Tritium Concentration in the F- and H-Area Seeplines and Fourmile Branch at SRS: September 1997 Event and 1989-1997 Summary

by

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October 1, 1998

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Prepared by:
J. W. Koch II

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Tritium Concentrations in the F- and H-Area Seepines and Fourmile Branch at SRS: September 1997 and March 1989-September 1997 Trending

J.W. Koch II

Abstract

The Environmental Analysis Section (EAS) of the Savannah River Technology Center (SRTC) conducted a quarterly monitoring program of the Fourmile Branch (FMB) stream and its associated seepine located down gradient from the F- and H-Area Seepage Basins from May 1992 to May 1995. The quarterly tritium survey was changed to a semi-annual schedule in 1996. This report presents the results of the second semi-annual event in 1997 and summarizes the tritium data beginning with the 1989 and 1992 baseline sampling events. The primary focus of this program is to measure and track changes in tritium concentrations. Specific electrical conductivity and pH were also measured. The results from this survey (September 1997) exhibited similar trends to data from the previous surveys. The results of this tritium survey and stream monitoring data (Looney et al., 1993) indicated that the tritium plume from the past operation of the seepage basins continues to flush from the seepines and wetlands to Fourmile Branch. The overall summary indicates that the tritium plumes are surfacing in somewhat localized areas along the F-Area and 643-E seepines. The tritium plume is surfacing more generally throughout the H-Area seepine and not in localized areas.

Executive Summary

In September 1997 the Environmental Analysis Section (EAS) surveyed the Fourmile Branch seepine down gradient from the F- and H-Area Seepage Basins for tritium, specific conductivity, and pH. This survey was the second of two surveys scheduled during FY97 to monitor the movement of contaminants from the basins since closure in 1990. Surface-water samples were collected at 39 of 63 planned locations along the seepines and from three stream locations along Fourmile Branch. The seepine locations included 18 from the F-Area seepine, 11 from the H-Area seepine, and 7 from the seepine south of 643-E, which is a decommissioned area in the Solid Waste Disposal Facility. Twenty-four of the planned sample locations were dry (eleven along the H-Area seepine, four along the F-Area seepine, and nine from the seepine south of 643-E). It was very unusual to have this many dry sites attributed to dry weather. This was five times the previously highest number of dry sites encountered.

Forty-four of the locations were sampled in 1989 by the Savannah River Technology Center as part of an extensive characterization study (Haselow et al. 1990). Tritium activities in the H-Area seepine in September 1997 were significantly lower than the activities measured by Haselow et al. (1990). The F-Area seepine tritium activities were not significantly lower statistically than measured by Haselow. There were seven locations from the September 1997 survey that showed an increase in tritium activity over 10% above the March 1989 results. The September 1997 conductivity measurements exhibited the same trends as tritium activities in both F- and H-Area seepines.

The average H-Area seepine water pH was approximately the same as the last three surveys that were conducted (September 1996, March 1997, and March 1996). The average F-Area seepine water pH has shown a gradual increase during these same periods (0.5 pH units). The results continue to indicate that conditions have somewhat stabilized

from extremely acid ($\text{pH} < 4.5$) to slightly acid (combined F and H seepage average of 5.6) which is closer to normal for this type of wetland. The EPA region IV chronic screening values for pH are 6.5-9.0 (ecological) and 5.0-9.0 for human health.

The seepage south of 643-E, along a tributary of Fourmile Branch, is influenced by tritium migrating from the Burial Ground Complex. The tributary (old F-Area effluent ditch) is a natural drainage that received effluent discharge from F-Area Separations prior to the construction of the engineered effluent canal. The September 1997 tritium concentrations on the east side of the natural drainage ranged from 3 to 1960 pCi/ml and on the west side from 3100 to 21,100 pCi/ml. The tritium activity measured in the stream of the natural drainage was 21,300 pCi/ml. These results continue to suggest that the tritium outcrop area has been delineated by the sampling locations established on the west side of the drainage channel. Conductivity and pH measurements taken on both sides of the drainage were similar to those recorded in March 1997, and were within the range of normal values for this wetland. The maximum tritium concentrations have declined from 59,400 pCi/ml at sample location FHB018 to a maximum of 21,300 pCi/ml at sample location FHB012 which is the stream sample location that separates the east and west sides of the ditch. Several of the dry sample locations during the September 1997 event were those that typically have low tritium concentrations. For this reason, the ranges of tritium concentrations for the east and west side drainage are biased when compared to previous event results.

Introduction

Seepage basins in the F and H Areas of SRS received low-level radioactive waste effluent from the chemical separation processes in the General Separation Area, (GSA). The basins retained the effluent and allowed it to be slowly released into the soil. The waste effluent consisted principally of sodium hydroxide, nitric acid, low concentrations of various radionuclides, and some metals (Killian et al., 1985a and 1985b). Discharges of tritiated water

to the seepage basins accounted for a majority of the radioactivity (Fenimore and Horton, 1972).

The Savannah River Technology Center conducted an extensive study designed to characterize the shallow groundwater outcropping into Fourmile Branch (FMB) and its associated seepage in 1988 and 1989 (Haselow et al., 1990). As a part of this study, Haselow et al. (1990) analyzed for tritium, and measured pH, and conductivity. Researchers found low pH and elevated conductivity and tritium values along the seepings and concluded that contaminants leaching from the F- and H-Area Seepage Basins were impacting the wetlands below the basins. SRS discontinued discharges to the seepage basins in 1988 and sealed the basins in 1990 to isolate the contaminants from direct rainfall. Scientists hypothesized that after the elimination of the contaminant source; natural groundwater flow from annual rainfall would flush the remaining contaminant plume out of the shallow groundwater over time. After the contaminant plume in the shallow groundwater is flushed out, the impacted wetland systems immediately down gradient from the basins should recover.

To investigate this hypothesis, a quarterly sampling program was begun in May 1992 and concluded in May 1995. EAS sampled 44 of the seepage locations sampled by Haselow et al. (1990) for tritium, pH, and specific conductivity. The 1997 sampling program was developed to complement sampling of the seepage for selected Appendix IX constituents, Dixon et al. (1995). The Appendix IX program began in July 1992 as a semi-annual program and since 1996 has been conducted annually. The Haselow et al. (1990) results established the baseline against which the results from the quarterly tritium sampling program are compared. These collection points were chosen as the baseline because they are the only data available that were collected before the basin discharges were discontinued. The Haselow et al. (1990) data should be representative of conditions immediately prior to closing the basins.

Later, concern was expressed about the source of tritium and other contaminants that possibly

emanate from an area in the southwest corner of 643-E rather than from the closed basins. To investigate this possibility, numerous sampling locations on the H-Area seepine south of 643-E were established and were incorporated into the quarterly sampling plans beginning in March 1993.

The objectives of this report are to present the results from the September 1997 sampling event and to trend the results beginning with the baseline sampling events (1989 and 1992) through the September 1997 sampling event.

Methods

EAS conducted the second of two FY97 sampling events for tritium in September 1997. Sampling locations were the same as those selected in the quarterly tritium surveys. These locations, according to 1989 data, exhibited high and low values for the three variables of concern (tritium, conductivity, and pH). Attempts were made to establish even ground coverage along both seepines. EAS collected 39 samples from the seepines in F and H Area, 18 from the F-Area seepine, 11 from the H-Area seepine, and 7 from the FHB seepine south of 643-E Area. Twenty-two of the seepine locations were dry. One sample was collected from the old effluent stream. EAS also collected three stream samples from locations on Fourmile Branch. Figures 1 and 2 approximate these sampling locations.

Prior to sampling for the first quarterly survey in May 1992, the Health Protection Department (HPD) collected soil samples from several locations along both seepines and monitored them for gamma radioactivity. HPD did not detect gamma radiation above concentrations of concern. Therefore, EAS selected rubber boots and disposable rubber gloves as protective clothing to prevent skin contact with seepine water during sampling operations.

Seepine sampling locations had been previously marked and labeled with PVC stakes. Samples were collected within a ten-foot radius of the PVC stake by boring a hole into the soil with a small soil auger, generally six inches and not more than eighteen inches deep. To collect water for tritium analysis, 25

milliliter polyethylene sample containers were filled and then capped. The outside of each container was then rinsed with deionized water and sealed in a small polyethylene bag to minimize the possibility of cross contamination. The small bags were then placed in a large polyethylene bag and sealed. General Engineering Laboratories (GEL) performed the tritium analysis for the standard and duplicate samples and the Environmental Monitoring Section (EMS) performed the analysis on split samples and samples with activities exceeding 2000 pCi/ml total counts. Chain of custody procedures were followed during the collection of all samples.

EAS measured specific conductivity and pH *in situ* with conductivity and pH electrodes (WSRC Procedure Manual L14.1, 1992a and 1992b). The electrodes were rinsed with deionized water after each sampling. All sampling equipment was thoroughly rinsed with deionized water at the end of each day.

Results and Observations

Parameters measured at seepine sampling locations fluctuate throughout the year. Seepine measurements were taken on water collected from fixed locations at the initial point of outcropping, or toe, of the contaminant plume in the streamside wetland. Since the plume is dynamic (i.e. influenced by weather and other activities in the area) seepine monitoring is sensitive to both long term changes and seasonal/transient influences. Climatic and seasonal conditions, especially amounts of rainfall, influence measured concentrations. Groundwater flow paths in F and H Area are complex, as illustrated in Figures 3 and 4. Recharge to the groundwater is primarily due to infiltration of rainwater (rainfall minus runoff and evapotranspiration). Groundwater then moves laterally, down and towards Fourmile Branch and its tributaries.

As the water travels toward the Fourmile Branch, additional infiltration forces up-gradient water deeper. Near Fourmile Branch, the flow lines rise to the surface, emerging between the seepine and the stream (this acts as the groundwater "drain"). This

typical vertical trajectory, a path curving downward near the groundwater divide and then upward into draining surface water, is shown as flow lines on Figures 3 and 4.

Figure 3 shows the flow lines without contaminated water from the seepage basins and Figure 4 shows the addition of contaminated flow lines resulting from F and H Area operation of the basins. The theoretical plume geometry was confirmed by the real vertical profile of the F-Area Seepage Basin plume based on the detailed grid wells available in the 1970s (Looney et al., 1993). Changes in the water balance in the area influence the flow velocity and tend to move the plume either deeper or shallower and cause the location of the contaminated water to move. This is particularly important to data interpretation if the "toe" of the plume is shifting relative to the fixed sample locations. Figure 5 summarizes the projected changes in the plume based on a range of transitory activities. Increased rainfall (or other activities that increase infiltration such as harvesting trees) results in increased plume velocity and movement downward and away from the seepline. This decreases contaminant concentrations at the seepline sampling locations. Less infiltration decreases plume velocity and causes the plume to move upward and outcrop closer to the basins. This results in increased contaminant concentrations, as measured at the seepline sampling locations.

Low rainfall for a few months prior to sampling is expected to increase constituent concentrations, and high rainfall decreases constituent concentrations in the shallow groundwater at the seepline intercept. Rainfall measured at the SRS weather station in F Area for March 1997 through August 1997 was 62.8 cm. The average long-term rainfall for this same period was 70.2 cm. Thus, rainfall in the sampling area was about much less than normal for the few months prior to this sampling event. Figure 6 compares 1997 rainfall to the long-term average (1961 to 1994). It is hypothesized that below average rainfall observed in the area for this period would cause contaminant concentrations to increase at sample locations closer to the basins and to decrease at the more distant locations. Note that the

direction of plume flow always remains the same, only the flow velocity and outcrop location changes relative to the changes in infiltration.

Tritium concentrations at nine sample locations were above the March 1989 readings, with these sample locations showing an average tritium activity increase of 512 pCi/ml. Generally, these are the most distant sample location points from the closed basins along Fourmile Branch. Figures 7 through 12 show comparisons of March 1989 with March 1997 and September 1997 tritium, conductivity, and pH measurements for locations along the F- and H-Area seepline. Data for the first fourteen surveys can be found in Dixon, Rogers, and Looney (1992, 1993a, 1993b, 1993c, 1993d and 1993e and 1994), Rogers et al. (1994a, 1994b, and 1994c) and Koch and Dixon (1994, 1995, 1996, and 1997). Figures 13 through 15 show the data for the Fourmile Branch stream locations. Figures 16 through 18 show the data for the sampling locations along the old effluent seepline and include one stream sample from the stream channel south of 643-E. These sampling locations were identified with the prefix FHB.

F- and H-Area Seepline Tritium Measurements

Figures 7 and 8 show tritium activities at F and H Areas for the September 1997 sampling event. Tritium concentrations increased by greater than 100 pCi/mL at 13 sample locations, while 16 locations either decreased or were relatively unchanged compared to the March 1997 sampling event. There were fifteen dry sites. This is a much greater number of dry sites than previously encountered. It can be attributed to the unusually dry month prior to conducting the sampling event. Overall, sampling has shown a declining trend in tritium concentrations at the F- and H-Area seeplines (Figures 19 and 20).

It is important to note that total tritium fluxes to the wetlands and FMB have steadily declined since basin closure (Looney et al., 1993) and that overall results of the tritium survey support this finding. Differences in tritium concentrations measured at

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seepage sampling locations from one sampling event to the next represent seasonal variability and variable rainfall as well as changes due to the plume flushing from the wetland system. Variability may also result from reduction in plume size along margins.

F-Area Seepage

September 1997 tritium values in the F-Area seepage ranged from 9 to 8,380 pCi/ml (Figure 7 and Table 2). Four of the 22 sampling locations were dry, and six sampling locations had a tritium activity exceeding the 1989 baseline measurements by more than ten percent. No sample exceeded the maximum value of 14,000 pCi/ml measured in March 1989 at this seepage.

As with data from previous sampling events, a Wilcoxon signed-rank test was conducted to compare September 1997 tritium activities to March 1989 baseline activities. The Wilcoxon signed-rank test uses the sign and the magnitude of the rank of the differences between pairs of measurements to compare nonparametric data (Daniel, 1978). This test was chosen because it allows comparisons of paired data without assumptions of normality. If the P value is less than or equal to 0.05, then the September 1997 tritium concentrations are significantly different from the March 1989 baseline tritium concentrations. The results from this test gave a P value = 0.099. Consequently, this test shows that the September 1997 concentrations were not significantly lower than the 1989 concentrations for this seepage. This result could be due to the somewhat higher than normal tritium concentrations observed from the movement of the plume's toe due to dry weather.

Examining the figures in Appendix A reveals the bulk of contaminants are located between sample locations FSP040 and FSP235. Very little change in tritium concentrations is occurring east of location FSP040 or west of FSP235.

H-Area Seepage

Tritium values in the H-Area seepage for September 1997 ranged from 38 to 8,120 pCi/ml (Figure 8 and Table 3). Eleven of the 22 sampling locations were dry, and three sampling locations had tritium activities that exceeded the 1989 baseline measurements by more than ten percent. These locations, HSP071, HSP097, and HSP103 are among the farthest locations from the closed basins. No sample exceeded the maximum value of 24,000 pCi/ml measured in March 1989 at this seepage.

Figure 22 shows the downward trend of tritium concentrations and the conductivity trends in this area. It presents the mean of the tritium concentrations from each sampling event beginning with the March 1989 baseline event (Table 6). Figure 23 shows the pH trends using the mean pH of each sampling event.

As with data from F Area, a Wilcoxon signed-rank test was conducted to compare September 1997 tritium activities to March 1989 activities. The result shows that the September 1997 concentrations were significantly less ($P = 0.029$) than the 1989 concentrations for this seepage.

It's worth noting that when examining the individual plots in Appendix B, sampling locations closest to the closed basins show a distinct decreasing trend. The locations furthest from the closed basins show an increasing trend. This supports the hypothesis that the contaminants are flushing from the system. Eventually the contaminant concentrations at these sample locations are expected to begin decreasing.

F- and H-Area Seepage Conductivity Measurements

F-Area Seepage

Conductivity measurements at the F-Area seepage in September 1997 ranged from 32 to 1,297 $\mu\text{S}/\text{cm}$ (Figure 9, Table 2). Due to the variability of conductivity measurements, only differences of 100

$\mu\text{S}/\text{cm}$ or more are considered significant. Of the 18 locations sampled at the F-Area seepage line, three of the locations measured more than 100 $\mu\text{S}/\text{cm}$ above the 1989 baseline measurements. A comparison of the results in Figures 7 and 9 suggests that conductivity follows the same general trends as the tritium activities. Using a Spearman rank correlation test for nonparametric data, the probability that tritium and conductivity exhibited independent trends was low, ($P < 0.001$). The Spearman rank correlation coefficient was calculated to be $r_s = 0.89$, suggesting that the two parameters behave dependently. This similarity of trends between conductivity and tritium is consistent with past results. In past tritium surveys, 1992 through March 1997, this correlation has been positive and significant. A rank correlation coefficient of 1.0 is a perfect correlation between variables.

H-Area Seepage Line

Conductivity measurements in September 1997 at the H-Area seepage line ranged from 49 to 399 $\mu\text{S}/\text{cm}$ (Figure 10 and Table 3). Only one of the sampling locations, had a measurement of more than 100 $\mu\text{S}/\text{cm}$ above the 1989 baseline measurements. The Spearman rank correlation test was used to investigate the correlation of tritium activities and conductivity values. The probability that the two parameters exhibited independent trends was low on this seepage line also ($P < 0.002$). The rank correlation coefficient ($r_s = 0.82$) was less than that for F Area suggesting a weaker correlation but still dependent behavior between variables. In past tritium surveys, 1992 to 1996, this correlation has been positive and significant.

F- and H-Area Seepage Line pH Measurements

F-Area seepage line pH values ranged from 3.1 to 6.8, with an average value of 5.2 (Figure 11, Table 2). H-Area pH values ranged from 5.0 to 6.4, with an average of 6.0 (Figure 12 and Table 3). The pH for the entire seepage line (F and H Areas combined) averaged 5.5. This represents an increase of 0.6 units over the 4.9 average in 1989 and is equal to the

overall average for the sampling event. An increase in pH will effect the solubility of metals in the soil, which should improve the soil water chemistry and enhance the recovery of wetland vegetation stressed indirectly by low pH.

Aluminum concentrations measured along the seepage line in 1989 were high enough to be toxic to plants (Haselow et al., 1990). Increases in pH from an average of 4.9 (in 1989) have likely reduced the amount of aluminum in solution and thereby reduced it as a possible source of plant toxicity. Concentrations of aluminum and other metals measured along the seepage line in March 1997 were substantially lower than 1989 concentrations, consistent with the observed pH (Koch and Dixon, 1998). Field observations have revealed that vegetation in most of the stressed areas is making noticeable recovery (Nelson and Irwin, 1994; Nelson and Rogers, 1995). Studies have also shown that the toxicity of these areas is decreasing, (Nelson and Westbury, 1994; Westbury and Nelson, 1994).

Fourmile Branch Measurements

Figures 13 through 15 show the tritium, conductivity, and pH values for the Fourmile Branch stream sampling locations. Table 4 provides the data used in the figures. Tritium activities at these locations in September 1997 ranged from 16 to 577 pCi/ml. These values continue to show that tritium concentration increase as you sample further downstream along this seepage line (as the seepage water enters the channel of Fourmile Branch). Conductivity measurements ranged from 62 to 66 $\mu\text{S}/\text{cm}$ and pH ranged from 6.1 to 6.8.

Solid Waste Disposal Facility (643-E) Seepage Line Measurements

The graphs in Figures 16 through 18 show tritium, conductivity, and pH values for the seepage line and stream sampling locations south of 643-E, which is part of the Solid Waste Disposal Facility. Table 5 provides the data used in the figures. This seepage line is along the natural drainage (old F-Area effluent ditch) that was used to discharge effluent from F-

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Area separations prior to the construction of the engineered effluent canal.

Only one sample was collected out of eight from the east side of the drainage. The other seven sites were dry from a month of unusually dry weather prior to sampling. The tritium activity for this location, FHB020, was 5 pCi/ml. Three of the seven sites on the west side of the drainage were dry. Of the remaining four, tritium activities ranged from 1,500 to 21,100 pCi/ml. The tritium activity at the stream location in the drainage (FHB012) was 21,300 pCi/ml.

In September 1997, pH values ranged from 3.6 to 5.3, with an average of 4.8. Conductivity measurements on both sides of the drainage were near background at most locations and ranged from 35 to 53 μ S/cm. Conductivity values are typical of the conductivity values being reported in the water table wells in the vicinity of the old F-Area effluent ditch (EMS, 1996). The Spearman rank correlation test was not conducted due to the number of dry sites. Past Spearman rank correlation test results showed no correlation between conductivity and tritium.

The tritium results were consistent with the Haselow et al. (1990) results for the west side sample locations of the 643-E seepage line, particularly near location HSP103. Haselow et al. (1990) found that down gradient from 643-E, conductivity values were near background whereas tritium concentrations were elevated. This finding was attributed to tritiated wastes deposited in 643-E. Tritium activities measured along the seepage line down gradient of 643-E (particularly sample points on the west side of the drainage) suggest that tritium migrating from 643-E and outcropping in this area was substantial. The detection of tritium on the west side (as opposed to the east side of the drainage) suggested that soil material placed in the northern reaches of the natural drainage forced the tritium plume to outcrop down gradient. It appears that the groundwater containing tritium is moving below the fill material and outcropping on the west side of the drainage channel. The results suggest that the sampling locations on the west side of the drainage

have delineated the tritium plume with the center located at or near FHB018.

Figure 30 shows the tritium data from all the sampling events for this seepage line area beginning with the 1992 sampling event. The higher tritium activity locations occur at four locations, all on the west side of the drainage. These locations are FHB013, 017, 018, and 019.

Overall Trends, and Summary

F-Area Seepage Line

Figure 19 shows the downward trend of tritium concentrations for the F-Area seepage line and the conductivity trends. It shows the mean tritium and conductivity concentrations from each sampling event beginning with the March 1989 baseline event through the September 1997 sampling event (Table 6). Each sampling event since 1989 has shown a statistically significant decrease in tritium concentrations when compared to the 1989 baseline event. Figure 20 shows the pH trends using the mean pH of each sampling event.

Figure 21 shows the tritium concentrations for all the sampling events at the F-Area seepage line. It indicates that a majority of the tritium measured appears at eight of the 22 sample locations. These locations, are FSP019, 026, 032, 034, 035, 040, 204, and 213. Very little of the tritium plume has been detected east of sample location FSP040 or south and west of sample location FSP0213. It also appears that two distinct groupings of sample locations delineate the bulk of the tritium plume from the seepage basins. Road C-4 separates these two groupings.

Table 9 shows the sample collection summary for this seepage line from 1989-1997.

H-Area Seepage Line

Figure 22 shows the downward trend of tritium concentrations for the H-Area seepage line and the conductivity trends. This figure shows the mean tritium and conductivity concentration from each

sampling event beginning with the March 1989 baseline event through the September 1997 sampling event (Table 6). Figure 23 shows the pH trends using the mean pH of each sampling event. Each sampling event since 1989 has shown a statistically significant decrease in tritium concentrations when compared to the 1989 baseline event.

Figure 24 shows the tritium concentrations from all the sampling events conducted for the H-Area seepage line. The sample locations having the highest and lowest tritium values over the entire sampling interval (1989 to 1997) can be seen from examining this figure.

Table 10 shows a sample collection summary for this seepage line from 1989 through 1997.

643-E

Figures 25 to 27 summarize the tritium concentrations, conductivity, and pH measurements of each sampling event. The delineation of the contamination is apparent in Figure 25. Figure 27 shows that a majority of the contaminant plume appears at four sample locations. These locations are on the west side of the drainage and are identified as FHB013, 017, 018, and 019.

Table 11 shows a sample collection summary for this seepage line area from 1992 through 1997.

Fourmile Branch

Figures 28 to 30 show the tritium concentrations, conductivity, and pH measurements for the Fourmile Branch sample locations from 1992 to 1997. Each point represents the actual concentration or reading and is not an average value.

Conclusions

The difference in tritium concentrations between sampling events is represented by rainfall and seasonal variability; as well as changes from the contaminant plume flushing from the wetland system. Conclusions about tritium fluxes into the

wetlands and FMB should consider the complexity of the groundwater system. They should also be based on long-term surface water, seepage line, and groundwater monitoring data and not on quarterly changes in concentrations at seepage line monitoring locations. No correction has been made for tritium decay because of the short time period between sampling events.

F- and H-Area Seepage Lines, and Fourmile Branch

- Tritium concentrations measured at most locations during September 1997 remained relatively unchanged compared to the previous sampling event, but were significantly lower than the 1989 baseline tritium concentrations.
- Total tritium fluxes to the wetlands and FMB have steadily declined since basin closure (Looney et al., 1993). Overall results from the September 1997 tritium survey support this finding. These findings continue to support the hypothesis that the tritium plume in F and H Area is being flushed from the shallow groundwater.
- A majority of the tritium detected along the F-Area seepage line appeared at two localized areas (i.e., eight of the 22 sample locations). These eight sample locations are FSP019, 026, 032, 034, 035, 040, 204 and 213.
- Two tritium results from the September 1997 survey were above 20,000 pCi/ml. Both of these occurred in the drainage area of the old F-Area effluent ditch, 643E seepage line.

Solid Waste Disposal Facility (643-E) Seepage Line

Data from 16 seepage line locations south of the 643-E Area indicated that tritium migrating from 643-E is outcropping at the F- Area effluent ditch, particularly on the west side of the stream channel. It appeared that sampling locations on the west side of the ditch have delineated the tritium outcrop area with the present climatic and hydrologic conditions.

Results of the Tritium Survey of Fourmile Branch and its Seeplines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary

- Data indicated tritium concentrations have decreased over the past nine sampling events.
- A major portion of the tritium detected was on the west side of the drainage at four sample locations. These four sample locations are FHB013, 017, 018, and 019.
- The tritium concentrations have steadily decreased at the west side sample locations since August, 1993.

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Figure 1. Location of F-Area Seepage Basins and Seepage Sampling Points.

Figure 2. Location of H-Area Seepage Basins and Seepage Sampling Points and FHB Sampling Points.

Results of the Tritium Survey of Fourmile Branch and its Seepages
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary

Figures 3 and 4. Schematic diagram of flow lines before and after closure of seepage basins.

Figure 5. Schematic Diagram of the Tritium Plume Migrating from F- and H-Area Seepage Basins and rainfall effects

Figure 6. Comparison of March 1996 through February 1997 Monthly Rainfall to the Long Term Average (1961-1994) for the F-Area Weather Station.

**Results of the Tritium Survey of Fourmile Branch and its Seepines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Figure 7. Comparison of Tritium Concentration at H-Area Seepine Locations

Figure 8. Comparison of Tritium Concentration at F-Area Seepine Locations

Figure 9. Comparison of Specific Electrical Conductivity at F-Area Seepage Locations

Figure 10. Comparison of Specific Electrical Conductivity at H-Area Seepage Locations.

**Results of the Tritium Survey of Fourmile Branch and its Seepines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Figure 11. Comparison of pH at F-Area Seepine Locations.

Figure 12. Comparison of pH at H-Area Seepine Locations.

Figure 13. Comparison of Tritium Concentrations at Fourmile Branch Locations.

Figure 14. Comparison of Specific Electric Conductivity at Fourmile Branch Locations.

**Results of the Tritium Survey of Fourmile Branch and its Seep Lines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Figure 15. Comparison of pH at Fourmile Branch Locations.

Figure 16. Comparison of Tritium Concentrations at Locations on the Seep Line South of 643-E.

Figure 17. Comparison of Specific Electrical Conductivity at Locations on the Seeline South of 643-E.

Figure 18. Comparison of pH at Locations on the Seeline South of 643-E.

**Results of the Tritium Survey of Fourmile Branch and its Seep Lines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Figure 19. Tritium and Conductivity Trends for F-Area Seep Line. Each point represents the mean value of a sampling event.

Figure 20. pH trends for the F -Area Seep Line. Each point represents the average value of a sampling event.

Figure 21. Tritium concentrations for F-Area Seepage (1989-1997)
Plot shows distribution of tritium throughout the entire sampling period.

Figure 22. Tritium and conductivity trends for H-Area Seepage. Each point represents the mean value of a sampling event.

**Results of the Tritium Survey of Fourmile Branch and its Seep Lines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Figure 23. The pH trends for the H-Area Seep Line. Each point represents the average pH value of a sampling event.

Figure 24. Tritium concentrations at the H-Area Seep Line (1989-1997)
Plot shows distribution of tritium throughout the entire sampling period.

Figure 25. Comparison of tritium concentrations for Seepline below 643-E. Each point represents the mean value of a sampling event. Note: September 1997 value not plotted because of 14 dry locations.

Figure 26. Comparison of conductivity concentrations for the Seepline below 643-E. Each point represents the mean value of a sampling event. Note: September 1997 value not plotted because of 14 dry locations.

Figures 27.

Bar chart scatter plot : Tritium concentrations at the seepine below 643E, (1992-1997)
Plot shows distribution of tritium throughout the entire sampling period.

* Stream sample location

Figure 28.

Tritium, conductivity, and pH at sample location FMCO01F (Fourmile Branch).

Figure 29. Tritium, conductivity, and pH sample location FMC001H (Fourmile Branch)

Figure 30. Tritium, conductivity, and pH at sample location FMC002H (Fourmile Branch).

**Results of the Tritium Survey of Fourmile Branch and its Seep Lines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Table 1. Comparison of 1996/1997 Monthly Rainfall to the Long Term Average Rainfall From the F-Area Weather Station

Month	Year	Rainfall (cm), F-Area Weather Station, (Sept.1996-Aug.1997)	Longterm Rainfall (cm), F-Area Weather Station, (1961-1994)
Sept	96	7.98	8.77
Oct	96	5.31	7.80
Nov	96	3.71	7.12
Dec	96	7.54	8.97
Jan	97	10.67	11.14
Feb	97	14.12	10.74
Mar	97	5.89	12.62
April	97	9.86	8.01
May	97	6.15	9.31
June	97	17.20	11.77
July	97	17.83	13.97
Aug	97	5.92	14.56

Table 2. Comparison of F-Area Seepage Measurements for Tritium, Conductivity, and pH for the March 1989, March 1997, and September 1997 Sampling Events.

Location	Tritium (pCi/ml)			Conductivity (μS/cm)			pH(-log H)		
	Mar-89	Mar-97	Sep-97	Mar-89	Mar-97	Sep-97	Mar-89	Mar-97	Sep-97
2	520	476	717	95	90	80	5.6	6.4	6.8
7	3400	1040	1000	681	244	579	5.4	6.3	6.13
12	260	44	54	30	50	36	5.3	5.7	5.6
14	14000	17	dry	666	24	dry	4.2	5.2	dry
19	4900	4660	3000	1424	1068	846	4.2	4.3	4.02
26	4400	6770	2750	1095	1649	694	6.5	4.5	6.44
32	3600	73	dry	174	37	dry	5.0	5.4	dry
34	14000	2180	dry	810	503	dry	3.8	4.4	dry
35	11000	5090	8380	1100	989	1297	3.9	4.4	3.99
40	7800	5670	3970	900	1382	709	5.2	4.5	4.16
47	100	15	117	52	54	41	4.7	5.2	5.28
56	19	6	9	34	88	47	4.5	5.5	3.1
204	3000	2400	2070	895	487	142	4.4	4.6	4.49
213	2800	684	2530	860	48	502	4.6	5.4	4.02
220	560	505	847	147	220	153	4.8	5.0	5.91
226	1300	758	476	306	251	81	5.1	5.5	5.85
235	580	242	dry	84	76	dry	5.7	5.4	dry
241	560	515	1050	36	155	266	4.7	5.5	5.91
249	580	193	702	84	78	39	4.4	5.2	5.42
256	400	80	608	56	58	174	5.1	5.4	6.13
270	40	32	47	50	170	40	4.1	4.3	4.98
290	35	24	41	49	65	32	3.6	4.2	4.94

Table 3. Comparison of H-Area Seepline Measurements for Tritium, Conductivity, and pH for the March 1989, March 1997, and September 1997 Sampling Events.

Location	Tritium (pCi/ml)			Conductivity ($\mu\text{S/cm}$)@25deg C			pH (-log H)		
	Mar-89	Mar-97	Sep-97	Mar-89	Mar-97	Sep-97	Mar-89	Mar-97	Sep-97
3	14000	1480	dry	468	223	dry	5.2	6.6	dry
4	11000	398	dry	292	117	dry	5.8	6.6	dry
8	24000	1130	884	556	156	97	5.7	6.6	5.96
11	960	135	dry	80	41	dry	5.1	5.7	dry
13	12000	735	168	592	148	81	6.2	6.4	5.98
15	1000	504	593	82	112	151	5.2	5.7	5.73
20	6500	147	dry	183	77	dry	6.2	5.7	dry
25	3300	258	441	135	53	120	4.7	5.4	6.27
29	9200	51.2	38	257	56	49	5.2	5.4	6.27
34	5600	dry	dry	331	dry	dry	5.8	dry	dry
38	6500	dry	dry	227	dry	dry	4.9	dry	dry
43	10000	1840	dry	413	132	dry	5.3	6.5	dry
46	11000	494	dry	318	171	dry	5.5	6.1	dry
49	11000	1250	1240	551	124	87	4.4	6.0	5.75
52	20000	7320	8120	699	385	399	4.1	5.9	6.24
57	15000	354	dry	581	122	dry	5.5	6.1	dry
60	21000	1470	dry	473	207	dry	5.9	6.0	dry
64	320	13.6	dry	38	35	dry	4.7	5.1	dry
71	450	1070	1830	40	115	160	5.1	6.5	6.42
76	400	202	96	146	133	70	5.7	6.3	6.2
97	1100	1370	1580	37	102	146	4.3	6.1	6.09
103	510	927	1940	43	83	125	4.4	5.5	5.01

Table 4. Comparison Measurements for Tritium, Conductivity, and pH in Fourmile Branch for the March 1996, March 1997, and September 1997 Sampling Events.

Location	Tritium (pCi/ml)			Conductivity ($\mu\text{S/cm}$)			pH (-log H)		
	Sep-96	Mar-97	Sep-97	Sep-96	Mar-97	Sep-97	Sep-96	Mar-97	Sep-97
1F	520	329	577	62	61	62	5.4	6.6	6.8
1H	35	9	16	49	98	62	6.1	7.7	6.5
2H	76	78	61	56	54	66	5.9	6.5	6.1

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Table 5. Comparison of 643-E Seep Line Measurements for Tritium, Conductivity, and pH for the March 1996, March 1997, and September 1997 Sampling Events. (Note: Location 12 is a stream sample location.)

Location	Tritium (pCi/ml)			Conductivity (μS/cm)			pH (-log H)		
	Sep-96	Mar-97	Sep-97	Sep-96	Mar-97	Sep-97	Sep-96	Mar-97	Sep-97
1	dry	42	dry	dry	47	dry	dry	5.6	dry
2	16	12	dry	47	39	dry	5.7	5.0	dry
3	87	101	1960	38	33	na	5.1	5.2	na
4	247	158	dry	18	38	dry	5.4	5.1	dry
5	496	435	dry	52	46	dry	5.6	5.5	dry
6	211	213	dry	34	42	dry	5.4	5.6	dry
8	200	111	dry	29	24	dry	5.3	5.3	dry
12	18500	17300	21300	46	38	45	5.4	4.8	5.31
13	7190	3050	6660	42	33	53	5.4	5.0	4.58
14	209	195	1500	33	37	35	5.2	5.0	3.48
15	dry	dry	dry	dry	dry	dry	dry	dry	dry
16	278	87	dry	80	66	dry	5.6	5.7	dry
17	8830	3470	21100	42	53	43	5.6	5.4	5.05
18	19100	10800	3100	74	90	36	6.1	6.1	4.99
19	dry	4960	dry	dry	51	dry	dry	4.9	dry
20	22	16	3	38	32	45	5.8	6.1	5.29

Table 6. Average Tritium, Conductivity, and pH values for F and H Area Seep Lines (March 1989-September 1997).

Sampling Event Date	F Area Seep Line-Average Values			H Area Seep Line-Average Values		
	tritium (pCi/ml)	Conductivity (μS/cm)	pH	tritium (pCi/ml)	Conductivity (μS/cm)	pH
Mar-89	3357	438	4.8	8402	297	5.2
May-92	1934	335	4.7	4131	183	5.9
Sep-92	1990	352	5.2	2904	182	6.0
Dec-92	1823	300	5.3	3001	165	6.0
Mar-93	1398	293	5.0	2063	124	5.9
Jun-93	1936	330	5.1	2885	157	6.0
Sep-93	2384	404	5.0	2876	205	5.7
Dec-93	1920	415	5.1	2749	181	5.7
Mar-94	1525	371	5.0	1818	140	5.6
Jun-94	1688	344	5.0	2053	153	5.8
Sep-94	1806	381	5.1	1953	159	6.0
Dec-94	1698	366	4.9	2836	179	5.8
May-95	1634	311	5.0	1547	131	5.6
Mar-96	1424	331	4.7	1082	113	5.9
Sep-96	1545	328	4.8	880	142	6.1
Mar-97	1431	354	5.1	1057	130	6.0
Sep-97	1576	320	5.2	1539	130	6.0

Table 7. Average Tritium and Conductivity, values for Seepline below 643-E.

Sampling Event Date	Tritium (all) (pCi/ml)	Tritium (East) (pCi/ml)	Tritium (West) (pCi/ml)	Conductivity (All) (μS/cm)	Conductivity (East) (μS/cm)	Conductivity (West) (μS/cm)
Mar-93	4808	242	8999	62	43	88
Jun-93	7617	389	14779	82	53	122
Sep-93	10924	445	22017	92	57	140
Dec-93	8182	435	15527	68	56	86
Jun-94	8557	324	14557	58	53	68
Sep-94	8065	303	15469	57	53	65
May-95	4323	270	6630	69	64	79
Mar-96	4069	143	7483	43	36	53
Sep-96	4260	183	7121	44	37	54
Mar-97	2730	136	3760	45	38	55
Sept-97	7946*	981*	8090*	43	45	42

Note: Due to many dry sites these averages are not representative of the areas and therefore not included in the statistical analysis and trending plots.

Table 8. Tritium concentrations for Fourmile Branch

Sample date	Sample ID	Tritium (pCi/ml)	Sample date	Sample ID	Tritium (pCi/ml)
Dec-92	FMC001H	55	Dec-94	FMC001F	312
Dec-92	FMC001F	455	Dec-94	FMC001H	59
Dec-92	FMC002H	2050	Dec-94	FMC002H	113
Apr-93	FMC001H	47	May-95	FMC001F	643
Apr-93	FMC001F	425	May-95	FMC001H	63
Apr-93	FMC002H	104	May-95	FMC002H	97
Sep-93	FMC001H	41	Mar-96	FMC001F	138
Sep-93	FMC002H	105	Mar-96	FMC001H	34
Sep-93	FMC001F	503	Mar-96	FMC002H	65
Dec-93	FMC001H	37	Sep-96	FMC001F	520
Dec-93	FMC001F	567	Sep-96	FMC001H	35
Dec-93	FMC002H	145	Sep-96	FMC002H	76
Mar-94	FMC001H	34	Mar-97	FMC001F	329
Mar-94	FMC001F	375	Mar-97	FMC001H	9
Mar-94	FMC002H	91	Mar-97	FMC002H	78
Jun-94	FMC001F	331	Sep-97	FMC001F	577
Jun-94	FMC001H	42	Sep-97	FMC001H	16
Jun-94	FMC002H	82	Sep-97	FMC002H	61
Sep-94	FMC001F	567			
Sep-94	FMC001H	52			
Sep-94	FMC002H	93			

Results of the Tritium Survey of Fourmile Branch and its Seepines
in the F and H Areas of SRS: September 1997 and 1989-1997 summary

Table 9. Sample Collection Summary for F-Area Seepine Locations 1989-1997

Sample ID	Sample Date																
	Sep-97	Mar-97	Sep-96	Mar-96	May-95	Dec-94	Sep-94	Jun-94	Mar-94	Dec-93	Sep-93	Jun-93	Apr-93	Dec-92	Sep-92	May-92	Mar-89
FSP002	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FSP007	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FSP012	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FSP014	dry	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FSP019	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FSP026	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FSP032	dry	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FSP034	dry	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FSP035	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FSP040	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FSP047	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FSP056	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FSP204	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FSP213	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FSP220	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FSP226	X	X	X	X	dry	X	X	X	X	X	X	X	X	X	X	X	X
FSP235	dry	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FSP241	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FSP249	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FSP256	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FSP270	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FSP290	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 10. Sample Collection Summary for H-Area Seep Line Locations 1989-1997

Sample ID	Sample Date														
	Sep-97	Mar-97	Sep-96	Mar-96	May-95	Dec-94	Sep-94	Jun-94	Mar-94	Dec-93	Sep-93	Jun-93	Apr-93	Dec-92	Sep-92
HSP003	dry	X	X	X	X	X	X	X	X	X	X	X	X	X	X
HSP004	dry	X	X	X	X	X	X	X	X	X	X	X	X	X	X
HSP008	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
HSP011	dry	X	dry	X	X	X	X	X	X	X	X	X	X	X	X
HSP013	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
HSP015	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
HSP020	dry	X	X	X	X	X	X	X	X	X	X	X	X	X	X
HSP025	X	X	X	X	dry	X	X	X	X	X	X	X	X	X	X
HSP029	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
HSP034	dry	dry	dry	X	dry	X	X	X	X	X	X	X	X	X	X
HSP038	dry	dry	dry	dry	X	X	X	X	X	X	X	X	X	X	X
HSP043	dry	X	dry	X	dry	X	X	X	X	X	X	X	X	X	X
HSP046	dry	X	X	X	X	X	X	X	X	X	X	X	X	X	X
HSP049	X	X	X	X	dry	X	X	X	X	X	X	X	X	X	X
HSP052	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
HSP057	dry	X	X	X	X	X	X	X	X	X	X	X	X	X	X
HSP060	dry	X	X	X	X	X	dry	X	X	X	X	X	X	X	X
HSP064	dry	X	X	X	X	X	X	X	X	X	X	X	X	X	X
HSP071	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
HSP076	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
HSP097	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
HSP103	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Results of the Tritium Survey of Fourmile Branch and its Seeplines
in the F and H Areas of SRS: September 1997 and 1989-1997 summary

Table 11. Sample Collection Summary for 643-E Seepline Locations 1992-1997

Sample ID	Sample Date													
	Sep-97	Mar-97	Sep-96	Mar-96	May-95	Dec-94	Sep-94	Jun-94	Mar-94	Dec-93	Sep-93	Jun-93	Apr-93	Dec-92
FHB001	dry	X	X	X	X	X	X	X	X	X	X	X	X	X
FHB002	dry	X	X	X	X	X	X	X	X	X	X	X	X	X
FHB003	X	X	X	X	X	X	X	dry	X	X	X	X	X	X
FHB004	dry	X	X	X	X	X	X	X	X	X	X	X	X	X
FHB005	dry	X	X	X	X	X	X	X	X	X	X	X	X	X
FHB006	dry	X	X	X	X	X	X	X	X	X	X	X	X	X
FHB008	dry	X	X	X	X	X	X	X	X	X	X	X	X	X
FHB012*	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FHB013	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FHB014	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FHB015	dry	dry	dry	dry	X	dry	dry	dry	X	X	X	X	X	X
FHB016	dry	X	X	X	X	X	X	X	X	X	X	X	X	X
FHB017	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FHB018	X	X	X	X	X	X	X	X	X	X	X	X	X	X
FHB019	dry	X	dry	X	X	X	X	X	X	X	X	X	X	X
FHB020	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Appendix A

F-Area Seepline
Tritium Concentrations and Conductivity Plotted by Sampling Location,
1989-1997

**Results of the Tritium Survey of Fourmile Branch and its Seep Lines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Sample Location FSP002

Sample Location FSP007

Sample Location FSP012

Sample Location FSP014

**Results of the Tritium Survey of Fourmile Branch and its Seep Lines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Sample Location FSP019

Sample Location FSP026

Sample Location FSP032

Sample Location FSP034

**Results of the Tritium Survey of Fourmile Branch and its Seep Lines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Sample Location FSP035

Sample Location FSP040

Sample Location FSP047

Sample Location FSP056

**Results of the Tritium Survey of Fourmile Branch and its Seepines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Sample Location FSP204

Sample Locaiton FSP213

Sample Location FSP220

Sample Location FSP226

**Results of the Tritium Survey of Fourmile Branch and its Seepines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Sample Location FSP235

Sample Location FSP241

Sample Locaiton FSP249

Sample Location FSP256

**Results of the Tritium Survey of Fourmile Branch and its Seep Lines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Sample Location FSP270

Sample Location FSP290

Appendix B

H-Area Seepline
Tritium Concentrations and Conductivity Plotted by Sampling Location,
1989-1997

**Results of the Tritium Survey of Fourmile Branch and its Seepines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Sample Location HSP003

Sample Location HSP004

Sample Location HSP008

Sample Location HSP011

**Results of the Tritium Survey of Fourmile Branch and its Seep Lines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Sample Location HSP013

Sample Location HSP015

Sample Locaiton HSP020

Sample Location HSP025

**Results of the Tritium Survey of Fourmile Branch and its Seep Lines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Sample Location HSP029

Sample Location HSP034

Sample Location HSP038

Sample Location HSP043

**Results of the Tritium Survey of Fourmile Branch and its Seep Lines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Sample Location HSP046

Sample Location HSP049

Sample Location HSP052

Sample Location HSP057

**Results of the Tritium Survey of Fourmile Branch and its Seep Lines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Sample Location HSP060

Sample Location HSP064

Sample Location HSP071

Sample Location HSP076

**Results of the Tritium Survey of Fourmile Branch and its Seepines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Sample Location HSP097

Sample Location HSP103

Appendix C

643-E Seepline
Tritium Concentrations and Conductivity Plotted by Sampling Location,
1992-1997

**Results of the Tritium Survey of Fourmile Branch and its Seepines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Sample Location FHB001

Sample Location FHB002

Sample Location FHB003

Sample Location FHB004

**Results of the Tritium Survey of Fourmile Branch and its Seep Lines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Sample Location FHB005

Sample Location FHB006

Sample Location FHB008

Sample Location FHB012 (stream)

Results of the Tritium Survey of Fourmile Branch and its Seepelines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary

Sample Location FHB013

Sample Location FHB014

Sample Location FHB015

Sample Location FHB016

**Results of the Tritium Survey of Fourmile Branch and its Seeplines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary**

Sample Location FHB017

Sample Location FHB018

Sample Location FHB019

Sample Location FHB020

Appendix D

Fourmile Branch
Tritium Concentrations and Conductivity Plotted by Sampling Location,
1992-1997

Results of the Tritium Survey of Fourmile Branch and its Seepines
in the F and H Areas of SRS: September 1997 and 1989-1997 Summary