	6.9	0.14	7-9-53
12-C	P	10.4	0.1	2.5		

*Number assigned to box; S - sample taken from side of box; C - sample taken from center of box

**Stored over week end in boxes at room temperature (80°F.), then resampled to 95°F.

Note: Fruit shipped 6-16-53
P = Phenodor Collar
L = Lemon Oil Collar

In a letter dated July 20, 1953, from Dr. Johns to Mr. Strange the comment is:

"The attached table gives the results of the analyses of the

2-S	L	138.2	0.6	35.0	1.57	6-29-53
2-C	L	93.7	0.2	23.8		
3-S	P	22.7	0.1	5.9	0.12	6-29-53
3-C	P	8.1	0.0	1.9		
4-S	P	42.1	0.4	11.1	0.23	6-29-53
4-C	P	13.8	0.4	4.0		
1-S**	L	418.0	2.1	99.8		
1-C	L	178.2	1.2	46.7		
2-S**	L	277.5	1.5	77.2		
2-C	L	150.0	1.3	34.9		
3-S**	P	44.8	0.0	11.9		
3-C	P	19.1	0.0	5.6		
5-S	L	103.8	1.6	31.8	0.90	7-9-53
5-C	L	18.4	0.6	5.7		
6-S	L	94.8	1.1	30.0	1.25	7-9-53
6-C	L	27.1	0.1	8.1		
7-S	L	106.5	0.9	31.4	1.52	7-9-53
7-C	L	94.5	1.2	23.2		
8-S	L	252.0	1.5	72.5	1.81	7-9-53
8-C	L	202.0	0.9	48.2		
9-S	P	50.2	0.2	13.7	0.13	7-9-53
9-C	P	20.4	0.1	6.5		
10-S	P	48.2	0.2	11.4	0.13	7-9-53
10-C	P	12.6	0.2	3.2		
11-S	P	53.2	0.6	16.0	0.11	7-9-53
11-C	P	52.0	0.4	12.0		
12-S	P	29.1	0.2	6.9	0.14	7-9-53
12-C	P	10.4	0.1	2.5		

*Number assigned to box; S - sample taken from side of box; C - sample taken from center of box

**Stored over week end in boxes at room temperature (80°F.), then resampled to 95°F.

Note: Fruit shipped 6-16-53

P = Phenodor Collar

L = Lemon Oil Collar

In a letter dated July 20, 1953, from Dr. Johns to Mr. Strange the comment is:

"The attached table gives the results of the analyses of the second shipment of oranges received by us. The boxes were numbered by us from 13 to 24, and as in the first report the samples of fruit taken from the sides of the boxes are given the suffix "S" and those from the center, the suffix "C"."

TABLE II
ANALYTICAL RESULTS OF SECOND SHIPMENT

Samples from Second Shipment	Fungistat	Biphenyl in Peel(ppm.)	Biphenyl in Pulp(ppm.)	Biphenyl in Whole Fruit (ppm.)	Biphenyl Box Collar (mg./sq. in.)	Box Sampled
13-S	L	296.0	1.4	78.0	2.09	7-13-53
13-C		224.5	0.7	70.4		
14-S	L	349.0	1.6	96.6	3.13	7-13-53
14-C		194.2	0.9	55.8		
15-S	L	400.0	2.6	98.2	4.66	7-13-55
15-C		250.0	1.4	66.6		
16-S	L	296.0	1.3	93.0	3.81	7-13-53
16-C		183.2	1.4	58.0		
17-S	L	282.0	1.8	89.7	4.66	7-13-53
17-C		195.0	1.5	61.6		
18-S	L	317.0	1.4	84.4	3.93	7-13-53
18-C		229.2	1.5	60.3		
19-S	P	62.6	0.3	14.4	0.366	7-13-53
19-C		27.0	0.3	8.7		
20-S	P	49.0	0.1	13.9	0.193	7-13-53
20-C		26.9	0.2	6.0		
21-S	P	36.6	0.3	8.7	0.219	7-13-53
21-C		33.5	0.2	6.7		
22-S	P	31.5	0.2	8.9	0.201	7-13-53
22-C		24.5	0.1	6.6		
23-S	P	39.8	0.5	9.3	0.125	7-13-53
23-C		28.2	0.5	7.6		
24-S	P	37.5	0.4	10.2	0.225	7-13-53
24-C		32.5	0.3	8.9		

Note: P = Phenodor Collar
L = Lemon Oil Collar

In a letter from D. R. Baesecker, of the Central Monsanto Research Laboratory to Mr. Strange dated August 10, 1953, the following statement is pertinent:

"The results of the analyses of the third orange shipment

14-S	L	349.0	1.6	96.6	3.13	7-13-53
14-C		194.2	0.9	55.8		
15-S	L	400.0	2.6	98.2	4.66	7-13-55
15-C		250.0	1.4	66.6		
16-S	L	296.0	1.3	93.0	3.81	7-13-53
16-C		183.2	1.4	58.0		
17-S	L	282.0	1.8	89.7	4.66	7-13-53
17-C		195.0	1.5	61.6		
18-S	L	317.0	1.4	84.4	3.93	7-13-53
18-C		229.2	1.5	60.3		
19-S	P	62.6	0.3	14.4	0.366	7-13-53
19-C		27.0	0.3	8.7		
20-S	P	49.0	0.1	13.9	0.193	7-13-53
20-C		26.9	0.2	6.0		
21-S	P	36.6	0.3	8.7	0.219	7-13-53
21-C		33.5	0.2	6.7		
22-S	P	31.5	0.2	8.9	0.201	7-13-53
22-C		24.5	0.1	6.6		
23-S	P	39.8	0.5	9.3	0.125	7-13-53
23-C		28.2	0.5	7.6		
24-S	P	37.5	0.4	10.2	0.225	7-13-53
24-C		32.5	0.3	8.9		

Note: P = Phenodor Collar
L = Lemon Oil Collar

In a letter from D. R. Baesecker, of the Central Monsanto Research Laboratory to Mr. Strange dated August 10, 1953, the following statement is pertinent:

"The results of the analyses of the third orange shipment are attached for your perusal. We have numbered these boxes 25 through 36. You will note that only oranges taken from the side of the box have been analyzed. Center sampling has been discontinued in order to lighten the analytical load."

The data attached to this letter are shown in Table III.

TABLE III
ANALYTICAL RESULTS OF THIRD SHIPMENT

Samples from Third Shipment	Fungistat	Biphenyl in Peel(ppm.)	Biphenyl in Pulp(ppm.)	Biphenyl in Whole Fruit (ppm)	Biphenyl in Box Collar (mg/sq. in.)	Box Sampled
25-S*	L	35.6	1.7	10.7	2.38	7-28-53
26-S	L	56.0	1.6	15.1	3.81	7-28-53
27-S	L	39.8	1.6	12.3	3.08	7-28-53
28-S	L	41.3	1.6	11.5	1.62	7-28-53
29-S	L	36.4	1.6	10.8	3.32	7-28-53
30-S	L	398.0	1.7	114.2	1.62	7-28-53
31-S	P	47.8	.3	13.2	0.11	7-28-53
32-S	P	38.0	0.4	11.1	0.11	7-28-53
33-S	P	37.9	0.3	8.8	0.14	7-28-53
34-S	P	29.9	0.3	6.5	0.07	7-28-53
35-S	P	27.6	0.3	7.5	0.05	7-28-53
36-S	P	39.0	0.6	10.3	0.09	7-28-53

*Samples taken from side of box (2 oranges per sample)

Note: P = Phenodor Collar
L = Lemon Oil Collar

In a letter dated August 26, 1953 to Mr. Strange, Mr. Baesecker stated:

"The diphenyl analyses of orange shipments four, five, and six numbered 49 through 60, 37 through 48, and 61 through 72, respectively. The boxes were numbered in this manner because the fifth shipment arrived before the fourth shipment. You will note from the attached data sheets that two oranges were taken per sample from shipment four and five. At the time these shipments were received

26-S	L	30.0	1.0	13.1	3.02	7-28-53
27-S	L	39.8	1.6	12.3	3.08	7-28-53
28-S	L	41.3	1.6	11.5	1.62	7-28-53
29-S	L	36.4	1.6	10.8	3.32	7-28-53
30-S	L	398.0	1.7	114.2	1.62	7-28-53
31-S	P	47.8	.3	13.2	0.11	7-28-53
32-S	P	38.0	0.4	11.1	0.11	7-28-53
33-S	P	37.9	0.3	8.8	0.14	7-28-53
34-S	P	29.9	0.3	6.5	0.07	7-28-53
35-S	P	27.6	0.3	7.5	0.05	7-28-53
36-S	P	39.0	0.6	10.3	0.09	7-28-53

*Samples taken from side of box (2 oranges per sample)

Note: P = Phenodor Collar
L = Lemon Oil Collar

In a letter dated August 26, 1953 to Mr. Strange, Mr. Baesecker stated:

"The diphenyl analyses of orange shipments four, five, and six numbered 49 through 60, 37 through 48, and 61 through 72, respectively. The boxes were numbered in this manner because the fifth shipment arrived before the fourth shipment. You will note from the attached data sheets that two oranges were taken per sample from shipment four and five. At the time these shipments were received samples of two oranges each were also taken from the center of each box. The latter were later discarded in order to lighten the analytical load. Subsequent shipments, starting with the sixth, have been sampled only at the sides. Four oranges, one from each treated side, are used per sample. This practice will give a more representative sampling."

The data attached to this letter are shown in Tables IV, V, and VI.

TABLE IV
ANALYTICAL RESULTS OF FOURTH SHIPMENT

Samples from Fourth Shipment	Fungistat	Biphenyl in Peel(ppm.)	Biphenyl in Pulp(ppm.)	Biphenyl in Whole Fruit (ppm.)	Biphenyl in Box Collar (mg/sq. in.)	Box Sampled
49-S*	L	216.8	1.9	49.5	4.06	7-29-53
50-S	L	205.3	1.3	50.6	4.00	7-29-53
51-S	L	300.4	3.9	82.2	4.26	7-29-53
52-S	L	318.5	2.6	79.4	3.56	7-29-53
53-S	P	4.5	0.26	1.7	.03	7-29-53
54-S	P	6.3	0.17	1.7	.05	7-29-53
55-S	P	9.4	0.16	2.6	.06	7-29-53
56-S	P	17.3	0.18	4.1	.03	7-29-53
57-S	L	354.9	3.2	91.2	**	7-29-53
58	L	248.8	3.8	59.5	2.37	7-29-53
59	P	14.3	0.36	4.2	.05	5-29-53
60	P	19.3	0.14	4.9	.03	7-29-53

*Samples taken from side of box (2 oranges per sample)

**Sample accidentally destroyed

Note: P = Phenodor Collar
L = Lemon Oil Collar

TABLE V
ANALYTICAL RESULTS OF FIFTH SHIPMENT

Samples from Fifth Shipment	Fungistat	Biphenyl in Peel(ppm.)	Biphenyl in Pulp(ppm.)	Biphenyl in Whole Fruit (ppm.)	Biphenyl in Box Collar (mg./sq. in.)	Box Sampled
37-S*	L	267.1	1.9	89.7	3.12	7-29-53
38-S	L	270.3	1.3	102.7	1.39	7-29-53
39-S	L	312.5	2.8	85.5	2.31	7-29-53
40-S	L	258.1	1.8	80.5	2.13	7-29-53

50-S	L	200.0	1.0	50.0	4.00	7-29-53
51-S	L	300.4	3.9	82.2	4.26	7-29-53
52-S	L	318.5	2.6	79.4	3.56	7-29-53
53-S	P	4.5	0.26	1.7	.03	7-29-53
54-S	P	6.3	0.17	1.7	.05	7-29-53
55-S	P	9.4	0.16	2.6	.06	7-29-53
56-S	P	17.3	0.18	4.1	.03	7-29-53
57-S	L	354.9	3.2	91.2	**	7-29-53
58	L	248.8	3.8	59.5	2.37	7-29-53
59	P	14.3	0.36	4.2	.05	5-29-53
60	P	19.3	0.14	4.9	.03	7-29-53

*Samples taken from side of box (2 oranges per sample)

**Sample accidentally destroyed

Note: P = Phenodor Collar
L = Lemon Oil Collar

TABLE V
ANALYTICAL RESULTS OF FIFTH SHIPMENT

Samples from Fifth Shipment	Fungistat	Biphenyl in Peel(ppm.)	Biphenyl in Pulp(ppm.)	Biphenyl in Whole Fruit (ppm.)	Biphenyl in Box Collar (mg./sq. in.)	Box Sampled
37-S*	L	267.1	1.9	89.7	3.12	7-29-53
38-S	L	270.3	1.3	102.7	1.39	7-29-53
39-S	L	312.5	2.8	85.5	2.31	7-29-53
40-S	L	258.1	1.8	80.5	2.13	7-29-53
41-S	L	281.1	2.5	70.2	2.19	7-29-53
42-S	L	212.7	2.3	65.9	3.06	7-29-53
43-S	P	15.0	0.06	3.9	0.09	7-29-53
44-S	P	17.8	0.06	4.6	0.09	7-29-53
45-S	P	17.2	0.06	5.1	0.11	7-29-53
46-S	P	13.1	0.0	4.4	0.09	7-29-53
47-S	P	18.0	0.0	4.0	0.05	7-29-53
48-S	P	14.7	0.0	4.3	0.04	7-29-53

*Samples taken from side of box (2 oranges per sample)

P = Phenodor Collar
L = Lemon Oil Collar

TABLE VI
ANALYTICAL RESULTS OF SIXTH SHIPMENT

Samples from Sixth Shipment	Fungistat	Biphenyl in Peel (ppm.)	Biphenyl in Pulp (ppm.)	Biphenyl in Whole Fruit (ppm.)	Biphenyl in Box Collar (mg./sq. in.)	Box Sampled
61-S*	P	**	**	**	0.21	8-4-53
62-S	P	28.9	0.32	8.1	0.15	8-4-53
63-S	P	335.1	3.2	77.7	3.81	8-4-53
64-S	P	35.3	0.44	8.9	.29	8-4-53
65-S	P	33.4	0.53	9.0	.24	8-4-53
66-S	P	40.6	0.63	11.6	.19	8-4-53
67-S	P	256.1	2.43	69.9	3.68	8-4-53
68-S	P	171.8	1.99	40.2	6.45	8-4-53
69-S	P	241.1	1.61	59.5	5.86	8-4-53
70-S	P	30.0	0.36	8.9	0.27	8-4-53
71-S	P	254.8	2.3	64.9	3.94	8-4-53
72-S	P	283.7	2.5	72.5	3.55	8-4-53

*S-four oranges per sample, one taken from each treated side of box
**Sample accidentally destroyed

Note: P = Phenodor Collar

In a letter from Mr. Baesecker to Mr. Strange dated August 31, 1953, it is stated:

"'Shelf-life' tests were made on this shipment in the following manner:

1. All oranges in contact with treated sides were piled in pyramids on a table in the laboratory. One pile was made for each box sampled. Tests were made at room temperature.
2. The piles were prepared August 12. Samples, consisting of four oranges each, were taken from the top of the piles on

63-S	P	335.1	3.2	77.7	3.81	8-4-53
64-S	P	35.3	0.44	8.9	.29	8-4-53
65-S	P	33.4	0.53	9.0	.24	8-4-53
66-S	P	40.6	0.63	11.6	.19	8-4-53
67-S	P	256.1	2.43	69.9	3.68	8-4-53
68-S	P	171.8	1.99	40.2	6.45	8-4-53
69-S	P	241.1	1.61	59.5	5.86	8-4-53
70-S	P	30.0	0.36	8.9	0.27	8-4-53
71-S	P	254.8	2.3	64.9	3.94	8-4-53
72-S	P	283.7	2.5	72.5	3.55	8-4-53

*S-four oranges per sample, one taken from each treated side of box
 **Sample accidentally destroyed

Note: P = Phenodor Collar

In a letter from Mr. Baesecker to Mr. Strange dated August 31, 1953, it is stated:

"'Shelf-life' tests were made on this shipment in the following manner:

1. All oranges in contact with treated sides were piled in pyramids on a table in the laboratory. One pile was made for each box sampled. Tests were made at room temperature.

2. The piles were prepared August 12. Samples, consisting of four oranges each, were taken from the top of the piles on August 14, 17, and 19 and are identified by the suffix ST-1, ST-2, and ST-3, respectively.

3. The analyses were made in the usual manner. No marked differences in biphenyl content of the "fresh" and "stored" samples can be found. The tendency, however, is for the "stored" samples to show slightly higher values. This increase may be due merely to loss of water from the fruit, which would make the apparent concentration of biphenyl higher.

The data attached to this letter are shown in Table VII.

TABLE VII
ANALYTICAL RESULTS OF SEVENTH SHIPMENT

Samples from Seventh Shipment	Fungistat	Biphenyl in Peel(ppm.)	Biphenyl in Pulp(ppm.)	Biphenyl in Whole Fruit (ppm.)	Biphenyl in Box Collar (mg./sq. in.)	Box Sampled
73-S*	P	243.8	2.1	63.4	2.13	8-13-53
74-S	P	217.9	2.1	60.9	2.10	8-13-53
75-S	P	205.6	1.2	61.5	4.94	8-13-53
76-S	P	202.1	2.1	67.5	4.34	8-13-53
77-S	P	202.6	1.4	63.5	1.91	8-13-53
78-S	P	214.2	2.1	55.6	5.37	8-13-53
79-S	P	203.8	1.8	60.6	1.87	8-13-53
80-S	P	228.8	2.0	65.6	1.62	8-13-53
81-S	P	200.0	1.3	62.5	1.78	8-13-53
82-S	P	248.5	1.3	72.6	4.25	8-13-53
83-S	P	195.0	1.6	55.0	4.38	8-13-53
84-S	P	166.1	1.0	46.6	1.90	8-13-53
Storage Samples from Seventh Shipment						
74-ST-1	P	298.1	1.2	76.6		
74-ST-2	P	264.5	1.3	70.2		
74-ST-3	P	310.0	1.2	84.8		
76-ST-1	P	294.5	2.8	87.4		
76-ST-2	P	242.6	0.9	66.4		
76-ST-3	P	247.9	0.8	62.9		
78-ST-1	P	174.8	1.1	48.4		
78-ST-2	P	174.8	1.1	48.4		

73-S*	P	243.8	2.1	63.4	2.13	8-13-53
74-S	P	217.9	2.1	60.9	2.10	8-13-53
75-S	P	205.6	1.2	61.5	4.94	8-13-53
76-S	P	202.1	2.1	67.5	4.34	8-13-53
77-S	P	202.6	1.4	63.5	1.91	8-13-53
78-S	P	214.2	2.1	55.6	5.37	8-13-53
79-S	P	203.8	1.8	60.6	1.87	8-13-53
80-S	P	228.8	2.0	65.6	1.62	8-13-53
81-S	P	200.0	1.3	62.5	1.78	8-13-53
82-S	P	248.5	1.3	72.6	4.25	8-13-53
83-S	P	195.0	1.6	55.0	4.38	8-13-53
84-S	P	166.1	1.0	46.6	1.90	8-13-53

Storage
Samples from
Seventh
Shipment

74-ST-1	P	298.1	1.2	76.6		
74-ST-2	P	264.5	1.3	70.2		
74-ST-3	P	310.0	1.2	84.8		
76-ST-1	P	294.5	2.8	87.4		
76-ST-2	P	242.6	0.9	66.4		
76-ST-3	P	247.9	0.8	62.9		
78-ST-1	P	174.8	1.1	48.4		
78-ST-2	P	172.0	0.6	53.5		
78-ST-3	P	224.8	1.1	55.9		
80-ST-1	P	200.1	1.0	58.2		
80-ST-2	P	204.1	0.9	56.6		
80-ST-2	P	221.9	1.4	54.8		

*S-four oranges per sample taken, one from each treated side

In a letter dated September 1, 1955 from Mr. Beasecker to Mr. Strange the following statement was made:

"Attached you will find the analytical results for the eighth orange shipment. The twelve boxes in the shipment have been numbered 85 through 96. Again there seems to be very little difference between the biphenyl content of lemon oil-biphenyl and Phenodor-treated oranges and boxes."

The data attached to this letter are shown in Table VIII.

TABLE VIII

ANALYTICAL RESULTS OF EIGHTH SHIPMENT

Samples from Eighth Shipment	Fungistat	Biphenyl in Peel (ppm.)	Biphenyl in Pulp (ppm.)	Biphenyl in Whole Fruit (ppm.)	Biphenyl in Box Collar (mg./sq. in.)	Box Sampled
85-S*	P	181.0	1.2	50.5	1.59	8-20-53
86-S	P	188.8	1.2	52.2	1.17	8-20-53
87-S	P	210.1	1.4	58.2	0.95	8-20-53
88-S	P	224.2	1.3	62.3	1.65	8-20-53
89-S	P	171.5	1.6	48.2	1.68	8-20-53
90-S	P	216.0	2.2	60.6	1.55	8-20-53
91-S	L	157.2	1.1	42.5	1.70	8-20-53
92-S	L	200.2	1.3	51.5	1.67	8-20-53
93-S	L	152.5	0.8	44.4	1.67	8-20-53
94-S	L	165.0	0.8	44.5	1.62	8-20-53
95-S	L	204.5	1.3	48.6	1.62	8-20-53
96-S	L	147.8	1.0	42.4	1.62	8-20-53

*Samples taken from each side of box (4 oranges per sample)

Note: P = Phenodor Collar
L = Lemon Oil Collar

A letter dated September 9, 1953 from Mr. Baesecker to Mr. Strange contained data on the ninth shipment

TABLE IX

ANALYTICAL RESULTS OF NINTH SHIPMENT

Samples from Ninth Shipment	Fungistat	Biphenyl in Peel(ppm.)	Biphenyl in Pulp(ppm.)	Biphenyl in Whole Fruit (ppm.)	Biphenyl in Box Collar (mg./sq. in.)	Box Sampled
97-S*	L	128.0	0.9	34.6	2.25	8-27-53
98-S	L	283.0	2.2	75.2	1.81	8-27-53
99-S	L	217.9	1.7	67.8	1.37	8-27-53
100-S	L	252.2	1.4	60.6	1.37	8-27-53
101-S	L	81.4	0.9	30.9	1.37	8-27-53
102-S	L	147.9	1.5	37.4	1.00	8-27-53
103-S	P	77.7	0.7	19.5	0.03	8-27-53
104-S	P	78.1	0.9	21.9	0.21	8-27-53
105-S	P	81.1	1.2	21.7	0.19	8-27-53
106-S	P	137.5	1.1	39.6	0.06	8-27-53
107-S	P	149.3	1.2	36.8	0.13	8-27-53
108-S	P	86.0	1.1	20.8	0.16	8-27-53

*Samples taken from each side of box (4 oranges per sample)

Note: P = Phenodor Collar
L = Lemon Oil Collar

On September 18, Mr. Baesecker wrote Mr. Strange as follows:

"The analysis of the tenth orange shipment has been completed.
A table of results is attached for your perusal.

Storage tests were made on this shipment in the same manner as reported for the seventh shipment with one exception. The tests were made over an eleven-day interval instead of a seven-day interval. As before the results show no loss of biphenyl upon storage. In fact the biphenyl content seems to be slightly higher. One conclusion to be drawn from this fact is that the fruit retains the biphenyl and that the higher apparent biphenyl content is due to

100-S	L	252.2	1.4	60.6	1.37	8-27-53
101-S	L	81.4	0.9	30.9	1.37	8-27-53
102-S	L	147.9	1.5	37.4	1.00	8-27-53
103-S	P	77.7	0.7	19.5	0.03	8-27-53
104-S	P	78.1	0.9	21.9	0.21	8-27-53
105-S	P	81.1	1.2	21.7	0.19	8-27-53
106-S	P	137.5	1.1	39.6	0.06	8-27-53
107-S	P	149.3	1.2	36.8	0.13	8-27-53
108-S	P	86.0	1.1	20.8	0.16	8-27-53

*Samples taken from each side of box (4 oranges per sample)

Note: F = Phenodor Collar
L = Lemon Oil Collar

On September 18, Mr. Baesecker wrote Mr. Strange as follows:

"The analysis of the tenth orange shipment has been completed.

A table of results is attached for your perusal.

Storage tests were made on this shipment in the same manner as reported for the seventh shipment with one exception. The tests were made over an eleven-day interval instead of a seven-day interval. As before the results show no loss of biphenyl upon storage. In fact the biphenyl content seems to be slightly higher. One conclusion to be drawn from this fact is that the fruit retains the biphenyl and that the higher apparent biphenyl content is due to loss in weight of the fruit by "drying out" during storage in the open air.

There appears to be one discrepancy in the results reported in the attached table. On the basis of past results, Phenodor treated samples were lower in biphenyl content than biphenyl-lemon oil treated samples. This analysis shows just the opposite effect. Could the shipper have made a mistake in labelling the boxes?

TABLE X
ANALYTICAL RESULTS OF TENTH SHIPMENT

Samples from Tenth Shipment	Fungistat	Biphenyl in Peel(ppm.)	Biphenyl in Pulp(ppm.)	Biphenyl in Whole Fruit (ppm.)	Biphenyl in Box Collar (mg./sq. in.)	Box Sampled
109-S*	L	54.2	0.5	17.5	1.06	9-3-53
110-S	L	60.6	0.4	21.7	0.93	9-3-53
111-S	L	75.6	0.5	23.4	0.82	9-3-53
112-S	L	66.2	0.4	23.3	0.83	9-3-53
113-S	L	41.6	0.3	11.7	0.65	9-3-53
114-S	L	62.7	0.5	17.6	0.74	9-3-53
115-S	P	162.5	1.6	52.6	5.10	9-3-53
116-S	P	211.8	1.5	62.8	4.43	9-3-53
117-S	P	195.2	1.8	58.9	5.19	9-3-53
118-S	P	182.5	1.5	58.8	5.37	9-3-53
119-S	P	202.8	1.5	60.6	7.41	9-3-53
120-S	P	181.5	1.3	61.0	3.94	9-4-53

*Samples taken from each treated side of box (4 oranges per sample)

Note: P = Phenodor Collar
L = Lemon Oil Collar

Storage* Samples from Tenth Shipment	Fungistat	Biphenyl in Peel(ppm.)	Biphenyl in Pulp(ppm.)	Biphenyl in Whole Fruit (ppm.)
109-ST-1**	L	60.0	0.1	16.4
110-ST-1	L	64.2	0.2	19.8
115-ST-1	P	212.8	0.9	62.9
116-ST-1	P	181.8	1.2	60.9
109-ST-2	L	76.8	0.2	21.7
110-ST-2	L	78.2	0.3	24.0
115-ST-2	P	230.6	1.4	65.6

110-S	L	60.6	0.4	21.7	0.93	9-3-53
111-S	L	75.6	0.5	23.4	0.82	9-3-53
112-S	L	66.2	0.4	23.3	0.83	9-3-53
113-S	L	41.6	0.3	11.7	0.65	9-3-53
114-S	L	62.7	0.5	17.6	0.74	9-3-53
115-S	P	162.5	1.6	52.6	5.10	9-3-53
116-S	P	211.8	1.5	62.8	4.43	9-3-53
117-S	P	195.2	1.8	58.9	5.19	9-3-53
118-S	P	182.5	1.5	58.8	5.37	9-3-53
119-S	P	202.8	1.5	60.6	7.41	9-3-53
120-S	P	181.5	1.3	61.0	3.94	9-4-53

*Samples taken from each treated side of box (4 oranges per sample)

Note: P = Phenodor Collar
L = Lemon Oil Collar

Storage*
Samples from
Tenth
Shipment

109-ST-1**	L	60.0	0.1	16.4
110-ST-1	L	64.2	0.2	19.8
115-ST-1	P	212.8	0.9	62.9
116-ST-1	P	181.8	1.2	60.9
109-ST-2	L	76.8	0.2	21.7
110-ST-2	L	78.2	0.3	24.0
115-ST-2	P	230.6	1.4	65.6
116-ST-2	P	234.6	1.1	66.5
109-ST-3	L	55.8	0.3	24.5
110-ST-3	L	76.1	0.2	23.6
115-ST-3	P	227.5	0.9	61.9
116-ST-3	P	281.0	0.8	79.0

*Fruit piled on table top September 3 and sampled on dates specified. Four oranges per sample taken. Only fruit in contact with treated sides used for tests.
**ST = Storage Test Note: P = Phenodor Collar L = Lemon Oil Collar

