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Pre-Decisional Draft

DETERMINATION OF THE TEMPORAL RESOLUTION REQUIRED FOR THE HEDR DOSE CODE

Hanford Environmental Dose
Reconstruction Project
Dose Code Recovery Activities
- Calculation 008

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PREFACE

The primary objective of the Hanford Environmental Dose Reconstruction (HEDR) Project is to estimate the radiation dose that individuals could have received as a result of the emissions since 1944 from the U.S. Department of Energy's (DOE) Hanford Site near Richland, Washington. An independent Technical Steering Panel (TSP) directs the project, which is conducted by Battelle Pacific Northwest Laboratories (BNW).

One of the major objectives of the HEDR Project is to develop several computer codes to model the airborne releases, transport, and environmental accumulation of radionuclides resulting from Hanford operations from 1944 through 1972. In July 1992, the HEDR Project Manager determined that the computer codes being developed (DESCARTES, calculation of environmental accumulation from airborne releases, and CIDER, dose calculations from environmental accumulation) were not sufficient to create accurate models.

A team of HEDR staff members developed a plan to assure that computer codes would be developed to meet HEDR Project goals. The plan consists of five tasks: 1) code requirements definition, 2) scoping studies, 3) design specifications, 4) benchmarking, and 5) data modeling.

This report documents one of a series of scoping calculations performed as part of the dose code recovery activities for the Hanford Environmental Dose Reconstruction Project. These scoping calculations form a mutually-dependent set that build upon each other, and each is best read in the context of the others. The complete list of scoping reports is shown in the table on the following page.

This report is intended to provide a definitive technical basis to help determine the temporal resolution that should be included in the HEDR process for estimating human radiation dose. The work documented in this report was performed concurrently with other tasks. Information developed in the course of the work for this document influenced the course of other studies and vice versa. In the interest of prompt interaction between the HEDR staff, the TSP, and the public, this report is being issued in its current form.

The reader should note that recommendations on several design issues have been made to the TSP, in part as a result of the studies described here. The recommendations pertinent to this report are 1) reducing the number of nuclides from three to one (iodine-131), 2) using weekly data for the iodine-131 emitted in the 1940s and monthly thereafter, and 3) dividing the geographic area in which a person may have received a dose of radiation into 1064 sections instead of the 2091 suggested by the draft requirements. Additional scoping calculations are in progress or planned, and each will be documented in similar project reports.

Title	Calculation Number
Scoping Calculations for Components of the Cow-Milk Dose Pathway for Evaluating the Dose Contribution from Iodine-131	001
Determination of the Contribution of Livestock Water Ingestion to Dose from the Cow-Milk Pathway	002
Determination of Radionuclides and Pathways Contributing to Dose in 1945	003
Determination of Radionuclides and Pathways Contributing to Cumulative Dose	004
Determination of Dose Distributions and Parameter Sensitivity	005
Determination of the Feasibility of Reducing the Spatial Domain of the HEDR Dose Code	006
Determination of the Spatial Resolution Required for the HEDR Dose Code	007
Determination of the Temporal Resolution Required for the HEDR Dose Code	008

CONTENTS

TABLES

1.0 INTRODUCTION

A series of scoping calculations has been undertaken to evaluate the radiation doses that may have been received by individuals living in the vicinity of the Hanford site. Recommendations determined from these scoping calculations are provided to the Hanford Environmental Dose Reconstruction (HEDR) Technical Steering Panel (TSP) with the intent of providing a definitive technical basis to assist in deciding the temporal resolution that should be included in the HEDR process for estimating dose for individuals. This scoping calculation is designed to provide information pertinent to developing the dose code, especially information relevant to code flexibility and data availability; the intent is to simplify the amount of information that must be stored and retrieved.

The primary impetus for this scoping calculation was to assess the consequences of selecting alternative computational time steps for the main Hanford Environmental Dose Reconstruction (HEDR) Project models. Current conceptual design of the primary HEDR dose code requires compiling a very large database of daily intermediate results; reduction in the size of this database could have significant impact on the selection of a final design strategy.

This scoping calculation (Calculation 008) examined the potential for changes in the uncertainty distributions of potential doses from releases in the year 1945 as a function of temporal resolution of the intermediate data storage. This study builds on the work initiated in the fifth scoping calculation, which addressed the uncertainty of the dose estimates at a point; the sixth calculation, which extrapolated the doses throughout the atmospheric transport domain; and the seventh, which evaluated the spatial scales across the domain. A projection of dose to representative individuals throughout the proposed HEDR atmospheric transport domain (Ramsdell and Burk 1992) was prepared on the basis of the HEDR source term (Heeb 1992). Addressed in this calculation were the contributions to iodine-131 thyroid dose of infants from 1) air submersion and groundshine external dose, 2) inhalation, 3) ingestion of soil by humans, 4) ingestion of leafy vegetables, 5) ingestion of other vegetables and fruits, 6) ingestion of meat, 7) ingestion of eggs, and

8) ingestion of cows' milk from Feeding Regime 1 as described in scoping calculation 001.

2.0 TECHNICAL METHODS

Thyroid doses were calculated for infants with maximal exposure parameters throughout the current HEDR atmospheric transport domain, using results from the detailed HEDR source term (Heeb 1992), the HEDR atmospheric transport model RATCHET (Ramsdell and Burk 1992), and the PILOT code developed to prepare analyses for preparation of a plan for performing sensitivity and uncertainty analysis of the HEDR model. Individuals were assumed to have a rural lifestyle, with milk supplied by a backyard cow supported on Feeding Regime 1 (HEDR staff 1991, page 2.17). The parameters used in the calculations were those intended for use in the main calculational model (Snyder et al. 1992). In the analysis for scoping calculation 005, the distributions from Snyder et al. (1992) were shown to lead to doses for which the uncertainties were dominated by two factors, the feed-to-milk transfer factor, and the ingestion dose factor. Therefore, analyses were also performed with these two parameters set to constant values, so that the atmospheric transport and deposition values could be evaluated without these confounding factors.

Surface deposition data used were calculated (J. V. Ramsdell Jr., data transfer, December 1992) using the RATCHET atmospheric dispersion code (Ramsdell and Burk 1992) based upon the latest Hanford iodine-131 source term information reported by Heeb (Heeb 1992, page 4.36). Daily air concentrations and surface depositions from 100 realizations were used in these scoping calculations (J. V. Ramsdell Jr., data transfer, December 1992).

2.1 USE OF PILOT CODE FOR CALCULATION OF DOSES

As part of the dose code studies, a prototype implementation of the full set of required equations has been made. This prototype code, called PILOT, is still in development; results must be considered to come from unverified software. However, the developers are reasonably comfortable with its results. The PILOT code was used to calculate the case listed below.

The case simulated was that of an infant drinking milk from a backyard cow fed on Feeding Regime 1. Monthly and total 1945 thyroid dose results from iodine-131 were estimated using the PILOT code for the combined pathways of 1) air submersion and groundshine external dose, 2) inhalation, 3) ingestion of soil by humans, 4) ingestion of leafy vegetables, 5) ingestion of other vegetables and fruits, 6) ingestion of meat, 7) ingestion of eggs, and 8) ingestion of cows' milk from Feeding Regime 1. These doses included the seasonally-dependent variation in vegetation growth, cow-feeding patterns, and fresh food availability.

PILOT code results for 6-mile by 6-mile grid nodes in the vicinity of Baker City, Oregon, and Eltopia and Spokane, Washington, were provided with all parameters varying stochastically, with the feed-to-milk transfer factor and ingestion-dose-factor set to constant (median) values, and with these parameters held constant and the environmental media averaged over different lengths of time.

2.2 EVALUATION TECHNIQUES

The factors of feed-to-milk transfer and dose-per-unit ingestion are only varied by realization, not by day. Because these two parameters currently induce large variability in the calculated dose estimates and because they are essentially independent of time (at least in the current implementation of the model), the results were evaluated without these two sources of uncertainty. Visual inspections of the median, minimum-to-maximum range, and lower and upper percentiles were used to evaluate the impacts of storing data daily versus weekly.

3.0 RESULTS/DISCUSSION

The primary impetus for this scoping study was to assess the consequences of selecting various alternative computational time steps for the main HEDR models. The current conceptual design of the primary HEDR dose code requires compiling a very large database of intermediate daily results; a reduction in the size of this database could have significant impact on the selection of a final design strategy.

The HEDR modeling strategy (Shipler and Napier 1992) indicates that, for years after about 1950, the modeling effort should be reduced to about a monthly time step because of the lack of availability of finer resolution of source term or environmental transport data. This lack of input data suggests that it is not necessary to carry internal calculations with a greater resolution than the data support, because any appearance of improved accuracy would probably be misleading. Thus, this analysis is directed toward the period of highest projected doses, the period of the mid- to late-1940s.

3.1 EVALUATION OF TEMPORAL IMPACTS

Summary annual thyroid dose results from the PILOT Code, with dose factors and feed-to-milk transfer factors set to their median values, are shown in Table 1 for Baker City, Oregon, and Eltopia and Spokane, Washington. Complete results of the PILOT Code estimation are provided in the Appendix. Results are shown for two cases: 1) daily time steps in the dose code and 2) weekly time steps in the dose code. Results are impacted in only the second or third significant figure of any of the calculated numbers. This is true for any month and any location. It is apparent that, for a person who remained within the domain during these time steps, the time step for calculating the dose is not significant.

There are actually very few parameters, other than the source term and atmospheric transport, that vary on a daily basis in the current model. The most important of these is the ingestion rate of various food products. However, when the dose is integrated over a period of other than a few days, the daily variations in the diet tend to cancel out. The day-to-day changes in the environmental concentrations tend to become small, because, even if

TABLE 1. Summary of Annual Thyroid Dose Distributions to Infants Drinking Milk from Cows Fed on Regime 1 at Three Locations for Daily and Weekly Time Increments, Transfer Factor and Dose Factor Held Constant (rad)

Location	5th Percentile	Median	95th Percentile
		Daily Increment	
Baker City	0.0579	0.212	0.593
Eltopia	15.6	33.3	68.6
Spokane	1.42	2.90	5.82
		Weekly Increment	
Baker City	0.0581	0.211	0.592
Eltopia	15.8	33.5	68.9
Spokane	1.42	2.94	5.82

there is little-to-no deposition on any given day, environmental contamination from previous deposition events lingers in the environment. Thus, storage of data in, and access from, the environmental contamination database, could be performed on time steps of a week, resulting in changes of less than one percent in the calculated doses and their estimated uncertainties compared with calculations performed on a daily time step.

3.2 EVALUATION OF CODE FLEXIBILITY

There is only one notable disadvantage to storing data on time steps longer than one day. This is the loss of flexibility in estimating doses to people who moved within the HEDR domain during periods of high contamination. The dates at which such people may be allowed to change residences would be constrained by the resolution of the environmental contamination data. For certain locations, such as immediately east of the Hanford Site during the year 1945, the dose accrued on a single day may approach the TSP dose decision level (Shleien 1992). However, if the person remained within this area for more than a few days, the actual fraction of the total dose that this represents would be quite small, and it is likely that such variations would be small in comparison with the uncertainty calculated for the remaining exposures. Because it should be rare that individuals will request doses for exposures lasting less than one week, the fractional loss of resolution in the dose calculation caused by using a weekly time step should be less than 10 percent for all individuals.

3.3 ADDITIONAL COMMENTS

It must be emphasized that the dose estimates presented in this scoping calculation do not represent final dose estimates for any person living in the HEDR study area. The computations use parameters selected to represent a general class of potentially-exposed individuals and may not adequately represent any one person. The computation described herein is intended solely as a theoretical screening device to direct the attention and level of detail needed in the development of the final dose code package.

4.0 RECOMMENDATIONS

Scoping calculations were performed to evaluate the impacts of use of various alternative levels of temporal resolution in the main HEDR dose calculation. The recommendations below are based on an accumulation of evidence tempered by the desire to reduce the size of the HEDRIC environmental accumulation database. Based on the results of this scoping study, the following recommendations are made for the HEDR project:

- Data within the environmental accumulation database should be stored on a weekly time step, for the period of the 1940s.
- Data for times beyond 1950 should be stored on a monthly time step, to acknowledge the loss of resolution in the source term and atmospheric transport data.

5.0 QUALITY ASSURANCE

Quality assurance was undertaken in accordance with PNL-MA-70, Volume 1, Procedures for Quality Assurance Program, under PNL administrative procedure PAP-70-301, "Hand Calculations, General." Complete documentation of the calculation was prepared by the authors, who performed the calculations. A thorough independent review was conducted by a senior scientist independent of the HEDR project. Documentation is on file and available for review.

6.0 REFERENCES

HEDR staff. 1991. Air Pathway Report; Phase I of the Hanford Environmental Dose Reconstruction Project. PNL-7412 HEDR Rev. 1, Pacific Northwest Laboratory, Richland, Washington.

Heeb, C. M. 1992. Iodine-131 Releases from the Hanford Site, 1944 Through 1947. PNWD-2033 HEDR Vol. 1, Battelle, Pacific Northwest Laboratories, Richland, Washington.

Ramsdell Jr., J. V., and K. W. Burk. 1992. Regional Atmospheric Transport Code for Hanford Emission Tracking (RATCHET). PNL-8003 HEDR, Pacific Northwest Laboratory, Richland, Washington.

Shipler, D. B., and B. A. Napier. 1992. HEDR Modeling Approach, PNWD-1983 HEDR, Battelle Pacific Northwest Laboratories, Richland, Washington.

Shleien, B. 1992. Scoping Document for Determination of Temporal and Geographic Domains for the HEDR Project, Technical Steering Panel.

Snyder, S. F., W. T. Farris, B. A. Napier, T. A. Ikenberry, and R. O. Gilbert. 1992. Parameters Used in the Environmental Pathways (DESCARTES) and Radiological Dose (CIDER) Modules of the Hanford Environmental Dose Reconstruction Integrated Codes (HEDRIC) for the Air Pathway. PNWD-2023 HEDR, Battelle, Pacific Northwest Laboratories, Richland, Washington.

APPENDIX

PILOT CODE RESULTS FOR THREE LOCATIONS FOR INFANTS FOR DAILY AND WEEKLY TIME STEPS

PILOT CODE RESULTS FOR THREE LOCATIONS FOR INFANTS FOR DAILY AND WEEKLY TIME STEPS

The following pages were prepared with the PILOT code. The PILOT output was manipulated into a readable form using commercial software called SAS®. Data are provided for three locations and their surroundings: Baker City, Oregon, Eltopia, Washington, and Spokane, Washington. The node representing Baker City is node 152. That representing Eltopia is node 962. The node representing Spokane is node 1507. Nodes are numbered sequentially, with the lower numbers being to the south and west on the grid.

Several statistics are provided for each node. Doses are presented for each month of the year 1945. The months are labeled MON. Results of the stochastic analyses are provided in terms of the minimum (MIN), fifth percentile (P5), twenty-fifth percentile (Q1), median (MEDIAN), seventy-fifth percentile (Q3), ninety-fifth percentile (P95), and maximum (MAX) value calculated in the 100 realizations. The totals at the bottom of each column are the actual calculated totals for the year, they may not be the sum of the individual monthly values.

Information pertinent to the calculations appearing on each page is presented on the bottom of the page.

NODE=152 (BAKER)

MON	MIN	P5	Q1	MEDIAN	Q3	P95	MAX
1	0.000000	0.000000	0.00000	0.00000	0.00000	0.00000	0.00000
2	0.000000	0.000000	0.00000	0.00000	0.00000	0.00000	0.00000
3	0.000000	0.000000	0.00000	0.00000	0.00001	0.00007	0.00014
4	0.000000	0.000001	0.00000	0.00000	0.00001	0.00002	0.00007
5	0.000415	0.001065	0.00293	0.00723	0.02022	0.08546	0.24551
6	0.000105	0.001289	0.00422	0.01245	0.03387	0.22328	0.85636
7	0.000066	0.000630	0.00193	0.00398	0.01518	0.06669	0.75894
8	0.010034	0.051747	0.16672	0.35816	0.63827	3.06945	6.16570
9	0.006474	0.030265	0.07283	0.14054	0.29034	0.73767	1.24954
10	0.000924	0.004233	0.01131	0.02333	0.05362	0.20618	0.40425
11	0.000158	0.000363	0.00082	0.00167	0.00380	0.01033	0.02501
12	0.000015	0.000041	0.00007	0.00016	0.00035	0.00076	0.00215
	0.019820	0.10982	0.30480	0.61920	1.05397	4.68724	8.69579

NODE=962 (ELTOPIA)

MON	MIN	P5	Q1	MEDIAN	Q3	P95	MAX
1	0.00025	0.00066	0.0027	0.0065	0.0156	0.036	0.083
2	0.00076	0.00123	0.0033	0.0064	0.0101	0.028	0.072
3	0.00011	0.00023	0.0007	0.0014	0.0027	0.007	0.018
4	0.01160	0.02129	0.0414	0.0973	0.3688	2.270	10.613
5	0.66268	2.83904	5.9546	10.9097	20.3673	62.184	222.995
6	1.40856	4.99394	13.4992	23.9668	40.6741	141.361	318.204
7	1.39642	5.40883	13.9394	22.0926	46.6855	142.746	230.019
8	1.13199	4.28806	8.1435	15.9948	28.5753	82.250	155.635
9	1.58024	4.14202	11.0075	21.1815	39.4004	115.429	398.093
10	0.76140	2.21512	6.2485	21.4291	48.6494	133.759	302.636
11	0.10170	0.19165	0.4095	0.8364	1.6510	3.681	8.046
12	0.06135	0.11344	0.2211	0.3100	0.4658	0.820	1.142
	9.17085	26.6412	65.6622	125.065	211.171	592.663	1545.60

NODE=1507 (SPOKANE)

MON	MIN	P5	Q1	MEDIAN	Q3	P95	MAX
1	0.00005	0.00010	0.00039	0.00083	0.00164	0.0050	0.0118
2	0.00001	0.00002	0.00005	0.00009	0.00018	0.0004	0.0008
3	0.00002	0.00003	0.00011	0.00026	0.00049	0.0024	0.0072
4	0.00143	0.00229	0.00503	0.00751	0.01089	0.0210	0.0486
5	0.00387	0.00711	0.01278	0.02150	0.03694	0.1282	0.3943
6	0.11790	0.35003	0.64828	1.35890	2.71564	10.7584	26.1243
7	0.13862	0.40221	0.94870	1.88331	3.46745	12.4256	32.4319
8	0.16430	0.38635	1.00148	1.93315	3.28957	11.6875	27.8972
9	0.32822	0.57017	1.68921	3.13333	5.05218	16.1120	33.9839
10	0.03355	0.12876	0.27846	0.43391	0.96867	2.4980	7.8488
11	0.01657	0.02664	0.05628	0.09233	0.16835	0.5441	1.3082
12	0.00157	0.00407	0.00700	0.01162	0.01885	0.0514	0.1335
	0.91460	1.81351	5.21221	9.39057	16.5175	47.5966	122.495

A "NORMAL" run

NODE=152 (BAKER)

MON	MIN	P5	Q1	MEDIAN	Q3	P95	MAX
1	0.000000	0.000000	0.00000	0.00000	0.00000	0.00000	0.00000
2	0.000000	0.000000	0.00000	0.00000	0.00000	0.00000	0.00000
3	0.000000	0.000000	0.00000	0.00000	0.00001	0.00005	0.00011
4	0.000000	0.000001	0.00000	0.00000	0.00001	0.00001	0.00003
5	0.000721	0.001481	0.00299	0.00873	0.01739	0.05220	0.10361
6	0.000456	0.001802	0.00480	0.01279	0.03470	0.15884	0.25929
7	0.000276	0.000525	0.00202	0.00458	0.01216	0.05457	0.18703
8	0.016289	0.085658	0.19606	0.38667	0.57103	1.53319	2.95884
9	0.015802	0.036054	0.08168	0.14575	0.23122	0.42731	0.71246
10	0.002597	0.005224	0.01314	0.02129	0.03824	0.14633	0.40335
11	0.000292	0.000450	0.00097	0.00185	0.00300	0.00726	0.01200
12	0.000027	0.000045	0.00010	0.00016	0.00025	0.00053	0.00104
	0.039188	0.19461	0.33873	0.66078	0.92734	1.97692	3.88051

NODE=962 (ELTOPIA)

MON	MIN	P5	Q1	MEDIAN	Q3	P95	MAX
1	0.00045	0.00073	0.0025	0.0060	0.0125	0.035	0.099
2	0.00085	0.00159	0.0033	0.0056	0.0085	0.019	0.113
3	0.00011	0.00029	0.0006	0.0013	0.0025	0.005	0.021
4	0.00935	0.02329	0.0446	0.0886	0.3442	1.990	4.556
5	1.66308	3.02322	6.3831	11.9468	19.6478	52.928	133.473
6	4.63007	6.07420	13.8641	25.5840	38.4434	106.434	143.334
7	3.71358	7.84408	14.4921	24.8133	44.4566	77.992	127.571
8	2.91512	5.55923	10.5278	15.8329	27.4038	49.305	74.756
9	3.75921	5.68392	11.2162	19.8668	35.6324	84.147	123.450
10	1.29470	2.28340	8.8610	20.4886	39.4405	88.546	139.758
11	0.19096	0.29325	0.5139	0.8637	1.2691	2.350	2.495
12	0.11928	0.15022	0.2216	0.2802	0.3506	0.453	0.583
	24.3464	42.5028	70.8212	128.546	202.503	465.628	639.343

NODE=1507 (SPOKANE)

MON	MIN	P5	Q1	MEDIAN	Q3	P95	MAX
1	0.00007	0.00009	0.00044	0.00073	0.00164	0.00287	0.0048
2	0.00002	0.00003	0.00005	0.00009	0.00014	0.00026	0.0006
3	0.00002	0.00004	0.00011	0.00025	0.00050	0.00124	0.0049
4	0.00240	0.00313	0.00453	0.00652	0.00905	0.01741	0.0418
5	0.00680	0.00837	0.01189	0.02058	0.03199	0.07323	0.2615
6	0.25542	0.47541	0.87783	1.48115	2.29127	6.90377	9.6467
7	0.29165	0.53678	1.11530	1.92392	2.98123	7.67500	15.5694
8	0.27899	0.64700	1.14060	1.86122	3.13343	7.02326	11.0839
9	0.59902	0.94104	1.87977	2.73614	4.67214	9.28041	16.3139
10	0.11925	0.18693	0.32664	0.45918	0.71093	1.58494	2.4336
11	0.03090	0.03603	0.06855	0.09734	0.13580	0.31287	0.6560
12	0.00288	0.00566	0.00788	0.01116	0.01554	0.03193	0.0774
	1.74933	3.52523	6.20618	8.65503	13.6939	32.6163	54.0926

TRANSFER FACTORS set to central value

NODE=152 (BAKER)

MON	MIN	P5	Q1	MEDIAN	Q3	P95	MAX
1	.0000000	0.000000	0.000000	0.00000	0.00000	0.00000	0.00000
2	.0000000	0.000000	0.000000	0.00000	0.00000	0.00000	0.00000
3	.0000000	0.000000	0.000000	0.00000	0.00001	0.00002	0.00006
4	.0000001	0.000000	0.000001	0.00000	0.00000	0.00000	0.00001
5	.0001204	0.000269	0.000675	0.00155	0.00402	0.01163	0.02381
6	.0000746	0.000321	0.001120	0.00244	0.00724	0.04487	0.12537
7	.0000446	0.000099	0.000380	0.00091	0.00276	0.01494	0.11990
8	.0064049	0.019965	0.058190	0.12446	0.24584	0.78725	2.19729
9	.0017180	0.011744	0.024312	0.04757	0.09489	0.22869	0.40952
10	.0006168	0.002074	0.005491	0.01295	0.02693	0.06710	0.13702
11	.0001052	0.000196	0.000529	0.00121	0.00267	0.00706	0.01280
12	.0000126	0.000019	0.000051	0.00011	0.00026	0.00053	0.00104
	.011216	0.044296	0.10237	0.19956	0.38699	1.26769	2.49888

NODE=962 (ELTOPIA)

MON	MIN	P5	Q1	MEDIAN	Q3	P95	MAX
1	0.00018	0.00030	0.00168	0.00377	0.0073	0.0211	0.0420
2	0.00039	0.00065	0.00158	0.00268	0.0046	0.0088	0.0198
3	0.00005	0.00008	0.00020	0.00053	0.0010	0.0027	0.0038
4	0.00848	0.01126	0.02611	0.05959	0.1363	0.4862	1.1977
5	0.22033	0.47089	1.17977	1.99178	3.0332	8.2427	12.5563
6	0.51502	1.01788	2.68195	4.32085	7.6512	14.1700	22.6481
7	1.09129	1.83168	4.86555	8.14542	14.3676	49.0111	72.3227
8	0.94619	1.37053	2.88999	5.60715	10.3375	23.8281	39.9523
9	0.77549	1.02776	2.84041	4.32369	6.9601	19.9132	28.8136
10	0.54491	1.41640	2.88503	6.23443	12.6941	25.5965	39.5881
11	0.09242	0.17892	0.38294	0.81357	1.6922	3.4961	7.9909
12	0.02967	0.07540	0.17965	0.24557	0.3457	0.6950	0.8562
	5.87989	7.20476	19.8473	34.6334	55.2962	139.300	175.225

NODE=1507 (SPOKANE)

MON	MIN	P5	Q1	MEDIAN	Q3	P95	MAX
1	0.000015	0.00004	0.00017	0.00034	0.00074	0.00171	0.00306
2	0.000006	0.00001	0.00002	0.00003	0.00005	0.00021	0.00029
3	0.000005	0.00001	0.00004	0.00011	0.00022	0.00051	0.00074
4	0.000647	0.00103	0.00232	0.00319	0.00470	0.00792	0.01254
5	0.001584	0.00286	0.00508	0.00881	0.01400	0.04916	0.25733
6	0.053574	0.08683	0.20596	0.35950	0.66065	1.50189	2.09749
7	0.052524	0.09236	0.21966	0.45520	0.69694	1.45404	2.39742
8	0.080050	0.11859	0.23794	0.47713	1.08264	2.19350	2.87926
9	0.095165	0.26035	0.65239	1.34425	2.35414	3.73826	6.13897
10	0.017527	0.08162	0.16255	0.28746	0.62382	1.21045	1.62862
11	0.012018	0.01846	0.04025	0.06589	0.12543	0.25917	0.41455
12	0.001157	0.00221	0.00488	0.00750	0.01304	0.02423	0.03731
	0.31609	0.81530	1.64030	3.16828	5.48651	8.99683	12.4655

DOSE FACTORS set to central value

NODE=152 (BAKER)

MON	MIN	P5	Q1	MEDIAN	Q3	P95	MAX
1	.0000000	0.000000	0.000000	0.00000	0.00000	0.00000	0.00000
2	.0000000	0.000000	0.000000	0.00000	0.00000	0.00000	0.00000
3	.0000000	0.000000	0.000000	0.00000	0.00000	0.00001	0.00001
4	.0000001	0.000000	0.000001	0.00000	0.00000	0.00000	0.00001
5	.0002119	0.000330	0.000852	0.00208	0.00323	0.00722	0.01319
6	.0001648	0.000575	0.001088	0.00209	0.00600	0.02226	0.05660
7	.0000832	0.000181	0.000358	0.00097	0.00278	0.01309	0.02334
8	.0062845	0.025224	0.073716	0.12801	0.23368	0.49640	0.60494
9	.0075922	0.015750	0.031244	0.05026	0.07084	0.12165	0.16437
10	.0020618	0.003308	0.007168	0.01341	0.02027	0.04601	0.06348
11	.0001211	0.000300	0.000686	0.00125	0.00213	0.00382	0.00806
12	.0000123	0.000030	0.000064	0.00012	0.00017	0.00030	0.00052
	.018531	0.057922	0.13501	0.21167	0.34952	0.59351	0.79484

NODE=962 (ELTOPIA)

MON	MIN	P5	Q1	MEDIAN	Q3	P95	MAX
1	0.00022	0.00040	0.00137	0.00326	0.0073	0.0164	0.0305
2	0.00041	0.00106	0.00185	0.00251	0.0034	0.0052	0.0080
3	0.00007	0.00010	0.00020	0.00045	0.0008	0.0018	0.0030
4	0.00619	0.01616	0.02926	0.05706	0.0956	0.3722	0.7743
5	0.51203	0.73356	1.29076	1.84948	2.4715	4.5539	6.6149
6	1.22208	2.01486	3.22217	4.62359	5.9929	8.6698	12.8515
7	1.68929	3.33065	5.74306	8.54410	11.0296	21.1176	33.0973
8	1.48418	2.48538	4.09745	5.88916	7.7400	10.7562	15.0055
9	1.56440	1.93877	3.12092	4.58401	6.2663	10.6169	19.02[illegible]
10	1.12907	1.80696	3.88269	6.37777	8.8719	17.4060	26.2743
11	0.17292	0.27066	0.49241	0.82968	1.2548	2.1959	2.4286
12	0.09631	0.13001	0.18383	0.22327	0.2689	0.3430	0.4955
	10.3903	15.6397	25.7314	33.3305	46.0873	68.6946	77.4800

NODE=1507 (SPOKANE)

MON	MIN	P5	Q1	MEDIAN	Q3	P95	MAX
1	0.00002	0.00005	0.00020	0.00038	0.00058	0.00104	0.00133
2	0.00001	0.00001	0.00002	0.00003	0.00005	0.00009	0.00015
3	0.00001	0.00001	0.00004	0.00010	0.00019	0.00033	0.00048
4	0.00150	0.00201	0.00246	0.00306	0.00355	0.00446	0.00532
5	0.00325	0.00481	0.00626	0.00813	0.00990	0.04255	0.14082
6	0.12136	0.15584	0.24377	0.37942	0.46780	0.75064	1.38414
7	0.14111	0.18536	0.30192	0.38985	0.56128	0.84346	0.95486
8	0.13127	0.21260	0.33745	0.48328	0.70681	1.31960	1.60674
9	0.35665	0.52051	0.86605	1.25519	1.67601	2.68841	3.37467
10	0.09129	0.13272	0.22140	0.29687	0.43368	0.90138	1.17743
11	0.02470	0.02788	0.04563	0.06601	0.09417	0.14827	0.19559
12	0.00238	0.00397	0.00534	0.00709	0.00922	0.01337	0.02156
	1.12565	1.42490	2.27488	2.90281	3.95880	5.82310	6.35587

DOSE FACTORS and TRANSFER FACTORS set to central values

NODE=152 (BAKER)

MON	MIN	P5	Q1	MEDIAN	Q3	P95	MAX
1	.0000000	0.000000	0.000000	0.00000	0.00000	0.00000	0.00000
2	.0000000	0.000000	0.000000	0.00000	0.00000	0.00000	0.00000
3	.0000000	0.000000	0.000000	0.00000	0.00000	0.00001	0.00001
4	.0000001	0.000000	0.000001	0.00000	0.00000	0.00000	0.00001
5	.0001622	0.000358	0.000837	0.00204	0.00344	0.00779	0.01349
6	.0001836	0.000586	0.001095	0.00206	0.00611	0.02144	0.05646
7	.0000852	0.000190	0.000536	0.00123	0.00322	0.01333	0.02462
8	.0057344	0.023761	0.071316	0.12696	0.23318	0.49088	0.60414
9	.0079998	0.015277	0.032038	0.05026	0.07210	0.11782	0.16389
10	.0021080	0.003442	0.007397	0.01348	0.02134	0.04655	0.06050
11	.0001211	0.000307	0.000687	0.00125	0.00229	0.00390	0.00806
12	.0000125	0.000030	0.000064	0.00012	0.00017	0.00030	0.00052
	.018590	0.058133	0.13252	0.21072	0.34878	0.59199	0.79551

NODE=962 (ELTOPIA)

MON	MIN	P5	Q1	MEDIAN	Q3	P95	MAX
1	0.00023	0.00041	0.00142	0.00332	0.0073	0.0163	0.0304
2	0.00040	0.00105	0.00179	0.00254	0.0034	0.0051	0.0078
3	0.00007	0.00010	0.00019	0.00044	0.0008	0.0017	0.0030
4	0.00626	0.01651	0.03852	0.05748	0.1018	0.3506	0.7035
5	0.55211	0.79315	1.37097	1.92465	2.5297	4.4469	6.3914
6	1.20041	2.01991	3.21811	4.56510	5.9248	8.7278	12.9552
7	1.67060	3.31785	5.76369	8.54107	10.9648	21.0241	32.8725
8	1.47474	2.51461	4.08994	5.92014	7.7986	10.7398	15.1119
9	1.58372	1.94654	3.15900	4.63162	6.1033	10.2980	19.4179
10	1.13738	1.77612	3.91307	6.41296	8.8817	16.9845	26.5208
11	0.16851	0.27027	0.50364	0.84244	1.2388	2.1973	2.4283
12	0.09711	0.13040	0.18379	0.22329	0.2693	0.3434	0.4956
	10.4446	15.7612	25.7677	33.4771	46.4772	68.9125	77.7862

NODE=1507 (SPOKANE)

MON	MIN	P5	Q1	MEDIAN	Q3	P95	MAX
1	0.00002	0.00005	0.00020	0.00036	0.00059	0.00104	0.00133
2	0.00001	0.00001	0.00002	0.00003	0.00005	0.00009	0.00015
3	0.00001	0.00001	0.00004	0.00010	0.00018	0.00032	0.00047
4	0.00150	0.00201	0.00246	0.00301	0.00356	0.00439	0.00533
5	0.00346	0.00503	0.00683	0.00920	0.01387	0.05912	0.11924
6	0.11719	0.15254	0.24456	0.37674	0.47440	0.72884	1.33652
7	0.14002	0.18625	0.29975	0.39356	0.56902	0.83373	0.97647
8	0.13272	0.20706	0.34100	0.48943	0.72013	1.32123	1.59047
9	0.36106	0.52733	0.87636	1.24504	1.67503	2.64582	3.36201
10	0.09251	0.13039	0.21752	0.30146	0.43860	0.90417	1.17795
11	0.02228	0.02728	0.04575	0.06602	0.09243	0.14573	0.19506
12	0.00239	0.00399	0.00533	0.00710	0.00921	0.01339	0.02159
	1.11610	1.42586	2.28984	2.93566	3.99901	5.82498	6.35117

WEEKLY averages of concentrations, DOSE FACTOR and TRANSFER FACTOR set to central values

DATE
FILMED
3/19/93