4B104

Woodward-Clyde Federal Services

Memorandum

000064243

1 of 5

To Neil Holsteen
EG&G

From Chuan-Mian Zhang
Pat Westphal

Office WCFS-Denver

Date Oct 7, 1994

Subject Objectives for Surface Water Modeling
Rocky Flats RFI/RI Report, Operable Unit No 6 (Walnut Creek Priority Drainage)

Within the last month, technical staff at Woodward-Clyde have conducted a preliminary evaluation of the surface water modeling for OU-6, focussing on the modeling objectives, source loads to the Walnut Creek drainage, the potential for contaminant migration, and the expected results of the modeling effort The major objective of the surface water modeling for OU-6 is to assess contaminant fate and transport in support of human health and ecological risk assessment For the human health risk assessment (HHRA), this entails predicting long-term average concentrations of contaminants in stream flow and in stream sediment at Indiana Street, the assumed exposure point for off-site receptors At EG&G's direction, only contaminant sources within OU-6 are to be used as contaminant loads to the Walnut Creek drainage

Our evaluation has led to the following conclusions

(1) the worst-case condition for exposure to contaminants in the drainage is direct exposure to current contaminant concentrations in pond sediments,

(2) contaminant concentrations in pond sediment will not increase in the future from source loads in OU-6, which are insignificant compared to existing pond sediment concentrations,

(3) little potential exists for contaminanted pond sediment transport beyond the ponds themselves, even under flood conditions,

(4) health risks under the worst-case on-site exposure condition are not likely to exceed EPA levels of concern (cancer risk > 10^{-4}), therefore, estimates of exposure concentrations for other conditions may not be needed to support remediation decisions

Although these conclusions could probably be supported without full scope work of surface water modeling using the Hydrogical Simulation Program - Fortran (HSPF) model, we propose to continue the modeling effort The modeling will be used to validate these conclusions for purposes of the baseline HHRA for OU-6 and to demonstrate negligible incremental risk from exposure of off-site receptors to predicted long-term average concentrations in water and sediment at downgradient exposure points We also acknowledge the merit of this model in serving other objectives than the

1/5

baseline HHRA, such as providing stream segment data for ecological assessments, modeling contaminant loads from outside OU-6, and supporting evaluation of future use scenarios at Rocky Flats

The rationale for our conclusions is described below

(1) Current Condition Is Worst-Case
(2) Current Sediment Contaminant Levels Will Not Increase from OU-6 Sources

Concentrations of chemicals of concern (COCs) in OU-6 media were reviewed to identify source loads for the model This review showed that contaminant concentrations were highest in the pond sediments themselves and that other potential sources of contaminant loadings to Walnut Creek in OU-6 (such as surface soil or groundwater) were insignificant in comparison This is demonstrated using summary statistics for plutonium-239/240 (Pu) in various media as an example

Summary Statistics for Plutonium in Various Media

Medium	No of samples	Arithmetic mean (pC_i/g)	Standard deviation (pC_i/g)	Maximum (pC_i/g)	Percent of results > 3 42 pC_i/g*
Pond sediment	50 (A- and B-series ponds)	16 25	32 80	180 2	46%
Stream sediment	15	0 29	0 51	1 95	0%
Surface soil	118	0 994	1 949	15 22	5%
Pond water (unfiltered)	51 (A- and B-series ponds)	0 015 (pC_i/l)	0 019(pC_i/l)	0 076(pC_i/l)	NA

* Risk-based screening level for plutonium-239/240 in soil, assuming residential use, is 3 42 pC_i/g (DOE 1994)

Review of the summary statistics shows that average Pu activities are one to two orders of magnitude higher in pond sediments than in stream sediment or surface soil in OU-6 This difference is typical of the concentrations of COCs in the various media The data support the conclusion that surface soil in OU-6 is not a likely source of radionuclides in pond sediment If only sources in OU-6 are considered, the future activities of Pu in pond sediment can be expected to decrease rather than

increase because overland flow will carry relatively clean soil into the ponds Therefore, transport of contaminants presently in pond sediments is the chief concern for predicting future conditions

Consequently, our preliminary evaluation turned to the assessment of (1) the potential for significant sediment transport to downstream exposure points and (2) for health risk to exceed a level of concern at downstream exposure points

(3) Minimal Potential for Sediment Transport

A screening-level evaluation of the potential for sediment transport off-site was conducted The B-series ponds (B1 through B-5) were selected for the evaluation because of the high radionuclide activities in sediments in ponds B-1 through B-4 The bed shear stress at the selected cross-sections along the B-series ponds under a 100-year flood event was estimated and compared to the critical shear stress for sediment suspension to determine if the pond sediment could be resuspended and transported out of the ponds Two scenarios with varying flood hydrographs (2-hour duration and 24-hour duration) were examined under the assumption that the ponds were full before peak flow coming

The results of tests indicate if the peak occurs at the later stage when ponds are filled up, except for Pond B-4, the bed shear stress during a 100-year flood event will not exceed the critical shear stress for suspension for consolidated silt and clay, which is assumed to represent the condition of the pond sediment (a common assumption for lake sediment, however, this parameter should be measured in the field before any decision is made) This means under such conditions, no pond sediment will be resuspended, except for Pond B-4 The suspended sediment from Pond B-4 may flow into Pond B-5 However, because of the sufficient capacity of B-5 the majority of sediment will resettle in Pond B-5 The very fine material of the suspended sediment from Pond B-4 may be carried out through the spillway of Pond B-5

This test case is based on a very conservative assumption Usually, under normal initial conditions (pond water is at 10-25% of capacity), 100-year flood may suspend pond sediment but may not carry the sediment out of the pond series The volume of runoff in the South Walnut Creek watershed during a 100-year flood event was estimated to be 72 ac-ft by using the Colorado Urban Hydrograph Procedure model (Wright McLaughlin Engineers 1969, and UDFCD 1989) The pond capacity of B-5 alone is 74 ac-ft If the peak of 100-year flood occurs at the early stage of the flood, it may have potential to scour the pond sediment However the suspended sediment may not be discharged out of Pond B-5 because it has sufficient capacity to store the flood volume, and detention time is sufficient for suspended sediment to resettle During the later stage of the flood, outflow over spillway may occur While the outflow rate could be much smaller than the peak inflow rate, the flow velocity in the pond could be low and the associated shear stress could be smaller than the critical shear stress for sediment deposition Therefore sediment may not be transported with the outflowing water

(4) Health Risk from Direct Contact May Be Below Level of Concern

Current contaminant concentrations in pond sediment appear to represent the worst-case condition for assessing health risk from exposure to sediment since, over time, concentrations are expected to decrease rather than increase (see 1 and 2 above) A preliminary risk assessment was performed for direct contact with sediment in Ponds B-1 through B-4, which contain the highest contaminant concentrations in the A- and B-series ponds The assessment evaluated ingestion and inhalation of Pu, americium-241, uranium-235, aroclor-1254, carcinogenic polycyclic aromatic hydrocarbons, and bis(2-ethylhexyl)phthalate, using 95% upper confidence level estimates of mean concentrations in the top 2-foot composite samples and assuming residential exposure to exposed sediments This is an extremely conservative exposure scenario that will overestimate probable risk by approximately two orders of magnitude, since actual exposure to submerged sediment in ponds is likely to be intermittent and short-term The estimated cancer risk under the residential scenario was 8×10^{-5}, which is below the level of 10^{-4} that usually determines whether remediation is required at Superfund sites (provided noncarcinogenic effects and ecological effects are not a concern) Considering that actual risk under a more reasonable exposure scenario, such as intermittent recreational use or exposure during ecological field studies, is likely to be about two orders of magnitude lower, direct exposure to contaminated pond sediment on-site is not likely to contribute significantly to overall risk, and risk would be negligible for off-site receptors, given the improbability of off-site transport of pond sediment

CONCLUSIONS

In summary, our preliminary investigations under the OU-6 surface water modeling task suggest that there is little likelihood of contaminated soils or sediments in OU-6 presenting a significant human health risk through surface water transport This is essentially because (a) risk from direct exposure to submerged pond sediment under probable exposure conditions are likely to be relatively insignificant and contaminant concentrations will not increase in the future based on OU-6 sources, and (b) even if the pond sediments present a significant risk, the potential for sediment to be transported downstream is minium at flood frequencies of 100 years or less With regard to continuing the OU-6 surface water modeling task given these insights, we propose to continue that effort under the assumption that it is beneficial to validat these conclusions and that other objectives, such as evluating futuer use scenarios or other loading to the watershed, can aslo be supported by the model

References

U S Department of Energy (DOE) 1994 Programmatice Preliminary Remediation Goals Rocky Flates Plant, Golden, Colorado

Urban Drainage and Flood Control District, Denver, Colorado 1989 CUHPE-PC, A Personal Computer Digital Model for Storm Hyetograph and Hydrograph Prediction

Wright-McLaughlin Engineers 1969 Urban Strom Drainage Criteria Manual, Volume I

cc Bob Clark, WCFS
Mary Lee Hogg, EG&G
Andis Berzins, EG&G
Kate Power, WCFS
Pat Westphal, WCFS
Frank Lan, WCC
Rob Zuber, WCC
Keith Little

(4047-610-0018-625) (ou6sw mem) (10/07/94 4 10pm)