# Letter Report on the Risks Associated with Contaminated Sediments Present in Coldwater Creek

## In Support of the Formerly Utilized Sites Remedial Action Program (FUSRAP)

**July 1993**

**Science Applications International Corporation**
**301 Laboratory Road**
**Oak Ridge, TN 37830**

# TABLE OF CONTENTS

## TABLES



## FIGURE

# EXECUTIVE SUMMARY

The human health risks associated with incidental ingestion and inhalation of particulates from radiologically contaminated sediments were evaluated for individuals involved in recreational activities and community-based cleanup projects around the creek. Contact with sediments during recreational or cleanup activities around the creek was considered likely as a result of walking, wading, and fishing. The combined risk associated with each exposure pathway was evaluated. The combined risk associated with recreational usage ranged from $3.0 \times 10^{-6}$ to $7.1 \times 10^{-6}$ and from $1.5 \times 10^{-6}$ to $4.3 \times 10^{-7}$ for community cleanup activities. This represents an overall risk of $2.2 \times 10^{-5}$ for the entire creek.

In terms of known contaminant distribution, the maximum concentration values found in Area B and C are of particular concern due to the higher doses found in these areas. The combined risk associated with Area B maximum concentration levels was $8.7 \times 10^{-6}$ for recreational usage and $1.5 \times 10^{-6}$ for community cleanup activities. This represents an overall risk of $1 \times 10^{-5}$. The total risk associated with Area C, the highest for any section of the creek, was $3.7 \times 10^{-6}$ for recreational usage and $4.3 \times 10^{-7}$ for community cleanup activities. This represents an overall risk of $4.1 \times 10^{-6}$ for receptors in this area.

The cancer incidence levels for current and future receptors attributable to radiologic contaminants at each area of Coldwater Creek are within the $10^{-4}$ to $10^{-6}$ target risk range. No further remedial action may be required [i.e., once the accessible soils at the St. Louis Airport Site (SLAPS) and the Hazelwood Interim Storage Site (HISS) are removed] because the risks are currently protective of human health and the environment under normal public activities.

# 1. INTRODUCTION

This assessment was conducted to evaluate the risks associated with contaminated sediments during recreational and community cleanup activities at specific areas of the creek. The specific areas of the creek, A, B, C, and D, include sections associated with the St. Louis Airport Site (SLAPS) and the Hazelwood Interim Storage Site (HISS). This evaluation considers Coldwater Creek as an individual remedial unit and risk estimates were generated for each area. The methodologies used are consistent with those present in the *Baseline Risk Assessment for Exposure to Contaminants at the St. Louis Site, St. Louis, Missouri* (ANL 1992).

This assessment was conducted as part of the *Feasibility Study-Environmental Impact Statement (FS-EIS) for the Radioactive Contaminants at the St. Louis Site* (SAIC 1993) to evaluate current and future risks associated with radiologic contaminants in the creek (i.e., baseline conditions with no remedial actions being implemented). This assessment was also conducted to evaluate the need for remedial solutions for the entire creek.

# 2. OBJECTIVE OF THE EXPOSURE ASSESSMENT

The primary objectives of assessing human health risk at Coldwater Creek are to:

- Characterize subpopulations that will be in contact with the creek,
- Identify exposure pathways through which these individuals may be exposed in the different areas of the creek, and
- Quantify exposure by estimating the levels to which these individuals may be potentially exposed (EPA 1989).

# 3. EXPOSURE POINTS, ROUTES, AND RECEPTORS

Coldwater Creek flows approximately 14 miles, originating upstream of SLAPS, to the Missouri River. All portions of the creek are potentially accessible to the public, although it should be noted that most of the creek is characterized by extremely steep embankments, making access uninviting and somewhat precarious. Access to the creek is most likely at the less steep embankment grades traversing the creek, and evidence of visits (beverage containers and graffiti) was plentiful beneath the bridges. In addition, the portion of Area D closest to the Missouri River appeared to be much more accessible than the upstream portions of the creek. A recreational scenario involving human ingestion of recreationally caught fish was evaluated, although few fish have been observed in most of Coldwater Creek.

Swimming is considered unlikely because the water levels in Coldwater Creek are typically intermittent, alternating from normally very low to very high during storm events. Swimming during these conditions would be either impossible or dangerous, and it does not appear to represent a likely or significant exposure pathway.

The receptors to the contaminated sediments in the creek are assumed to be an occasional recreational user who may either ingest sediment or consume fish caught in the creek. In addition, it was assumed that periodic cleanup of the creek (for removal of debris present in the creek) may be conducted by members of the community twice a year. During such semiannual activities, these community members could also be potential receptors to creek sediments. Because future land use on the creek in not expected to change, these assumptions, for current receptors, would also apply to future receptors.

The exposure pathways of interest for this assessment include direct radiation, inhalation of particulates, ingestion of aquatic animals, ingestion of sediments, and radon exposure. The Residual Radioactive Code, 4.31 (RESRAD) was used to evaluate the dose associated with each pathway (Gilbert 1989). The methodology used for RESRAD is described in detail in the St. Louis Baseline Risk Assessment and FS-EIS.

## 4. ESTIMATION OF EXPOSURE POINT CONCENTRATIONS

Exposures were evaluated by means of upper-bound estimates of contaminant levels in sediments as represented by the upper 95th percentile estimate on the mean (EPA 1989). Data analysis is conservative in that it relies on upper-bound estimates (overestimates of the mean), although it cannot resolve potential impacts attributable to areas with elevated levels of contamination. To account for these areas, additional exposure estimates were conducted by assuming that exposure occurs at the maximum sediment levels found in a highly contaminated area of the creek with the greatest maximum concentration and with high population densities near the creek (Area B). An exposure point concentration was developed for each area. Area A is immediately downstream from SLAPS and HISS, and areas B, C, and D are located adjacent to each other and further downstream from SLAPS and HISS (Figure 1).

The lengths of different areas of the creek are summarized below:

| Area | Length |
|---|---|
| A | 1.7 miles |
| B | 1.5 miles |
| C | 4.8 miles |
| D | 5.9 miles |

## 5. ESTIMATION OF CONTAMINANT DOSE AND INTAKE

Assumptions and Intake Parameters

- A contamination depth of 15 cm was assumed.

- Because the activities at Coldwater Creek typically involve physical activity, the inhalation rate was increased from 7,000 $m^3$/yr (20 $m^3$/d) for 350 d/yr to 10,000 $m^3$/yr. This inhalation rate represents the upper level allowed by the RESRAD software (Gilbert 1989).

- The soil ingestion rate was assumed to be 0.42 g/yr for recreational activities and 0.96 g/yr for community cleanup activities. These rates are based on a presumed 35 g/yr soil ingestion rate for normal activities if it occurred continuously at 0.1 g/day for 350 d/yr, and a presumed elevated 168 g/yr ingestion rate for an individual working in the soil if it occurs at 0.48 g/d for 350 d/yr (EPA 1991). It is presumed that the soil/sediment ingestion rate for individuals involved in community cleanup activities is similar to a landscaper working in soil.

- It was assumed that individuals living in the area of the creek will spend a portion of their time (1.2 percent of a year or 1 hr/d for 104 d/yr) doing recreational activities at the creek. In addition, it was assumed that individuals will spend 2 d/yr for 8 hr/d (0.2 percent of a year) in a community cleanup project for Coldwater Creek. If an individual uses the creek for recreational purposes and participates in cleanup activities, the risk may be combined to obtain a total risk.

- It was assumed that an individual consumes approximately 54 g/yr of aquatic animals and that 1 percent is obtained from Coldwater Creek. If an individual resides near a large water body (ocean or great lake), 95 percent of these individuals consuming aquatic food might supplement 10 to 100 percent of their diet with aquatic food. If this were a large river, then the supplementation value would fall to between 1 and 10 percent. For a small creek such as Coldwater Creek, a 1 percent value appears conservative.

- Uranium-235 (U-235) and its progeny were assumed to be associated with U-238 at a concentration that is 5 percent of the U-238 activity concentration. Activity concentrations of the radionuclide progeny were assumed to be in equilibrium with their first parent radionuclide and normal radioactive decay equilibrium ratios were assumed.

- To assess the impact of averaging the concentration over the large areas described above, a single area of elevated levels of contamination (i.e., 100 $m^3$) was analyzed using the maximum concentration detected in the creek in Area B.

Based on these assumptions, estimated annual exposure projections are summarized in Table 1. Risks were calculated based on the annual exposure projections for a residency time of 9 years. The risk factor used was $6 \times 10^{-7}$ fatal cancers per mrem (EPA 1989a). These risk projections are shown in Table 2.

## 6. CONCLUSIONS

Under current and most likely future land uses, cancer risks were estimated for a human receptor as a recreational user of the creek. Health risks were also determined for community members involved in semiannual cleanup in the creek. In general, contact with sediments during recreational or cleanup activities around the creek was considered likely as a result of walking, wading, and fish consumption. The combined risk associated with recreational usage of the creek ranged from $3 \times 10^{-6}$ to $7.1 \times 10^{-6}$ and from $1.5 \times 10^{-6}$ to $4.3 \times 10^{-7}$ for community cleanup activities. This represents an overall risk of $2.2 \times 10^{-5}$ for the entire creek.

The maximum concentration values found in Area B were of particular concern due to the higher concentrations in the sediments for this area (Table 1). As shown in Table 2, a recreational user would be exposed to a combined risk of $8.7 \times 10^{-6}$ and a community cleanup worker would be exposed to a combined risk of $1.5 \times 10^{-6}$ for the maximum concentrations found in Area B creek sediments. However, based on the doses calculated from concentration levels in the upper 95th percentile estimate on the mean, the greatest risk from exposure for a recreational user would be a combined risk of $3.7 \times 10^{-6}$ and for a community cleanup worker would be a combined risk of $4.3 \times 10^{-7}$ for Area C.

As shown in Table 2, the estimated cancer risk for current receptors attributable to radiologic contaminants at each area of Coldwater Creek are within the $10^{-4}$ to $10^{-6}$ target risk range specified by the U.S. Environmental Protection Agency as an acceptable risk for the general public. The background risk due to direct exposure and dose from terrestrial sources and cosmic radiation greatly exceeded site-related exposures at $1.4 \times 10^{-3}$. The dose values for background levels were derived from national averages, and they vary throughout the United States.

Based on the above analysis, it appears that no remedial actions are required at Coldwater Creek because the risks are protective of human health and the environment under normal public creek activities. Once the source of contamination is removed (i.e., the accessible soils present at SLAPS and HISS), the creek sediments will not be further contaminated. Consequently, the

existing low levels of creek contamination will further dissipate/disperse over time due to scouring and continued downstream contaminant transport.

## 7. REFERENCES

ANL (Argonne National Laboratory) 1992. *Baseline Risk Assessment for Exposure to Contaminants at the St. Louis Site, St. Louis, Missouri*, DOE/OR/23701-41.1, May.

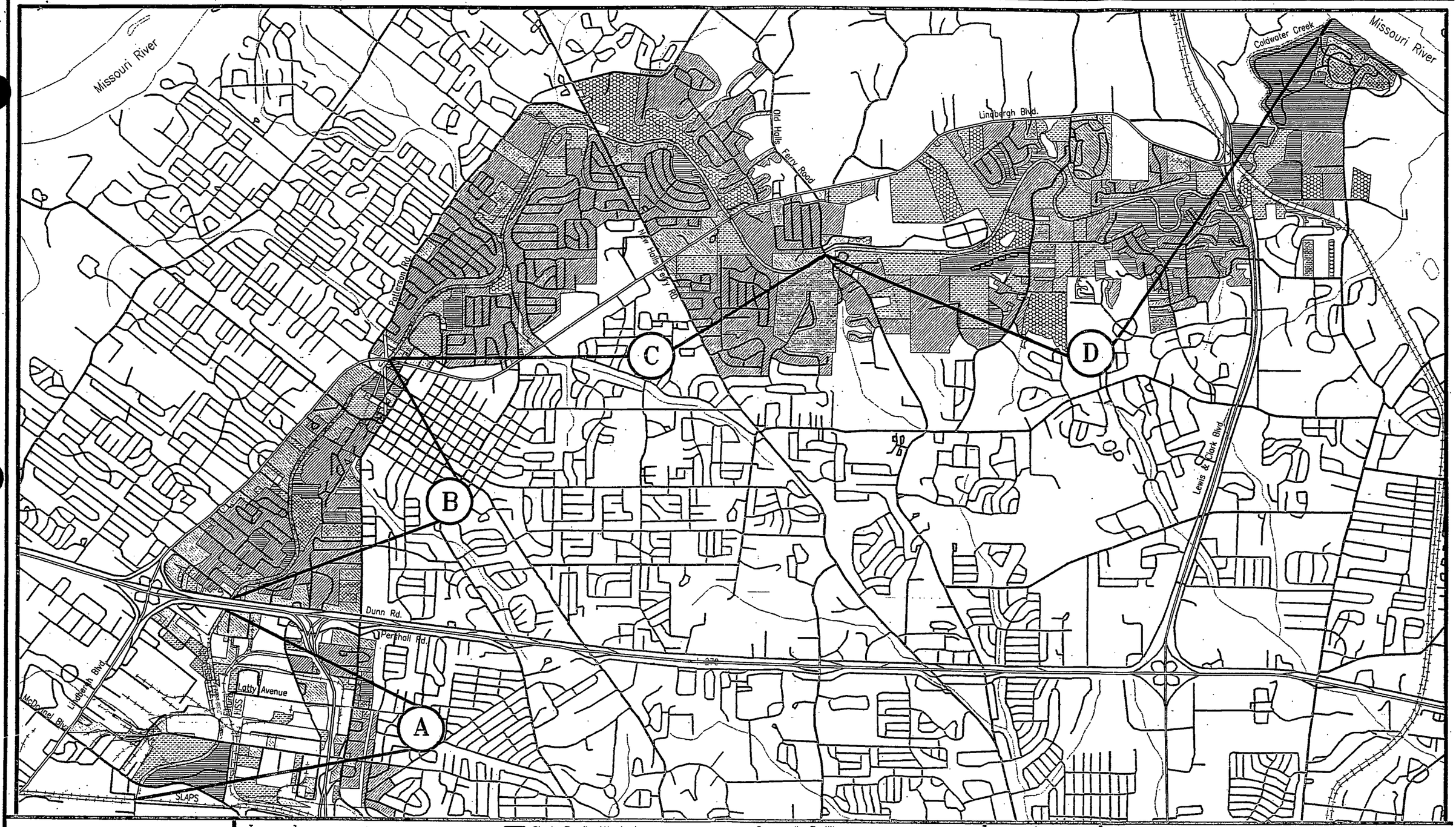
EPA (U.S. Environmental Protection Agency) 1989. *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual*. Office of Emergency and Remedial Response, EPA/540/1-89/002, December.

EPA 1989a. *Risk Assessments Methodology, Environmental Impact Statement, NESHAPS for Radionuclides, Background Information Document, Volume I*, Office of Radiation Programs, EPA/5201-89-005, September.

EPA 1991. *Human Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors*, Office of Solid Waste and Emergency Response (OSWER), OSWER Directive 9285, 6-03, May.

Gilbert, T.L. et al., 1989. *A Manual for Implementing Residual Radioactive Material Guideline, ANL/es-160 (DOE/CH/8901), prepared by Argonne National Laboratory, Energy and Environmental Systems Division, Argonne, Ill., for U.S. Department of Energy, Assistant Secretary for Nuclear Energy*, June.

SAIC (Science Applications International Corporation) 1993. *Feasibility Study-Environmental Impact Statement (FS-EIS) for the Contaminants at the St. Louis Site*, July.




| | | |
|---|---|---|
| PROJECT NO.: Z-0019A | PLOT FILES: | XREFS: |
| DWG FILE: | LUCWC1.PLT | Z-0019A/ FLORI |
| LU-TTL.DWG | LNCWC2.PLT | Z-0019A/ DATA/ CWCLU-B |
| DATE: 6-21-93 | | |
| PLOTTED BY: P. HOLM | | |
| SHEET 1 OF 1 | | |

Legend

- Historical Building/ Area
- Medical Facility, Emergency Services, Fire
- Park
- Single Family Attached, Apartment, Residental
- Commercial, retail, wholesale, office
- Common Ground
- Farm
- Community Facility, Government Facility, Business, Civic Org.
- Vacant
- Parking
- Utility/Industrial, Maintenance, Warehouse

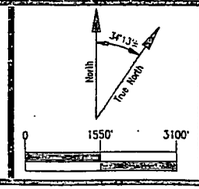



**Figure 1.**

## Land Use Along Coldwater Creek

## Table 1. Dose/Exposure Projections (mrem/9 yrs)

| Location | Pathway | | | | | |
|---|---|---|---|---|---|---|
| | Direct | Inhalation | Radon | Soil | Fish | Total |
| RECREATIONAL USAGE | | | | | | |
| A | 0.92 | 0.073 | $3.6 \times 10^{-3}$ | $6.7 \times 10^{-4}$ | 0.26 | 1.3 |
| B | 2.5 | 0.22 | $1.1 \times 10^{-3}$ | $1.7 \times 10^{-3}$ | 2.9 | 5.6 |
| C | 3.6 | 0.17 | $2.3 \times 10^{-3}$ | $1.3 \times 10^{-3}$ | 2.4 | 6.2 |
| D | 3.4 | 0.17 | $6.6 \times 10^{-3}$ | $1.3 \times 10^{-3}$ | 1.5 | 5.1 |
| B Maximum Concentration Values* | 13.6 | 1.0 | $3.2 \times 10^{-5}$ | $1.1 \times 10^{-5}$ | 0.028 | 15 |
| COMMUNITY CLEANUP | | | | | | |
| A | 0.17 | 0.014 | $6.3 \times 10^{-4}$ | $3.0 \times 10^{-4}$ | NA | 0.18 |
| B | 0.47 | 0.052 | $1.9 \times 10^{-4}$ | $9.2 \times 10^{-4}$ | NA | 0.52 |
| C | 0.67 | 0.043 | $4.0 \times 10^{-4}$ | $7.2 \times 10^{-4}$ | NA | 0.71 |
| D | 0.66 | 0.035 | $1.1 \times 10^{-3}$ | $7.2 \times 10^{-4}$ | NA | 0.70 |
| B Maximum Concentration Values* | 2.3 | 0.16 | $5.4 \times 10^{-4}$ | $4.2 \times 10^{-6}$ | NA | 2.5 |
| BACKGROUND@ | 495 (252$) | 3.5 # | 1800 | # | # | 2300 |

NOTES:

NA means not applicable.

* Note: This is for a 100-$m^2$ area only.

@ These values are for continuous exposure (365 days per year for 9 years) to ambient natural background based on the information in BEIR V. This is based on national average data and varies significantly throughout the U.S.

\# This includes inhalation of material other than radon and ingesting foods and soil.

$ The value in parenthesis is the direct exposure/dose from terrestrial sources (e.g., soils, rock, building material, air) and the balance is from cosmic radiation. These values are a national average and vary throughout the U.S.





PREDECISIONAL DRAFT - DO NOT CITE

## Table 2. Coldwater Creek Sediments Risk Projections (cancer incidents x $10^{-6}$)

| Location | Pathway | | | | | |
|---|---|---|---|---|---|---|
| | Direct | Inhalation | Radon | Soil | Fish | Total |
| RECREATIONAL USAGE | | | | | | |
| A | 0.55 | 0.044 | 0 | 0 | 0.16 | 0.71 |
| B | 1.5 | 0.13 | 0 | 0 | 1.7 | 3.3 |
| C | 2.2 | 0.10 | 0 | 0 | 1.4 | 3.7 |
| D | 2.0 | 0.10 | 0 | 0 | 0.9 | 3.0 |
| B Maximum Concentration Values* | 8.1 | 0.6 | 0 | 0 | 0.017 | 8.7 |
| COMMUNITY CLEANUP | | | | | | |
| A | 0.1 | 0 | 0 | 0 | NA | 0.1 |
| B | 0.28 | 0.031 | 0 | 0 | NA | 0.31 |
| C | 0.40 | 0.026 | 0 | 0 | NA | 0.43 |
| D | 0.40 | 0.02 | 0 | 0 | NA | 0.42 |
| B Maximum Concentration Values* | 1.4 | 0.096 | 0 | 0 | NA | 1.5 |
| BACKGROUND@ | 300 (150$) | 2.1 # | 1100 | # | # | 1400 |

**NOTES:**

NA means not applicable.

Values less than $1 \times 10^{-8}$ are indicated as zero.

* Note: This is for a 100-$m^2$ area only.

@ These values are for continuous exposure (365 days per year for 9 years) to ambient natural background based on the information in BEIR V. This is based on national average data and varies significantly throughout the U.S.

\# This includes inhalation of material other than radon and ingesting foods and soil.

$ The value in parenthesis is the direct exposure/dose from terrestrial sources (e.g., soils, rock, building material, air) and the balance is from cosmic radiation. These values are a national average and vary throughout the U.S.





PREDECISIONAL DRAFT - DO NOT CITE

# FUSRAP Document Management System

Year: 00
ID: 2789
Further Info? ☐

Operating Unit: North County
Site:
Area:
MARKS Number: FN:1110-1-8100g

Primary Document Type: Site Management
Secondary Document Type: Reference Documents

Subject or Title: Letter Report on the Risks Associated with Contaminated Sediments Present in Coldwater Creek, dated July 1993

Author/Originator:
Company: SAIC
Date: 7/1/1993

Recipient (s):
Company (-ies):
Version: Draft

Original's Location: Central Files
Document Format: Paper
Confidential File? ☐

Include in which AR(s)?

- ☑ North County
- ☐ Madison
- ☐ Downtown
- ☐ Iowa

Comments:
ETL: 1.6

SAIC number:
Filed in Volume: 1

Bechtel ID: