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Responsible NRC Individual and NRC Office or Division: Phillip R. Reed. Environmental Effects Research Branch, Division of Safeguards, Fuel Cycle and Environmental Research, Office of Nuclear Regulatory Research

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Prepared for
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

NRC FIN No. B0275

QUARTERLY REPORT
APRIL-JUNE 1980

SEDIMENT AND RADIONUCLIDE TRANSPORT IN RIVERS FIELD SAMPLING PROGRAM CATTARAUGUS AND BUTTERMILK CREEKS, NEW YORK

FIN Number B2275

Prepared for
the U.S. Nuclear Regulatory Commission

Pacific Northwest Laboratory
Richland, Washington 99352

WORK PERFORMED

The radiological analyses of water and sediment samples for Phase 2 was completed by the University of Washington. The radiological work on Phase 3 samples continued. A two-man field trip was necessary during this quarter to supplement the hydrologic data for the unstady flow modeling task.

PHASE 2 DATA COLLECTION PROGRAM

Radiological Analysis

The laboratory analysis of Phase 2 water and sediment samples was completed during this quarter. Table 1 is a summary of the concentrations of ^{241}Am, ^{244}Cm, $^{239,240}Pu$, ^{238}Pu, and ^{90}Sr in the stream bed sediments at five of the sampling points for Phase 2. Four of the locations are in the immediate vicinity of the NFS facilities in Erdman's Brook and Frank's Creek. Franks Creek is a tributary to Buttermilk Creek as shown in Figure 1 and drains the watershed area that surrounds the NFS facilities. Erdman's Brook is a small tributary of Franks Creek and is adjacent to the facilities. The concentrations for ^{90}Sr were the highest for any of the radionuclides. The maximum concentration of ^{90}Sr (11.07 pCi/g) was found in the clay fractions of ore of the samples from Erdman's Brook. The maximum concentration of ^{241}Am (0.245 pCi/g) was ^{244}Cm (0.077 pCi/g) are found in the sand fractions of the sample collected at the confluence of Erdman's Brook and Frank's Creek. These readings are considerably higher than those found in the Erdman's Brook samples collected upstream of this point. The maximum concentrations of $^{239,240}Pu$ (0.785 pCi/g) and ^{238}Pu (0.710 pCi/g) are found in the sand fractions of the FC-1 sample. This sampling point is the farthest downstream on the Franks Creek drainage system. In summary, the sand fractions of the Erdman's Brook-Frank's Creek system appear to contain the highest concentrations of ^{241}Am, ^{244}Cm, $^{239,240}Pu$, and ^{238}Pu while the clay fractions contains the highest concentrations of ^{90}Sr. The accumulation of the higher concentrations of the Americium, Curium, and Plutonium isotopes may be due to the accumulation of sand fractions at the

TABLE 1. Concentration of Radionuclides in the Phase 2 River Bed Material Samples in pCi/g of Dry Sediment

Location	Sediment Type	Sample Wt. (g)	^{241}Am	^{244}Cm	$^{239,240}Pu$	^{238}Pu	^{90}Sr
Erdman's Brook	sand	39.07	0.028 (0.006)	*	0.008 (0.002)	0.011 (0.002)	1.56 (0.120)
	silt	37.3	0.031 (0.009)	*	0.004 (0.001)	0.0045 (0.0003)	0.753 (0.074)
	clay	25.0	0.016 (0.014)	0.023 (0.007)	0.027 (0.015)	*	0.081 (0.038)
Erdman's Brook	sand	67.5	0.025 (0.004)	*	0.017 (0.002)	0.018 (0.002)	2.57 (0.170)
	silt	50.0	0.029 (0.007)	0.010 (0.003)	0.018 (0.002)	0.021 (0.002)	3.42 (0.210)
	clay	25.0	0.072 (0.009)	0.011 (0.006)	0.048 (0.005)	0.057 (0.006)	11.07 (0.650)
Frank's Creek @ Erdman's Brook	sand	50.0	0.245 (0.091)	0.077 (0.042)	0.158 (0.026)	*	0.330 (0.049)
	silt	50.0	*	0.010 (0.006)	0.0026 (0.0005)	0.0008 (0.0001)	0.389 (0.041)
	clay	7.5	0.101 (0.016)	0.0084 (0.0068)	0.016 (0.003)	0.007 (0.002)	2.040 (0.510)
FC-1	sand	50.0	0.118 (0.021)	*	0.785 (0.113)	0.710 (0.105)	*
	silt	22.4	0.017 (0.009)	0.012 (0.005)	0.0038 (0.0007)	0.0034 (0.0001)	0.579 (0.085)
	clay	12.2	lost	lost	0.010 (0.003)	0.023 (0.004)	lost
Lake Erie							
Sta. 1	**	25.0	0.019 (0.005)	0.039 (0.008)	0.0067 (0.0016)	0.0018 (0.0005)	0.220 (0.130)
Sta. 2	**	64.1	0.001 (0.003)	0.0062 (0.0017)	0.0047 (0.0018)	0.0030 (0.0013)	0.573 (0.047)
Sta. 3	**	50.0	*	0.017 (0.004)	0.0050 (0.0005)	0.0004 (0.0001)	*

* Indicates a radionuclide below detection
** Composite sample of sand, silt, and clay
( ) Standard deviation

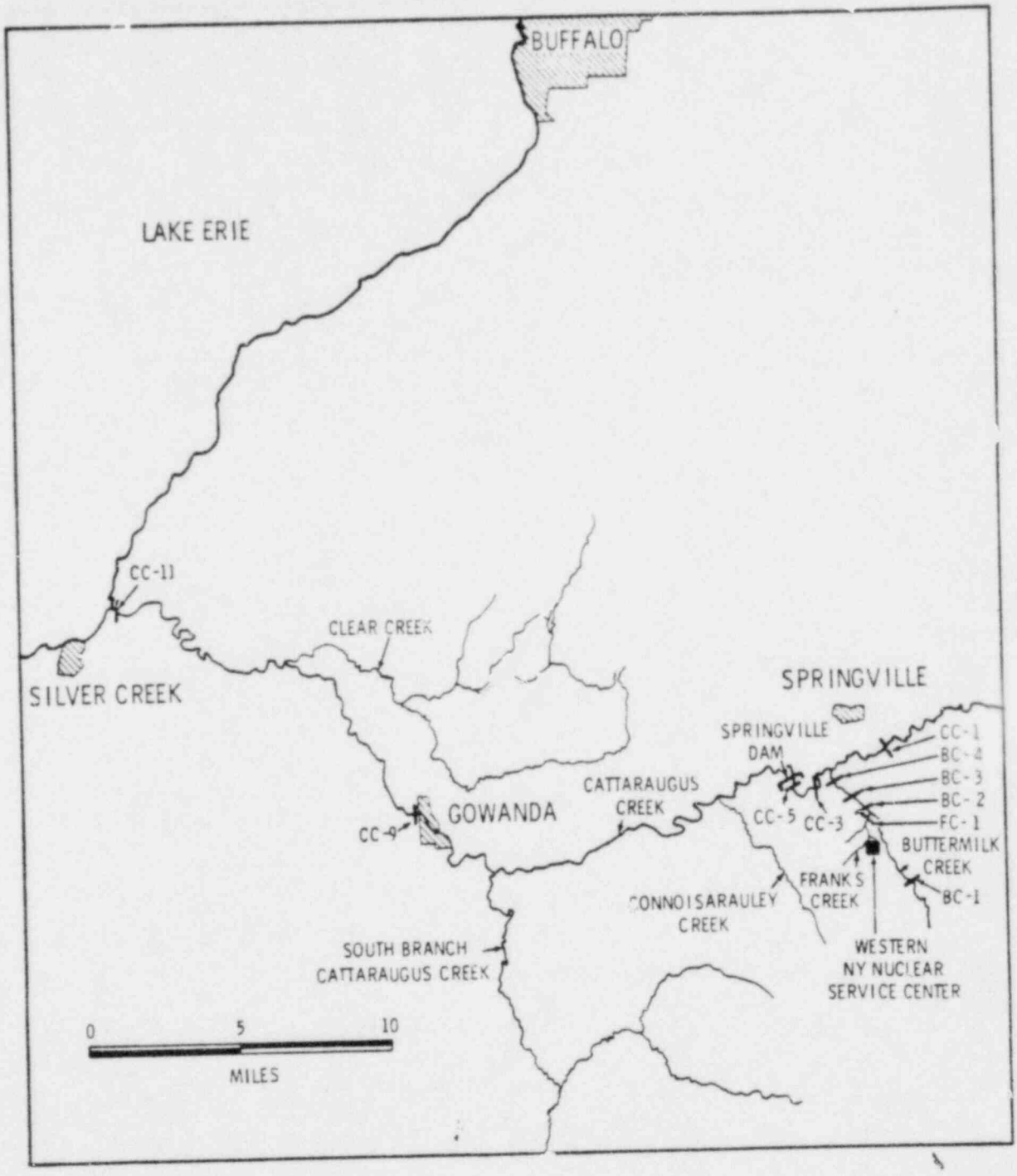

FIGURE 1. Franks-Buttermilk-Cattaraugus Creek System and Sampling Locations

lower extremeties of Franks Creek when they tend to form an alluvial fan. Comparison with the data from Phase 3 may provide some confirmation of this preliminary result.

The Lake Erie samples were not separated into the sand, silt, and clay fractions but were analyzed as a composite sample. The highest concentrations recorded involved the isotope ^{90}Sr as in the other samples from Erdmans Brook and Franks Creek. The Plutonium isotopes recorded the lowest concentration with ^{241}Am and ^{244}Cm at intermediate levels in between.

Table 2 shows the levels of Tritium for the Buttermilk and Cattaragus Creek system. The background level of activity corresponds very closely to the levels at BC-1 and CC-1 which are the upstream boundarys of the study reaches. These two sampling points are not affected by surface water inflow from the NFS facilities and would be expected to approximate background level. The maximum value recorded (3413.93 pCi/l) was at Franks Creek (FC-1). Other significantly high concentrations were found in Buttermilk Creek at BC-4 (830.01 pCi/l) and at one location in Cattaragus Creek at CC-3 Station 3 (1055.85). The remaining nine sampling points contained near uniform levels which ranged from 261.58 to 388.94 pCi/l. The high concentration of FC-1 indicates a source of Trituim from the NFS facilities and the high concentration at BC-4 about 2 miles downstream in Buttermilk Creek would be expected. However, the high concentration at CC-3 Station 3 cannot be explained at this time. Comparison with Phase 3 data may give some indication whether this is a definite trend or not.

TABLE 2. Concentration of Tritium in Phase 2 Water Samples. Cattaraugus and Buttermilk Creeks, New York.

Location	Volume	Activity Tritium Unit	Activity pCi/liter(a)
BC-1	1000 ml	65.004 ± 10.385	209.18 ± 33.42
BC-4	1000 ml	257.927 ± 13.280	830.01 ± 42.73
CC-1	1000 ml	52.436 ± 10.789	168.74 ± 34.72
CC-3 Sta 1-Top	1000 ml	100.360 ± 10.854	322.96 ± 34.93
CC-3 Sta 1-Bot	1000 ml	120.865 ± 11.758	388.94 ± 37.84
CC-3 Sta 2	1000 ml	119.162 ± 11.116	383.46 ± 35.77
CC-3 Sta 3	1000 ml	328.107 ± 16.149	1055.85 ± 51.95
CC-5 Sta 1	1000 ml	81.286 ± 11.184	261.58 ± 35.99
CC-5 Sta 2-Top	1000 ml	94.161 ± 11.367	303.01 ± 36.58
CC-5 Sta 2-Top-M	1000 ml	83.432 ± 11.214	268.48 ± 36.09
CC-5 Sta 2-Bot	1000 ml	113.474 ± 11.648	365.16 ± 37.48
CC-5 Sta 3	1000 ml	113.474 ± 11.648	365.16 ± 37.48
CC-11	1000 ml	92.492 ± 11.343	297.64 ± 36.50
FC-1	1000 ml	1060.886 ± 28.894	3413.93 ± 92.98
Background	1000 ml	64.408 ± 9.693	207.26 ± 31.19

(a) t1/2 - 12/35 years and 1 T.U. = 3.218 pCi/liter.

PHASE 3 DATA COLLECTION PROGRAM

The radiological analysis of Phase 3 water and sediment is underway at the University of Washington and is expected to be completed by the end of Setember 1980.

HYDROLOGIC DATA COLLECTION

Channel Profile and Cross-Sections

The lack of adequate channel profile and cross-section data for Buttermilk and Cattaraugus Creeks required a two-man surveying field trip from May 4-14, 1980 to supplement existing data on the creek system. Because of the low flow conditions during the Phase 3 sampling period a more detailed set of cross-sections on Buttermilk Creek is required for unsteady flow modeling. More detail was needed for the channel and water surface slope from the mouth of Frank's Creek to Frye Bridge over Cattaraugus Creek for the same reason. A total of 15 cross-sections were surveyed on Buttermilk Creek plus 2 more on Cattaraugus Creek. The water surface and channel profiles were determined by profile leveling at intervals of about 500 ft and tied into all cross-sections.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SEP 18 1980

MEMORANDUM FOR: Distribution

FROM: Phillip R. Reed
Environmental Effects Research Branch
Division of Safeguards, Fuel Cycle and
Environmental Research

SUBJECT: PROGRESS REPORTS: PNL STUDY TO VALIDATE SEDIMENT/ RADIONUCLIDE TRANSPORT MODEL FOR RIVERS

Enclosed for your information are copies of the quarterly progress reports covering research activities from April 1 through June 30, 1980 for the following PNL programs:

1. "Sediment and Radionuclide Transport in Rivers, Field Sampling Program, Cattaraugus and Buttermilk Creeks, New York" (B2275)

2. "Sediment and Radionuclide Transport in Rivers, Transport Modeling" (B2294)

I am also enclosing for your review and comment a statement concerning the liquid pathway/sediment and radionuclide transport research program which appeared in Section 5.5, page 32, of the recently issued ACRS report (NUREG/CR-0699) on the RES FY82 budget.

Your comments are encouraged on the scope, technical merit, and direction of this research effort.

Phil R. Reed

Phillip R. Reed
Environmental Effects Research Branch
Division of Safeguards, Fuel Cycle and
Environmental Research

Enclosures:
1. Progress Reports
2. Statement of Budget from NUREG/CR-0699

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NUREG-0699

Comments on the NRC Safety Research Program Budget for Fiscal Year 1982

Manuscript Completed: July 1980
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Advisory Committee on Reactor Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

by municipal water purification facility personnel for removing radionuclides from surface and ground waters that have been contaminated by reactor effluents. The overall funding level requested for this subelement is considered satisfactory.

5.4 Airborne Effluents - Environmental Impacts (Item 5.c)

Projects reviewed within this subelement included those on "Radioiodine Pathway Analysis," "Early Effects of Inhaled Radionuclides," and "Acute Morbidity and Mortality from Nuclear Accidents." Although the first of these is considered important, we note that it is very similar to a Technical Assistance Project being conducted by the Radiological Assessment Branch. For this reason, we recommend that the two projects be combined. There is no need to do this work twice. Although we believe the last two projects would yield data useful for making better estimates of the health effects of accidental releases from nuclear power plants, we recommend that this work be carefully correlated with similar work underway within other Federal agencies. Such an evaluation may lead to changes that will make this research more productive.

Although we have in past years called for reduced efforts on improving models for the environmental transport and behavior of radionuclides under conditions of routine plant operations, the recent challenges to U.S. population dose estimates by scientists in Japan and the FRG show the need for a continuing effort in this subject area. We support the requested $2.3 million funding level for FY 1982.

5.5 Aquatic Effluents - Environmental Impacts (Item 5.d)

Although, in general, we endorse the NRC research on the liquid pathway, there is a need for a shift in its emphasis. To be specific, we recommend that this work be modified to place less emphasis on sediments and more on the sediment-biota interface and associated implications in terms of the resulting population dose. In addition, the work should be directed to the assessment of the behavior of specific radionuclides rather than to radioactive materials, in general. The specific nuclides selected should be those of primary public health interest. We endorse the requested FY 1982 funding level of $1.8 million.

5.6 Occupational Exposures and Health Effects (Item 5.e)

Projects covered in this subelement include those pertaining to Neutron Dosimetry and Effects, the Behavior and Health Effects of Ingested and Inhaled Radionuclides, and Epidemiological Studies of Exposed Populations. We endorse the projects on Improved Neutron Dosimetry and Effects Evaluation, and on "Decorporation Techniques for Radionuclides." However, we believe that the project relating to "Health Effects Assessment" is in need of better definition. Similarly, we believe that the project entitled, "Dosimetric Model - ALARA," should be more clearly defined,