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insoluble zinc concentrations in the effluent have increased since the King study.

According to King (2), overall zinc removal by alum coagulation would be in the order of 25 to 40 percent assuming an insoluble fraction of 25 percent and a soluble fraction of 75 percent. He predicted that zinc removal by alum coagulation would not be sufficient to reduce effluent concentration to 1 mg/l. If the partitioning pattern of the effluent has changed to increase the fraction of insoluble zinc, higher levels of removal than previously predicted might be achieved as a result of alum coagulation (which is quite effective in removing suspended particulates). It should be kept in mind that total zinc levels determined in current study are about 1-2 mg/l lower than those that existed in the effluent at the time of the King study.

An alum coagulation color removal treatment system is to be installed in the near future. Alum along with a polymer will be employed. Part of the color is associated with colloidal material. Because of association of metals with colloids, removal of these substances, by alum coagulation, together with suspended solids, should further reduce the dissolved zinc ($< .45\mu$) content of the effluent.

The Effluent from the Keysville STP

The results have shown that the wastewater effluent from the Keysville STP is a source of suspended and dissolved zinc, discharged to Ash Camp Creek. The highest concentration of zinc was associated with the dissolved fraction (mean \leq 0.63 mg/l); however, there is a degree of uncertainty associated with this mean because detectable concentrations

treated sewage was bypassed around the filter and highly chlorinated prior to discharge. Mean total suspended solids were quite high for the study period (about 64 mg/l) probably as a consequence of the bypassing procedure. A high, mean suspended zinc level value may be a consequence of high total suspended solids in the inadequately treated effluent. The relationship of suspended solids to suspended zinc has been previously explained. If the influent wastewater had been properly treated by the trickling filter, one would anticipate that attachment of inorganic and organic suspended particles to filter media would have likely reduced the suspended particulates, and consequently, the suspended zinc concentration in the effluent. Because of biotic uptake and sorption, dissolved zinc concentrations might also have been reduced.

Because of a high volatile suspended solids (total suspended solids was 60% volatile) and high total organic carbon content much of the zinc (dissolved and suspended) is probably associated with the carbonaceous constituents of the effluent. A lower dissolved solids content (lower conductivity) sewage than for industrial effluent may be the reason why there is a smaller percentage of metal associated with the dissolved fraction of the treated sewage.

The reduction of the total suspended solids content of the effluent to the secondary treatment requirement of 30 mg/l would reduce total suspended solids by about half. A reduction in the solids concentration should bring about a concomitant reduction in zinc. Proper

The mean ratio of dissolved to suspended zinc increases from about 1.1 at Station 8 to 1.4 at Station 4, suggesting a possible decline in suspended zinc concentration between the two stations. There is a slight increase in dissolved zinc which could account for the increase in the above ratio. There is also a reduction of total zinc from Stations 3 to 4. The ratio of total zinc in the water column to zinc in the sediments declines by almost 50% between Stations 3 and 4, which suggests that the increases in sediment concentrations may be caused by sedimentation from the water column.

Because the conductivity is constant from the point of discharge to Station 4, it is likely that dissolved solids are not precipitating within this stream segment. For this reason, dissolved zinc is not likely being deposited on the streambed along this segment.

In sum, the high sediment concentrations at Station 4 have been caused probably by sedimentation of inorganic particles in response to a reduced flow velocity at the station. The inorganic particles may have zinc complexes attached by sorption or contain surface coatings of hydrous oxides of iron and manganese to which the zinc is bound. An analysis of sediments for iron and manganese might confirm the existence of the hydrous oxide coatings.

Between Stations 4 and 6, the stream receives flow from the Keysville STP and an unnamed tributary. There is a reduction of 33% in total zinc concentration and 38% in dissolved zinc concentration whereas the concentration of suspended zinc increases slightly. A drop in conductivity occurs between Stations 4 and 6 and there is a 100% increase in the organic content of the sediments.

substances and other organic compounds) that are released as decomposition products within the surrounding forestland and washed into stream in runoff. Trace metals such as zinc can attach to organic compounds and promote coagulation and settling in accordance with the Schulze Hardy rule.

Total zinc concentrations decline by 83% from Stations 6 to 7. Dissolved zinc drops by 28% and suspended zinc by 67%. There is a reduction of total suspended solids of 85% and volatile suspended solids of 88%. Because dilution is minimal from Station 6 to 7, the above data would seem to suggest that sedimentation may be playing a key role in reducing the suspended zinc concentrations.

The fact that conductivity decreases by 62% between Stations 6 and 7 indicates that complexation and precipitation processes may be functioning to remove dissolved solids and complexed zinc.

Although a decline in TOC of 56% and in suspended volatile solids of 58% is noted, at Station 7, there is no dramatic increase in organic carbon in sediments as indicated by mean percent loss on ignition. It seems probable that carbon compounds with complexed zinc may be settling out upstream of Station 7.

The 5.2 to 8.2 km Segment of Ash Camp Creek

Between Stations 7 and 8, inflow from tributaries becomes greater. According to the State Water Control Board (64), below 5 kilometers (Station 7) Ash Camp Creek is typical of any stream with permanent flow. Dilution, therefore, becomes a more important factor in reducing the concentrations of various water quality components. In this segment because of dilution, a 50% decrease in conductivity and total organic

carbon occur, but there is a slight increase in total suspended solids (volatile solids do not change). It is possible that tributaries might be introducing an additional suspended solids load, thereby, increasing the suspended solids concentration of Ash Camp Creek.

The carbon content of the sediments (as indicated by percent loss on ignition) does not differ between Stations 7 and 8. Carbon compounds which are settling out in the sediments are possibly being diluted with low carbon inorganic sedimentary material.

Dilution is likely responsible for the decline in suspended and dissolved zinc concentrations between Stations 7 and 8. At Station 8, most of the zinc is in the dissolved fraction with a lesser amount in the suspended fraction. The ratio of dissolved zinc to total zinc is much greater than the ratio of suspended zinc to total zinc. The above data also suggest that suspended zinc has declined more than dissolved zinc because of sedimentation which affects preferentially the suspended fraction.

The concentration of zinc in the sediments is higher at Station 8, although not significantly different from that at Station 7. It is possible that zinc compounds or complexes may be adsorbing to inorganic stream constituents (clays, silts, etc.) which are carried downstream and deposited in the vicinity of Station 8 during periods of high flow. Ferrous and manganese oxide coatings on inorganic silts, clays, and fine sands may play an important role in scavenging dissolved and complexed zinc from the water column. A black coating, possibly, of hydrous oxides of manganese and iron, on the sediments was noted downstream from Station 8.

VI. CONCLUSIONS

The following conclusions can be derived from the results of this study:

1. The major source of zinc to Ash Camp Creek is the Va. Crafts discharge followed, in order, by the Keysville STP, and urban runoff. The contribution from urban runoff appears only to be important during wet weather when rainfall washes zinc and other pollutants from streets, paved surfaces, and other areas of the watershed into the stream.
2. The measured zinc levels in Ash Camp Creek below the Va. Crafts outfall exceed the toxic level (.01 mg/l) established by the Virginia State Water Control Board for aquatic life in Ash Camp Creek. During wet weather, the toxic level is exceeded at Station 1 upstream of the point of discharge. Levels of zinc in the Keysville sewage treatment plant effluent also exceed the toxic level.
3. There is a definite partitioning pattern of zinc in effluent and stream water samples. Ratios of dissolved to suspended zinc varied from about 0.60 to 1.35. Ratios of dissolved to total zinc and suspended to total zinc varied from about 0.43 to 0.62 and from 0.38 to 0.57, respectively. Changes in the above ratios appear to be related to the sedimentation of suspended zinc onto stream sediments.
4. Direct correlations between suspended zinc and total suspended solids and suspended zinc and volatile suspended solids appear to exist in effluent and stream water samples. The above relationship would suggest that (a) the zinc content of the effluents and the stream may be influenced by the suspended solids concentration, and (b) the amount of suspended organic matter may be an important factor determining the zinc concentration.
5. Of the chemical and physical factors in Ash Camp Creek which affect the distribution and partitioning of zinc, sedimentation, dilution, sulfide precipitation, and adsorption on inorganic sediment particles may play a dominant role. The high sediment concentrations of zinc (over 1,000 mg/kg) 80 m downstream from the

Va. Craft's discharge seem to be the result of sedimentation of suspended zinc in response to decreased flow velocity. Sulfide precipitation is possibly an important mechanism for zinc removal in the sludge bank area below the sewage outfall. Beaver dam impoundments in the segment of Ash Camp Creek between the Keysville STP outfall area and 4.8 km downstream facilitate sedimentation by providing quiescent conditions for the settling of suspended zinc and other suspended pollutants. Downstream of Station 7 (4.9 km below STP outfall) where Ash Camp Creek becomes a permanent type stream, dilution, sedimentation, and adsorption to inorganic sediment particles appear to function in reducing zinc concentrations.

VII. SUMMARY

It was the purpose of this study to determine the distribution and partitioning of zinc in a small stream, Ash Camp Creek, which receives a treated textile wastewater, domestic sewage, and urban runoff. Water samples were collected and analyzed to determine the physical and chemical water quality characteristics and the distribution and partitioning of zinc among dissolved and suspended fractions of the water column. Several core samples were obtained and analyzed to determine zinc concentrations in the sediments.

The results indicate that the major source of zinc is the treated textile waste followed, in order, by sewage discharge, and urban runoff. Water samples analyzed for each of the sources exhibited a pronounced partitioning of zinc among the dissolved and suspended fractions and showed distinct physical and chemical water quality characteristics. Urban runoff was only important as a zinc source during wet weather.

In the upper 0.4 km segment of Ash Camp Creek; water quality is most influenced by the physical and chemical characteristics of the industrial discharge. Partitioning of zinc was evident along this segment and sediment concentrations ranged from 300 to 1000 ppm. In the region downstream of the industrial discharge, hydraulic conditions, e.g., reduced stream velocity, which are dependent on the discharge rate of treated textile wastewater seem to affect the sedimentation of zinc to the streambed.

The discharge from the sewage treatment plant and flow of a small tributary which empties into Ash Camp Creek at the point of discharge from the STP have a moderating effect on the water quality of Ash Camp Creek, functioning to slightly dilute concentrations of pollutants (contributed by treated textile wastewater). Sulfide precipitation may be a major mechanism by which zinc is removed from solution in the sludge area downstream from the sewage discharge. Mobilization of zinc from this region may be facilitated by complexation with organic and inorganic ligands released as decomposition products from sludge bank and by-products of domestic wastewater treatment or as components of sewage effluent.

The stream receives flow from only a few permanent type tributaries in the region from the sewage outfall to 5.2 km downstream. Beaver dams and other obstructions along this segment act to create quiescent settling areas for the deposition of suspended zinc.

In the region from 5.2 to 8.2 km downstream, the stream receives the flow of permanent type tributaries which act to dilute zinc and other pollutant concentrations. Zinc is also likely removed in this region by sorption onto inorganic particles of the sediments. Water quality is greatly improved 8 kilometers below the point of discharge of the treated textile waste.

Correlations between various water quality parameters and either suspended, dissolved, and/or total zinc were demonstrated.

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IX. APPENDIX

Table A 1. Field pH Data for Stream and Effluent Water Samples

Sampling Date	Station Number							
	1	2	3	4	5	6	7	8
6/9/77	8.2	7.0	6.4	6.0	6.5	6.8	6.8	7.5
6/16/77	9.3	6.8	6.8	7.0	7.1	7.2	7.3	7.3
6/22/77	8.8	8.2	7.8	7.2	4.6*	6.5	6.7	7.1
6/28/77	8.7	6.9	7.6	7.3	7.0	7.2	7.7	7.7
6/29/77	8.6	7.3	8.2	7.7	6.7	8.0	7.4	7.7
Average	8.7	7.2	7.4	7.0	6.4	7.1	7.2	7.5

*Measured in lab at Va. Crafts

Table A 2. Field Temperature (Temp) and Dissolved Oxygen (D.O.) Data for Stream and Effluent Water Samples (Temp Values in °C and D.O. Values in mg/l)

Sampling Date	Station Number															
	1		2		3		4		5		6		7		8	
	Temp	D.O.	Temp	D.O.	Temp	D.O.	Temp	D.O.	Temp	D.O.	Temp	D.O.	Temp	D.O.	Temp	D.O.
6/9/77	17	7.0	20	7.2	21	7.5	20	7.0	20	5.1	20	7.3	20	8.0	19	7.6
6/16/77	19	7.2	26	6.6	25	5.2	26	5.4	22	6.2	26	4.6	22	7.0	25	5.5
6/23/77	19	*	26	*	26	*	26	*	21	*	24	*	19	*	20	*
6/28/77	22	5.6	28	6.7	28	6.6	30	6.7	27	6.7	33	5.1	29	7.0	30	3.6
6/29/77	24	3.3	29	8.5	29	8.2	29	4.2	27	4.6	30	3.9	28	7.6	28	7.1
Average	20.2	5.8	25.8	7.2	25.8	6.9	26.2	5.8	23.4	5.7	26.5	5.2	23.6	7.4	24.4	6.0

*D.O. meter not functioning properly

Table A 3. Field Conductivity Data for Stream
and Effluent Water Samples (All Values in $\mu\text{mho/cm}$)

Sampling Date	Station Number							
	1	2	3	4	5	6	7	8
6/9/77	8.04×10^{-3} *	130.00	123.00	126.00	46.3	111.80	36.00	14.20
6/16/77	40.80	120.00	127.00	126.00	48.00	103.00	44.80	28.00
6/23/77	13.60	113.00	106.00	103.00	48.00	96.00	47.70	21.70
6/28/77	46.60	117.00	117.00	124.00	62.00	106.00	26.00	26.00
6/29/77	39.80	123.00	125.00	120.00	51.00	109.00	45.00	23.00
Average	35.20	120.50	119.60	119.80	51.06	105.16	39.90	22.58

*Error in measurement; value not averaged

Table 4 A. Alkalinity Data for Stream and Effluent Water Samples (All Values in mg/l as CaCO₃)

Date	Station Number							
	1	2	3	4	5	6	7	8
6/9/77	18.0	20.0	20.0	17.0	78.0	37.0	40.0	43.0
6/16/77	61.0	22.0	40.0	37.0	46.0	51.0	45.0	40.0
6/23/77	18.0	51.0	51.0	50.0	*	51.0	39.0	42.0
6/28/77	57.0	55.0	54.0	52.0	74.0	51.0	37.0	44.0
6/29/77	65.0	55.0	56.0	55.0	22.0	55.0	42.0	43.0
Average	43.8	40.6	44.2	42.2	55.0	49.0	40.6	42.4

*No Alkalinity present

Table A 5. Calcium (Ca) and Total (TOT) Hardness (EDTA) Data
for Stream and Effluent Water Samples (All Values in mg/l as CaCO₃)

Sampling Date	Station Number															
	1		2		3		4		5		6		7		8	
	Tot	Ca	Tot	Ca	Tot	Ca	Tot	Ca	Tot	Ca	Tot	Ca	Tot	Ca	Tot	Ca
6/9/77	26.0	22.0	80.0	72.0	80.0	70.0	74.0	64.0	66.0	62.0	82.0	68.0	68.0	60.0	44.0	36.0
6/16/77	130.0	128.0	84.0	70.0	82.0	68.0	76.0	74.0	42.0	34.0	72.0	64.0	60.0	58.0	60.0	50.0
6/23/77	40.0	38.0	74.0	70.0	72.0	70.0	74.0	72.0	64.0	*	76.0	66.0	74.0	70.0	60.0	58.0
6/28/77	148.0	144.0	90.0	84.0	94.0	84.0	80.0	78.0	70.0	64.0	72.0	66.0	58.0	48.0	50.0	46.0
6/29/77	120.0	114.0	78.0	76.0	80.0	72.0	76.0	72.0	64.0	62.0	76.0	70.0	64.0	58.0	52.0	42.0
Average	92.8	89.2	81.2	74.4	81.6	72.8	76.0	72.0	61.2	55.5	75.6	68.8	68.4	58.8	53.2	46.4

*Interference

Table A 6. Total Suspended Solids (TSS) Data
for Stream and Effluent Water Samples (All Values in mg/l)

Sampling Date	Station Number							
	1	2	3	4	5	6	7	8
6/9/77 (1)	55.0	14.6	36.7	30.0	45.2	24.0	1.5	4.0
(2)	35.0	31.0	53.3	30.0	60.0	20.0	---	3.0
6/16/77 (1)	10.0	71.6	52.0	76.0	33.0	20.0	9.0	16.0
(2)	10.0	65.0	48.0	50.0	10.0	44.0	---	17.3
6/23/77 (1)	45.3	----	70.0	62.0	84.3	70.0	8.0	7.6
(2)	40.0	76.0	74.0	56.0	82.0	78.0	8.8	11.6
6/28/77 (1)	10.8	66.7	14.5	56.0	100.0	68.0	14.0	21.5
(2)	10.4	70.0	78.2	32.0	100.0	34.0	3.2	15.5
6/29/77 (1)	8.4	66.0	44.0	20.0	----	86.0	5.5	13.3
(2)	6.8	86.0	46.0	46.0	----	12.0	3.5	28.7
Average	23.2	60.8	51.7	45.8	64.3	45.6	6.7	13.9

Table A 7. Volatile Suspended Solids (VSS) Data for
Stream and Effluent Water Samples (All Values in mg/l)

Sampling Date	Station Number							
	1	2	3	4	5	6	7	8
6/9/77 (1)	14.0	13.3	28.3	21.6	41.9	22.0	--	2.5
(2)	4.0	28.0	28.3	12.9	46.0	-----	--	2.0
6/16/77 (1)	6.8	51.7	52.0	52.0	31.0	10.0	--	6.7
(2)	--	53.3	36.0	36.0	10.0	34.0	5.5	8.7
6/23/77 (1)	20.6	--	52.0	48.0	74.2	42.0	4.8	1.2
(2)	18.7	60.0	52.0	40.0	70.0	60.0	5.0	4.8
6/28/77 (1)	1.6	--	23.5	22.0	40.0	42.0	2.0	2.5
(2)	2.0	26.0	41.8	--	52.0	14.0	--	2.5
6/29/77 (1)	1.2	36.0	4.0	--	--	24.0	1.5	1.3
(2)	0.4	18.0	12.0	24.0	1.3	--	--	11.3
Average	7.7	35.8	33.0	32.0	40.7	31.0	3.8	4.4

Table A 8. Total Organic Carbon (TOC) Data for Stream and Effluent Water Samples (All Values in mg/l)

Sampling Date	Station Number							
	1	2	3	4	5	6	7	8
6/9/77	18.3	73.0	63.5	68.4	84.0	100.3	65.0	37.0
6/16/77	26.0	80.2	76.0	76.4	50.6	65.8	23.1	11.0
6/23/77	27.4	79.4	69.1	69.7	72.6	92.3	23.0	10.8
6/28/77	8.4	102.5	85.0	75.4	24.4	67.0	18.6	7.1
6/29/77	7.8	83.7	82.6	85.4	71.8	79.4	46.7	56.9*
Average	17.6	83.8	75.2	75.1	60.7	81.0	35.3	16.5

*Error in analysis; not averaged

Table A 9. Total Zinc (Zn) Data for Stream and Effluent Water Samples (All Values in mg/l)

	Station Number							
	1	2	3	4	5	6	7	8
6/9/77 (1)	5.00	2.00	4.60	8.00*	5.90	6.00	0.60	1.50
(2)	4.60	5.30	6.80	5.40	3.80	16.40	1.70	0.90
(3)	≤ 0.01	3.10	2.90	3.60	0.60	2.50	0.40	≤ 0.01
6/16/77 (1)	≤ 0.01	2.10	1.70	3.60	1.90	1.90	≤ 0.01	≤ 0.01
(2)	≤ 0.01	2.00	2.00	1.30	4.60*	1.30	≤ 0.01	≤ 0.01
(3)	≤ 0.01	2.10	1.70	1.40	1.10	1.40	≤ 0.01	≤ 0.80
6/23/77 (1)	0.50	1.90	2.30	0.80	0.060	1.50	≤ 0.01	≤ 0.01
(2)	2.40	2.40	1.90	1.20	≤ 0.01	0.90	≤ 0.01	≤ 0.01
(3)	3.90	1.60	1.10	1.60	≤ 0.01	1.80	≤ 0.01	≤ 0.01
6/28/77 (1)	≤ 0.01	1.80	0.90	1.10	0.80	0.40	0.10	0.45
(2)	≤ 0.01	1.60	1.20	0.90	0.80	0.90	≤ 0.01	0.85
(3)	≤ 0.01	2.60	0.90	2.50	≤ 0.01	0.30	≤ 0.01	≤ 0.01
6/29/77 (1)	≤ 0.01	1.40	0.90	1.30	0.20	0.70	≤ 0.01	≤ 0.01
(2)	≤ 0.01	1.40	1.30	0.40	≤ 0.01	0.60	≤ 0.01	≤ 0.01
(3)	≤ 0.01	0.72	1.60	2.50	≤ 0.30	0.60	≤ 0.01	≤ 0.01
Average	≤ 1.10	1.91	1.79	1.71	≤ 0.53	1.14	≤ 0.19	≤ 0.31

*Apparently contaminated; value not averaged

Table A 11. Suspended Zinc (Zn) Data for
Stream and Effluent Water Samples (All Values in mg/l)

Sampling Date	Station Number							
	1	2	3	4	5	6	7	8
6/9/77 (1) (2)	0.60	0.82	0.75	0.49	0.55	1.00	0.21	0.12
	0.98	0.46	0.79	0.71	0.55	0.71	0.11	0.19
6/16/77 (1) (2)	0.05	0.90	2.10	2.10	0.50	1.00	0.90	2.50*
	0.40	2.80*	1.40	1.30	4.00*	1.90	0.10	≤ 0.01
6/23/77 (1) (2)	0.32	0.70	≤ 0.01	0.60	0.24	≤ 0.01	0.06	0.12
	0.52	1.30	0.50	0.60	0.16	1.10	0.06	0.08
6/23/77 (1) (2)	0.30	0.90	1.20	1.60	0.20	2.30	0.80	1.65*
	0.62	1.30	1.40	1.40	0.80	1.50	0.70	0.60
6/29/77 (1) (2)	0.70	1.10	≤ 0.01	≤ 0.70	0.05	0.40	0.20	≤ 0.01
	0.01	1.70	0.20	≤ 0.01	0.35	0.60	1.50	0.80
Average	0.45	1.02	≤ 0.84	≤ 0.95	0.38	≤ 1.05	0.35	≤ 0.24

*Apparently contaminated; value not averaged

Table A 12. Data for Zinc in the Upper 5 cm
of Stream Sediments (All Values in mg/kg)

Sampling Date	Station Number					
	1	3	4	6	7	8
6/9/77 (1) (2)	604.94 296.49	345.62 315.71	943.92 910.17	514.73 766.07	27.71 15.73	70.87 23.71
6/16/77 (1) (2)	325.10 292.59	542.13 496.50	709.01 701.55	692.52 490.86	23.52 43.39	27.76 27.96
6/23/77 (1) (2)	282.03 222.20	647.82 661.30	1045.08 991.63	660.85 740.81	39.57 27.77	102.63 51.82
6/29/77 (1) (2)	207.63 226.56	725.95 661.72	1504.47 1494.06	476.68 674.71	31.83 35.71	43.75 43.75
Average	307.19	549.59	1037.49	627.15	30.65	49.03

Table A 13. Data For Percent (%) Loss on Ignition for Stream Sediments (All Values in %)

Sampling Date	Station Number					
	1	3	4	6	7	8
6/9/77	4.38	4.42	3.39	9.58	1.93	1.77
6/16/77	5.13	4.20	4.00	7.35	1.02	1.65
6/23/77	4.50	3.68	3.36	9.28	2.03	2.48
6/29/77	4.30	3.89	4.12	5.77	1.82	2.58
Average	4.58	4.05	3.72	8.00	1.70	2.12

VITA

Jonathan C. Hay was born in Pasadena, California on January 27, 1951. He attended elementary school in Whittier, California, before moving with his parents to Richmond, Virginia in 1960. After attending elementary school for three years in Richmond, he returned with his family to California for completion of his elementary education. In 1964, he and his family returned to Richmond where they have since resided. Jonathan was graduated from John Randolph Tucker High School in May 1969. He attended Virginia Tech for a year before transferring to the University of Richmond. He graduated Magna Cum Laude receiving a Bachelor of Science Degree in Biology. Jonathan was elected to Phi Beta Kappa, Beta Beta Biological Honor Society, Gamma Sigma Epsilon Chemical Honor Society. During 1973 to 1976 he worked as a Pollution Control Specialist for the Bureau of Enforcement, State Water Control Board and attended graduate school part-time at Virginia Commonwealth University. From 1976-1977, he attended VPI & SU under an E.P.A. Traineeship Grant, where he completed the requirements for a Master of Science Degree in Environmental Sciences and Engineering. Jonathan plans to work for the County of Los Angeles Sanitation Districts.

Jonathan's father is a Welding Engineer, now retired from Reynolds Metals Company, and his mother is a homemaker. He has three sisters and one brother.

Jonathan C. Hay

ZINC DISTRIBUTION IN A SMALL STREAM
RECEIVING TREATED TEXTILE WASTEWATER

by

Jonathan C. Hay

(Abstract)

Effluent samples for a treated textile wastewater and treated domestic sewage wastewater and water and sediment samples for an 8.2 km region of Ash Camp Creek near Keysville, Virginia, were collected in June, 1977. Effluent and stream water samples were analyzed for various water quality parameters and for suspended, dissolved, and total zinc. Sediment samples were analyzed for zinc and percent loss on ignition. The treated textile wastewater was the major source of zinc to the stream. The effluent and stream water samples exhibited a marked partitioning of zinc among the dissolved and suspended fractions of the water column. The ratios of mean dissolved to mean suspended zinc ranged from about 0.76 to about 1.40. The ratios of mean dissolved to total zinc and mean suspended to total zinc ranged from about 0.42 to 0.62 and from about 0.38 to 0.57, respectively. Anomalously high zinc concentrations were found in the sediments 0.80 m downstream from the point of discharge of the treated textile wastewater and appeared to be caused by sedimentation of suspended zinc induced by a reduction in stream velocity. The domestic discharge together with flow from a small unnamed tributary had a moderating effect on the water quality of the stream functioning to dilute stream pollutant load. Sulfide

precipitation appeared to be an important mechanism by which zinc was concentrated in the sediments 40 m below the domestic sewage discharge. Zinc concentrations declined further downstream likely as a result of such factors as dilution, sedimentation, and sorption by inorganic sediment particles.