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November 10, 1993

93-RF-13912

ADMIN RECORD

Richard J Schassburger
Acting Director
Environmental Restoration Division
DOE, RFO

Attn N Castañeda

OPERABLE UNIT NO 6 DRAFT TECHNICAL MEMORANDUM NO 3, MODELING - WSB-456-93

This letter transmits the regulatory agency comments and EG&G Rocky Flats, Inc responses to Operable Unit 6 Draft Technical Memorandum No 3, Modeling

If you have any questions regarding this transmittal, please contact E C Mast of my staff at extension 8589

WSBly

W S Busby
Acting Director
ERM/Remediation Project Management

NAH dql

Orig and 1 cc - R J Schassburger

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EPA COMMENTS

Item or Section	Comment	Resolution
1 0 1	General Comments The conceptual model should include at least a brief characterization of the contaminant sources present at OU6 For instance, this section lacks a discussion of whether any contaminants are likely to be present as immiscible phases in the subsurface If contaminants are likely to be present as dense nonaqueous phase liquids, the scope of modeling effort will have to expanded to consider multiply pathways at each subsite, particularly some that involve subcropping sandstones	A brief discussion of the potential contaminant sources at OU 6 will be added
1 0 2	The intent of Section 2 0, General Conceptual Model of Operable Unit 6, is to identify and describe potential exposure scenarios for present and future human receptors in OU6 The exposure pathways should be updated as necessary to be consistent with Tech Memo 2 for OU6	The exposure scenarios and exposure pathways to be used at OU 6 are delineated in Technical Memorandum #2 "Exposure Scenarios " Any changes due to comment resolution on technical memorandum #2 will automatically apply to technical memorandum #3
2 0 1	The limitations, assumptions, and uncertainties associated with the use of the ONED3 groundwater model at 0U6 have not been provided, as required by the IAG The OU6 shallow groundwater system is a variably saturated, heterogeneous, anisotropic, unconfined aquifer of limited extent Most of the various contaminant sources at OU6 are unlikely to fully penetrate the aquifer Application of the model ONED3 to the shallow groundwater system at OU6 will violate most of ONED3's underlying assumptions, as listed in the ONED3 model documentation (Bejin and van der Heijde 1993) The model assumes	Because the objective of the modeling is to support the OU-6 Human Health Risk Assessment, and limited OU-6 hydrogeologic and contaminant information is available to support a complex two- or three-dimensional numerical modeling approach, a conservative analytical modeling approach was selected for groundwater fate and transport modeling at OU-6 This is appropriate because the degree of model complexity need only be sufficient to provide conservative (i e , relatively higher) estimates of contaminant mass loading to Walnut Creek than would be simulated by a more complex model

Item or Section	Comment	Resolution
	• A uniformly porous confined aquifer • A homogenous and isotropic aquifer with respect to its hydraulic and transport characteristics • A semi-infinite aquifer in extent (in the positive x-direction) of constant thickness • A source fully penetrates the aquifer • A fully saturated groundwater flow regime • One-dimensional, steady-state, uniform, regional flow away from the source • The density and viscosity of the solute in the source and in the aquifer are identical and do not change with time • No solute advection of dispersion into or out of the confining layers	ONED3 was selected as the model code based on criteria specified in TM-3 ONED3 is similar to other analytical transport models in its governing equations and underlying assumptions, and in its limitations In general, limitations imposed by the underlying assumptions can be addressed by making conservative assumptions in the application of the model to OU-6, thus reducing the importance of model uncertainties with respect to risk assessment needs The following discussions address the model assumptions listed in comment 4-1
	The OU6 model description must list the model's underlying assumptions and discuss how violating the assumptions will affect the model results, show how uncertainty will be accounted for, and provide a justification for selection this model for risk assessment purposes despite the disparity between assumed and actual conditions	<u>A uniformly porous confined aquifer</u> - The primary limitation of this assumption is that it implies aquifer thickness is constant, a condition not necessarily true in all cases for an unconfined aquifer However, for the purpose of this study, steady-state conditions will be assumed for the OU-6 groundwater flow systems Under steady-state conditions with no aquifer stresses (i e , no pumping), unconfined aquifers also have constant thickness and, thus, the assumption of confined conditions is not a limitation

Item or Section	Comment	Resolution
		In reality at OU-6, the groundwater flow systems are probably highly transient, varying substantially in thickness during the year in response to local recharge events, in some cases possibly even becoming unsaturated at times However, contaminant movement through the transient OU-6 systems is probably slower than would occur if the flow systems were steady-state and of constant thickness equal to the average of the variable thicknesses Therefore, the ONED3 model, which will assume steady-state conditions and no aquifer stresses, should result in conservative (i e , faster) estimates of contaminant movement relative to actual conditions Moreover, when converting ONED3 simulated concentrations to mass loading rates at discharge points along Walnut Creek, a conservatively high value of groundwater flow rate will be applied to result in conservative estimates of loading <u>A homogeneous and isotropic aquifer with respect to its hydraulic and transport characteristics</u> - Limited data from the Phase I investigation are available for OU-6 to characterize aquifer heterogeneity and anisotropy Thus conservative values for hydraulic conductivity, effective porosity, dispersion coefficient, and soil bulk density will be applied to result in conservative model simulation results <u>A semi-infinite aquifer in extent (in the positive x-direction) of constant thickness</u> -The OU-6 model simulations will conservatively assume steady-state conditions, no aquifer stresses (e g , pumping), and homogeneous conditions

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Item or Section	Comment	Resolution
		Under steady-state conditions with no aquifer stresses (i e , no pumping), unconfined aquifers also have constant thickness Therefore, model boundary influences will be negligible in the OU-6 modeling, and will not adversely affect the conservative nature of the model results A source fully penetrates the aquifer - For the purposes of modeling, identified groundwater contamination areas will be used as the contamination source areas The identified groundwater contamination areas will be assumed to extend throughout the entire thickness of the saturated zone (i e , fully penetrating) at the measured concentrations, and to exist throughout the entire simulation period This will result in conservative estimates of contaminant loading to Walnut Creek A fully saturated groundwater flow regime - In reality, in some cases, portions of the OU-6 flow systems may become partially saturated during dry times of year Because contaminant migration rates are higher under fully saturated conditions than under partially saturated conditions, other things being equal, the assumption of fully saturated conditions in the ONED3 model will result in conservative estimates of contaminant migration One-dimensional, steady-state, uniform, regional flow away from the source - The assumption of these conditions is conservative in that it maximizes contaminant migration rates from source areas to discharge points along the creek Use of two- or three dimensional flow, or transient conditions would likely result in slower (less conservative) simulated transport rates

Item or Section	Comment	Resolution
		The density and viscosity of the solute in the source and in the aquifer are identical and do not change with time - Based on the low concentrations of contaminants detected in groundwater to date (i e , the low µg/L range), affects due to density or viscosity differences between the solute and water are not of concern This assumption is reasonable for OU-6 conditions No solute advection or dispersion into or out of the confining layers -- As discussed in TM-3, commingling of contaminant plumes from different source areas along complex flow paths is not believed to be prevalent at OU-6 Therefore, advection and dispersion of solute into a model domain from a source outside of the model is not a substantial concern Advection/dispersion of solute to above the water table or into the claystone bedrock is unlikely Advection and dispersion of solute out of the model domain would tend to reduce contaminant concentrations simulated at the creek Therefore, the assumption of no advection or dispersion out of the model is conservative Contaminants will not migrate ss/cs bedrock
2 0 2	The IAG requires that the model description include a summary of the data to be used with the model The only information provided is the parameter values and ranges given in Table 3-1 This table consists of textbook values Table 3-1 should be replaced with tables that summarize field-derived or locally representative values of hydraulic conductivity, effective porosity and bulk density if they are available If not, it should be explained where these parameters will be obtained and why they will be adequately representative of site conditions The OU6 model description gives no information on how the contaminant source terms will be configured in time and space and how this information will be input into ONED3 This information is critical to the model description and should be briefly explained here	Table 3-1 states that parameter values for groundwater modeling will be based on literature values and site-specific OU-6 and OU-2 data Where OU-6 data are available from the RI I/RI investigation, they will be used to specify or develop model parameters Where appropriate, OU-2 data will also be used to supplement the OU-6 data Literature values will be used for certain chemical-specific parameters (e g , octanol-water coefficient, degradation half-life) and where site-specific data are unavailable or highly uncertain

Item or Section	Comment	Resolution
	Finally, an adequate description of the model should show locations and distances of groundwater pathlines, discharge points to surface water or human receptors, and the length of time the simulations will be run	The draft version of TM-3 did not contain specific model details such as contaminant source term configurations, groundwater pathlines, discharge points to surface water or human receptors, and the length of time the simulations will be run, because compilation and analysis of data from the RFI/RI investigation is ongoing and had not progressed to the point where model details could be included A map showing source areas, potential groundwater flow and contaminant migration pathlines, and discharge points to surface water and potential human receptors will be prepared If the necessary data are available in time, this map will be included in the final version of TM-3 If not it will be submitted separately to EPA when completed A detailed description of all modeling procedures, input parameters and conditions, and results will be included in the OU-6 RFI/RI Report
2 0 3	ONED3's governing equations and initial and boundary conditions should be presented in this document or specific references provided The governing equations and initial and boundary conditions constitute the mathematical framework of a model and are an integral part of the model description This information is necessary for model evaluation	ONED3's governing equations and underlying assumptions are described in the model documentation (Belgin, M S 1989 SOLUTE, A Program of Analytical Models for Solute Transport in Ground Water International Ground Water Modeling Center, Colorado School of Mines, Golden, Colorado) A copy of the model documentation has been provided to EPA for review

Item or Section	Comment	Resolution
4 Section 3 2 1, Page 3-3, Paragraph 1	The text states "available site-specific data and fate and transport parameters, source areas, and hydrogeologic conditions will be integrated using ONED3 to simulate the fate and transport of dissolved-phase contaminants in the saturated zone from source areas through the alluvium and colluvium, to discharge points along Walnut Creek " This statement appears to discount the possibility that contaminants can move from alluvium and colluvium into subcropping sandstones and then discharge into Walnut Creek This situation appears to exist in nearby portions of OU-2 in hydrogeologic settings similar to portions of OU6 This situation must either be accounted for or justification provided for concluding that the bedrock pathways can be neglected without jeopardizing the utility of the model results In addition, the sources of the site-specific data on fate and transport parameters, source areas, and hydrogeologic conditions should be provided A summary of these data would be useful in this document	The hydrogeology of OU-6 differs substantially from that observed at OU-2 Based on the available OU-6 hydrogeologic data, subcropping Arapahoe No 1 Sandstone, which underlies portions of the alluvium and colluvium at OU-2, does not appear to be present at OU-6 Based on available data, the shallow groundwater system at OU-6 appears to consist of areas of saturated alluvium and or colluvium overlying claystone bedrock Data collected for OU-2 indicates that claystone, in general, has low permeability there, therefore, potential migration of contamination through subcropping sandstone or claystone bedrock pathways does not appear to be of concern at OU-6
5 Section 3 2 1 Pages 3-3, paragraph 2	The text states "contaminant fate and transport will also be evaluated using water balance and chemical mass balance analyses as a check for the reasonableness of the ONED3 results " The sources and validity of data for each component of the water and mass balance should be discussed	The results of the ONED3 model will be simulated concentrations of contaminants at the points where groundwater discharges to Walnut Creek In order to estimate contaminant mass loading this assumption is not a significant limitation to the creek, which is the input parameter required for the surface water model, estimates of groundwater discharge rates will be necessary (i e , the contaminant mass loading = the contaminant concentration multiplied by the discharge rate) The water balance analysis referred to in TM-3 will be used to estimate groundwater discharge rates The discussion of chemical mass balance analyses will be removed from the final version of TM-3

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Item or Section	Comment	Resolution
3 0 1	The surface water model description lacks a clear definition of the model inputs The text only states "model inputs will be a time series of precipitation and groundwater seep flows/loads" and "the time step is anticipated to be daily, or possibly smaller as appropriate to describe rainfall/runoff and erosional processes " The OU6 model description should indicate how data will be input into the model and include a discussion of the data sources and time step(s) to be used, and the types and recurrence intervals of storm events that will be simulated It should also discuss how seepage and base flow will be determined and input	HSPF9 inputs will be sequential times series of meteorological data, including precipitation, air and dew point temperatures, solar radiation, wind speed, and evaporation Except for the evaporation times series, the time series are obtained from Rocky Flats Plant meteorological tower as 15 minute readings and appropriately aggregated to a 1 hour interval by summing or averaging the 15 minute readings The evaporation time series is developed from the other series mentioned using aggregated daily values as input The resulting daily evaporation values are then disaggregated to obtain hourly values It was necessary to use daily values to develop the evaporation time series as the calibration criteria against which the series was developed has a daily resolution A 1 hour input (simulation) time step was chosen so that the effects of temporally short, but relatively intense meteorological events will not be obscured, as may occur if the meteorological conditions were considered on a mean daily basis Output can be obtained at any aggregation of the simulation interval Daily summaries will be used as 1 hour to 1 hour comparisons of simulated versus observed values requires extremely detailed boundary condition development and determination of localized variations that are beyond the scope of this project Further, though it would be possible to attempt flow calibration at this time scale, there are no water quality data available at this time resolution for use in such a model calibration Given that the water quality data are point readings, daily summaries of simulation are the preferred method

Item or Section	Comment	Resolution
		The simulation time frame to be used is July 1 , 1989 to June 30, 1993 This time frame was selected as it encompasses the period where flow and water quality data is available in sufficient quantity and quality for use in model calibration The four years meteorological data averages are considered typical for this region and include an event with a greater than ten year recurrence interval Simulating specific recurrence intervals are not in the scope of this project Seepage and baseflow are to be added to the model as sequential time series The seepage time series is a "boundary condition" that may be modified during the calibration process Initial estimates of seepage will be obtained from a sitewide groundwater flow model that is currently under development and modified during model calibration if necessary Baseflow data is a boundary time series that is available from pond operation records and flow recording instrumentation
3 0 2	The model description must specify what data will be used with the model and the sources from which it will be obtained Table 3-2 should include available field-derived values for the model parameters as well as the contamination input values and other boundary conditions or show where adequately representative values for these parameters will be obtained	The summarizing of file-derived values is part of the actual modeling process and should not be undertaken until model development is complete This development process requires knowledge of the chemicals of concern to be simulated before initial and boundary conditions can be addressed and field derived values selected It is inappropriate at this stage to determine field-derived values for the model parameters
3	The major contaminant transport and hydrologic equations used by the model should be presented in this report or specific references provided for where they can be obtained	HSPF is a comprehensive watershed level/water quality model that incorporates several decades of prior hydrologic/water quality research The underlying mathematical equations are contained in numerous references and are not assembled together in any one document The final TM will provide more extensive discussion of the underlying theory

Item or Section	Comment	Resolution
4 Section 3 3 1, Page 3-6, Paragraph 3	The flow routing technique used with HSPF9 assumes complete mixing in all surface impoundments However, if larger lakes or reservoirs with seasonal stratification are being simulated with HSPF9, then this model would not accurately handle pollutant fate and transport mechanisms Therefore, this model should only be used for portions of watershed that do not contain stratified impoundments	Rocky Flats Plant's reservoirs are assumed to be fully mixed based on their depth and turnover ratios
5 Table 3-2	The partitioning coefficient between dissolved and suspended states (KDJ) is listed as having no units If defined like other commonly used partitioning coefficients, this should have actual units Actual units should be listed on this table, or this parameter should be more explicitly defined	The listing of partitioning coefficient KDJ with no units and a range of 0-1 is in error KDJ is the distribution coefficient for the constituent between the dissolved state and adsorbed state (suspended and/or bed sediment associated) The units are in liters/mg with a minimum value of 1×10^{10} and no maximum value
6 Table 3-2	The partitioning coefficient (KDJ) has a range of values listed as "0-1" However, many contaminants exhibit ratios between dissolved and suspended states that would be much greater than 1 Either this software is incapable of handling partitioning of many contaminants or this range is incorrectly listed Therefore, either the table listing should be corrected, or the parameter definition should be explicitly stated, or the model has a very limited range of usage that excludes many organic contaminants	The listing of partitioning coefficient KDJ with no units and a range of 0-1 is in error KDJ is the distribution coefficient for the constituent between the dissolved state and adsorbed state (suspended and/or bed sediment associated) The units are in liters/mg with a minimum value of 1×10^{10} and no maximum value

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Item or Section	Comment	Resolution
4 0 1 Section 3 5 1, Pages 3-13 and 3-14	The Box Model is proposed to calculate contaminant concentrations under the following two scenarios (1) the transport of volatile organic compounds into a building and (2) the transport of particulate matter to on-site receptors The Box Model may not be the most appropriate choice for either scenario In scenario number 1, the Box Model may not accurately estimate concentrations for an enclosure such as a building Under these conditions, it may be difficult to accurately estimate the mean wind speed, a critical mathematical parameter in the Box Model In scenario number 2, other models such as the Industrial Source Complex Short Term (ISCST) may yield more accurate estimates than the Box Model This is especially true if the distance from the emission source (the contaminated soil) and the receptors exceeds 100 meters The text did not, but should, list the precise algorithm used for the Box Model since several variations exist The text should also include a mathematical justification for these algorithms	Both of the scenarios cited in this comment are for receptors immediately above or on the areas of contamination of concern The use of ISCST or other typically approved EPA models is not appropriate for estimating the impacts for receptors located within 100 meters of an emission source since predicted impacts tend to increase unrealistically as a result of forcing the interpolation of values for the internal dispersion parameters at inappropriately small distances For this reason the ISC model typically ignores estimates of impact contributions from emission sources on receptors less than 100 meters away The distance between emission sources and on-site receptors for the OU-6 modeling is much less than 100 meters which precludes the use of EPA-approved Gaussian models The Box Model is typically used to estimate on-site air quality impacts only where receptors are located within the immediate areas of the emissions source The Box Model estimates impacts by the use of one basic equation that estimates a concentration within a volume centered directly above the emission source of interest that is a function of wind speed, emission rate and the physical dimensions of the volume This equation is

Item or Section	Comment	Resolution
		$C_i = E_i / UA$ where, C_i - concentration of chemical component, i, in grams per cubic meter E_i - emission rate of chemical component, i, in grams per second U - wind velocity through the volume, in meters per second A - cross-sectional area of the volume, in square meters This equation is widely published and has been accepted for use by EPA for near-source impacts One citation of this equation can be found on page 88 of Volume II - Estimation of Baseline Air Emissions at Superfund Sites of the Air/Superfund National Technical Guidance Study Series, EPA-450/1-89-002a For the building scenario, the box model equation will be modified by using an appropriate value of the passive air exchange rate within the building to estimate a volumetric flow rate that is substituted for the product of the U x A term in the denominator

Item or Section	Comment	Resolution
2 Section 3 5 1, Pages 3-13 and 3-14	The Fugitive Dust Model (FDM) is proposed to calculate contaminant concentrations of particulate matter to off-site receptors The FDM is a widely used model to derive exposure point concentrations However, due to the complex algorithms used, the FDM is not as efficient as other models This is particularly true when multiple contaminant sources are involved, which is possible in the present modeling It can take days to complete one computer run Also, EPA in Region 8 prefers the use of the ISCST model	As described in the technical memorandum for the model description, FDM has an improved algorithm for gravitational settling and deposition as compared to the ISCST and is more suited for treatment of fugitive dust emission sources Validation studies for FDM have indicated that modeled particulate concentrations from fugitive dust sources agree much more significantly with concurrently monitored particulate concentrations than ISC These studies, conducted by TRC (EPA, 1989), concluded that FDM is a more suitable model for predicting particulate impacts from fugitive dust emission sources than from other available, EPA-approved models such as ISC on the basis of the following reasons • Existing ISC model algorithms produce physically unrealistic estimates of impacts • The virtual point source approach in ISCLT2 cannot handle complex source/receptor geometries In addition, FDM has been improved to incorporate an integrated line source algorithm Recent work has been conducted to revise the ISCST model so that it is more appropriate for modeling fugitive dust impacts from large surface coal mines One of the revisions includes changing the deposition algorithm in ISCST so that it is more consistent with the technique used in FDM

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Item or Section	Comment	Resolution
		The statement that execution time for FDM can be inordinately long is true under certain scenarios when hourly meteorological data is used with numerous sources with several particle sizes and corresponding gravitational settling velocities and a receptor grid containing a large number of receptors However, if ISCST were used with the same data input configuration, its execution time would also be long since specifying several particle size categories and settling velocities effectively increases the execution time in proportion to the average number of particle size categories used for each source In the OU-6 air modeling study, the number of receptors will be small (probably ten or less) and will be executed in a long-term mode with a joint frequency distribution, rather than hourly meteorological data Recent experience with executing FDM for OU-2, a modeling scenario with a similar number of sources and receptors, indicated reasonable execution times
3 Section 3 5, Pages 3-13 through 3-16	It is unclear if the modeled concentrations are calculated from the cumulative effects of all the defined sources This document may calculate contaminant concentrations individually from the sources The contaminant concentrations should be calculated from the aggregate effect of all the defined sources Also, the OU6 model description did not, but should clearly define all input terms used for the Box and FDM models	The modeling of particulate (radionuclide) impacts at off-site receptors at the perimeter of OU-6 will be performed by dividing the entire area of OU-6 into areas representative of a specific radionuclide soil concentration and estimating the cumulative impact of wind erosion from all these separate area sources Thus, ambient radionuclide modeling at the off-site receptors will consider the cumulative impacts from all radionuclide-bearing surficial soils on OU-6

Item or Section	Comment	Resolution
		On-site ambient radionuclide impacts from OU-6 will be modeled by designating an area that conservatively represents observed surficial soil concentrations of radionuclides The radionuclide soil concentration used for this representative location will be obtained from estimating the reasonable maximum exposure (RME) of all surficial soil radionuclide concentrations sampled on OU-6 The size of the area will correspond to an average size of one of the areas designated in the off-site particulate (radionuclide) modeling A similar approach will be used for estimating VOC concentrations within an on-site building RME values of sub-surface soil and groundwater VOC concentrations will be used to estimate an ambient VOC impact within an on-site building, located on OU-6 Using a RME value (95% percentile value of the mean of a data set) will provide a conservative estimate of potential VOC impacts within an on-site building that could be located anywhere within OU-6 The basis of the data used as inputs for the air models mostly will be from recent OU-6 soil sampling and groundwater monitoring programs performed in anticipation of the OU-6 RFI/RI report These data will include • Surficial soil sampling for metals, radionuclides, semi-volatiles and volatile organic compounds from all the IHSS's located within OU-6, surficial soil characteristics and concentrations will be estimated from these sampling data for the ambient radionuclide modeling

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Item or Section	Comment	Resolution
		• Groundwater concentration data gathered from the recently installed eleven monitoring wells on OU-6 for metals, radionuclides, semi-volatiles and volatile organic compounds Groundwater concentrations from these data will be used to provide estimates of liquid-phase concentrations for the on-site building modeling • Sub-surface soil concentration data for the on-site building modeling will be obtained from soil boring sampling conducted at locations near the surficial soil sampling locations on the OU-6 IHSS's Comparisons of the modeled off-site ambient radionuclide impacts to concurrently monitored RAAMP (i e , during the 1992 meteorological monitoring year consistent with the time frame of the meteorological data set used in the FDM modeling) data will be performed as a reality check Meteorological data for the FDM modeling will be from the 61m tower in the west buffer zone, located on the west side of the Rocky Flats Plant, for the calendar year, 1992 Data from the ten meter level will be merged with concurrent mixing height data from Stapleton International Airport Stability class will be determined from sigma theta and wind speed measurements obtained from West Buffer Zone database Meteorological data from this site is deemed representative of conditions in the vicinity of OU-6 and meet EPA quality control and quality assurance criteria

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CDH COMMENTS

Item or Section	Comment	Resolution
General Comment	On the surface the selected air models will probably be acceptable for the OU6 area, however, the input data should be monitored carefully	
Section 3 2 1	The choice of ONED3 as a contaminant transport model needs more justification The hydrologic conditions of the colluvium violate almost every assumption the model depends upon uniformly porous, confined aquifer, homogeneous, isotropic, uniformly porous, confined aquifer, homogeneous, isotropic, constant thickness, fully saturated, no density/viscosity differences between source and aquifer, no solute advection or dispersion into or out of the confined aquifer The text should discuss why these assumptions can be ignored ONED3 gives concentration as output, the water balance it totally irrelevant to the model Is the use of this model entirely theoretical or will some of the results be compared to data? In the second paragraph, page 3-3-, it is stated that a water balance and chemical mass balance will be performed to check the reasonableness of the model results It is not clear that the water balance is part of the conceptual model rather than a check on model output There is no discussion on how the water balance will be done What will be included? Very little field data exists for inflow and outflow, the methods used to estimate these flows differ in their complexity and accuracy What will be done to check the reasonableness of the water balance estimate? The method to be used for the chemical mass balance is not discussed either What assumptions and data will be used to calculate the mass balance?	Please see the resolution to PRC's comment 4-1 See also the resolution to PRC's comment 4-5

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Item or Section	Comment	Resolution
Section 3 5 2	The Model Selection Criteria Evaluation, Selection Criteria 3 and 4 page 3-16 states, " the FDM model has undergone considerable validation and verification " While there has been a considerable amount of work done on and with the FDM model, neither the reviewer, nor the Air Pollution Control Division (APCD) staff, is aware that the model has been validated The FDM is usable when applied to small areas of relatively flat terrain but does have problems with complex terrain If the FDM is used, the 1991 update version should be used	Since the FDM is on the EPA Bulletin Board for use as a public domain air quality model, it has been used in numerous regulatory applications and considerable study had been performed demonstrating its better agreement with monitored data as compared to other EPA-approved models such as ISCST, we had assumed that EPA had accepted FDM as a validated model However, within the limited area around OU-6 that FDM will be applied, we believe that it is the appropriate choice for modeling fugitive dust emission impacts at off-site receptors that are located within a relatively flat terrain area In addition, ongoing studies have been performed to further improve FDM Eventually, the superior deposition algorithm found in FDM will be incorporated into an improved version of ISCST that will be distributed for public use in the future, but not soon enough for the OU-6 modeling The most recent 1993 version of FDM available on the EPA Bulletin Board will be used for OU-6 modeling
Section 3 6	Under the Summary of Parameter Values on page 3-17 is a discussion of the meteorological data to be used The "met" data from the site if validated, however, consideration should be given to working in the data collected by APCD's three sites on the perimeter of the plant The data for these sites has been provided to the Plant and additional copies are available if requested from APCD The data from 1992 would be better for use in the model than 1991, although either would be acceptable	The 1992 meteorological data set from the West Buffer Zone, located on the west side of the Rocky Flats Plant, has been compiled, validated and formatted for use as a modeling data set Although, minor short-term variations in wind flow patterns may exist between the West Buffer Zone and the three APCD sites cited in the above comment, it is doubtful that significant differences in long-term (annual) average ambient concentrations at the off-site receptors and in representation of conditions around OU-6 would result from using the different data sets The use of multiple meteorological data sets to model impacts from OU-6 to the relatively close location of the off-site receptors is not warranted

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Item or Section	Comment	Resolution
Table 3-1	In the table effective porosity and bulk density are listed but they are not used in ONED3, what model will they be used in?	ONED3 requires input of a pore velocity value Pore velocity for ONED3 is equivalent to effective porosity Bulk density is used to calculate retardation factor from the distribution coefficient, Kd Retardation factor is an input to ONED3
Table 3-4	In this table under "Source" the document states, RFP Site Environmental Report for 1990 (EG&G 1991a)" would be used for "Joint frequency distribution of stability class, wind speed and direction" There should be a later report which would be better	At the time that this technical memorandum was being prepared, the West Buffer Zone meteorological data for 1992 was not yet available This data will be used for the OU-6 modeling and the joint frequency distribution of stability class, wind speed and direction presented in the OU-6 RFI/RI report will also be based on the West Buffer Zone data set

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CDH COMMENTS

Item or Section	Comment	Resolution
3 2 1	Although our reviewers do not concur with the DOE responses in the fullest possible extent, it has been determined that the proposed models and there applications will be sufficient, in most cases to meet the goals of the Phase I RFI/RI Workplan for OU-6 The one comment that was not satisfactorily addressed was in respect to Section 3 2 1 On the second comment to section 3 2 1 the responses to the following comments were inadequate • There is no discussion on how the water balance will be done • What will be done to check the reasonableness of the water balance estimate?	The ONED3 fate and transport model simulates concentrations of contaminants at the points where groundwater is simulated to discharge to Walnut Creek In order to estimate contaminant mass loading, which is the input parameter required for the Walnut Creek surface water model, separate water balance analyses to estimate groundwater discharge rates will be necessary (i e , the contaminant mass loading = the ONED3 contaminant concentration multiplied by the groundwater discharge rate) The water balance analyses referred to in TM-3 will be used to estimate the groundwater discharge rates
	DOE's response states, "The water balance referred to in TM-3 will be used to estimate groundwater discharges " Section 3 2 1 of TM-3 merely states that, "Contaminant fate and transport will also be evaluate during water balance and chemical mass balance analyses as a check for the reasonableness of the ONED3 model results " We are aware that water balance calculations will be performed How the balance will be calculated and how the results will be evaluated have not been discussed in the TM DOE should provide an informal written response to the two issues The Division will then inform DOE if the TM may be amended accordingly or whether additional information is needed	An average annual water balance will be estimated for the saturated alluvium or colluvium in the vicinity of each modeled contaminant migration pathway in order to estimate the annual groundwater discharge rate for that pathway The first step in this process will be to estimate the net groundwater recharge rate based on available meteorological data, soil and ground cover data, water level data, and other available OU-6 site-specific information Recharge information developed for OU-2 may also be used if OU-6 data are insufficient The next step will be to estimate the areal extent of the saturated zone based on the available OU-6 groundwater data

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		The average annual groundwater discharge rate will then be calculated by multiplying the net groundwater recharge rate by the saturated area This approach assumes no water is lost from the system due to evaporation from the alluvium or colluvium (i e , all groundwater recharge ultimately is discharged at Walnut Creek) This is a conservative estimate because it results in a higher estimate of groundwater discharge (and thus, contaminant loading) than would be calculated if evaporation from the alluvium and colluvium were included Estimates of groundwater discharge will be qualitatively compared to observed seep conditions, where possible, to verify that the groundwater model is not underestimating discharge rates However, it is anticipated that limited data will be available for OU-6 to quantitatively verify the water balance results Therefore, the groundwater recharge and discharge rate estimates will also be compared to those calculated for OU-2, where substantially more data are available to estimate recharge and discharge rates