COMMENT/RESOLUTION SUMMARY OF

EPA AND CDH COMMENTS ON SITEWIDE

TREATABILITY STUDIES PLAN

EG&G ROCKY FLATS

Environmental Restoration Program

May 28, 1991

U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant
Golden, Colorado

ADMIN RECORD

REVIEWED FOR CLASSIFICATION/UCNI (UNU)
By Karl L. Gallegos
Date 7/9/91

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COMMENT/RESOLUTION SUMMARY OF EPA AND CDH COMMENTS ON SITEWIDE TREATABILITY STUDIES PLAN

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General		December 21, 1990	
1	1	Mr. Robert M. Nelson, Jr., Manager Department of Energy Rocky Flats Area Office P.O. Box 928 Golden, CO 80402-0928 Mr. James O. Zane Rocky Flats Plant Manager EG&G Inc. P.O. Box 464 Golden, CO 80402-0464 Gentlemen: Attached are the Colorado Department of Health, Hazardous Materials Waste Management Division, ("The Division"), comments on the Draft Treatability Studies Plan submitted September 21, 1990. The purpose of writing a "Draft Treatability Studies Plan" is to screen both practical conventional and innovative technologies to determine the technologies which need the additional information gained by performance of treatability studies. The screening process is a comprehensive literature search on each technology, followed by application of appropriate Rocky Flats contaminate levels and types which should result in the elimination of some technologies as being inappropriate for Rocky Flats and other technologies for having sufficient information available to eliminate them from the treatability study process. "The Division" finds it difficult to believe that only three technologies have	The Treatability Studies Plan now includes innovative/emerging technologies.

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		sufficient information available to eliminate them from the "treatability study" process. The major flaw in the screening process used by DOE and EG&G is that the "Procedure for technology selection and screening" figure 5-1 page 5-2 is not an accurate interpretation of the screening process outlined in the EPA Guide for Conducting Treatability Studies Under CERCLA EPA/540/2-89/058, page 9 Figure 2. A copy of both flow diagrams is attached. The rearrangement and addition of steps in the selection and screening process results in performance of treatability studies for almost every technology. In fact, only three of the twenty-two "practical" standard conventional technologies evaluated are judged to have enough information available to avoid treatability studies.	The selection and screening process has been revised as suggested.
		DOE's screening process substitutes "Evaluate existing site data" with "Site characterization data", the difference being that all the site characterization data will not be available for several more years. The DOE screening process adds "Identify potential ARAR's", of which there is not mention in the IAG Statement of Work definition of Treatability Study. The biggest hole in the DOE screening process is opened by the replacement of "Search Literature to determine data needs", with DOE's "Determine Data needed for screening". By not performing a comprehensive literature search before identifying data gaps almost every technology must fall into the "Conduct Treatability Study" block.	ARARs must be considered in selecting and evaluating technologies since they define the contaminants of concern and the target treatment goals. A comprehensive literature search was used to identify and screen technologies.
		In addition, the Interagency Agreement (IAG), Statement of Work, page 39 XI, Treatability Study states, "Within the Treatability Study Plan, DOE shall submit information on performance, relative costs, applicability, removal efficiencies, operation and maintenance requirements, and implementability of candidate technologies in addressing the below listed general types of waste." Each of these six parameters must be addressed for each of	The screening process has been revised to include these six parameters.

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		the candidate technologies. The information submitted in the Appendix C Technology Data Sheets is incomplete.	The Technology Data Sheets have been expanded.
		There are no innovative new technologies screened in the plan. EG&G's two phase approach is not acceptable to "the Division." At a minimum, all of the technologies currently under review by the DOE's Office of Technology Assessment should be included in the Treatability Studies Plan.	Innovative/emerging technologies have been included in the revised TSP.
		The "Division" will not approve the Final Treatability Studies Plan unless the above concerns are addressed.	
		If you have any comments regarding our comments please contact Noreen Matsuura at 331-4920.	
		Sincerely, Gary W. Baughman Unit Leader Hazardous Waste Facilities Hazardous Materials and Waste Management Division	
		cc: Thomas T. Olsen, DOE Scott Grace, DOE Tom Greengard, EG&G Gary Anderson, EG&G Martin Hestmark, EPA Arturo Duran, EPA Teresa Hamoton, AGO	

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		Executive Summary. A two phase treatability studies plan is unacceptable given the time frame and scheduling of the IAG. Innovative and emerging technologies must be screened in the final treatability studies plan. DOE's Office of Technologies Assessment, Dr.Gloria Patten has several technologies under assessment. All of these technologies should be screened for applicability to Rocky Flats.	Innovative/emerging technologies have been included in the revised TSP.
2	1	Figure 1-1, page 1-4. The block diagram flowchart is unacceptable as shown in Fig.1-1.	The figure has been revised.
3	1	Section 3.0 Program Objectives, page 3-1. The purpose of the conducting treatability studies is not to generate data required to evaluate and screen technologies. The purpose of the conducting treatability studies is to generate data when there is not enough data available to evaluate and screen technologies. This slight change in word order forces treatability studies to be performed on almost every technology. It is not necessary to reinvent the wheel to asses the applicability of every available technology.	Screening criteria includes consideration of whether or not additional data is required to evaluate and screen technologies.
4	1	The list of specific objectives listed on page 3-2 needs to be checked against the parameters listed in the IAG Statement of Work Section XI Treatability Studies Plan.	The TSP conforms to the requirements of IAG Section XI.
5	1	Section 5.0 Technical Approach, page 5-1. The elements of the "Program" as stated are not independent. The "Treatability Studies Plan" sorts all technologies into two types. One type could be designated "Enough information available to determine relevancy to Rocky Flats". The second type could be designated, "Not enough information to evaluate relevancy to Rocky Flats, needs Treatability Study".	Section 5.0 has been revised.

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6	1	Only the technologies which need Treatability Studies need to have Treatability Study Work Plans and the subsequent Treatability Study Reports after the treatability study is performed.	Agree.
7	1	Figure 5-1 Technology Selection and Screening Process page 5-2. Enclosed is a copy of the analogous flow chart from the EPA Guidance document as cited in the transmittal letter. This guidance document is listed in the bibliography, and it remains a puzzle why it is not used in writing this document.	This figure has been revised.
8	1	It is not necessary to have complete site characterization data to identify applicable technologies.	Site characterization data, along with ARARs, is necessary to determine what has to be "treated." This information, plus literature review, data base search, etc., was used to identify potential technologies.
9	1	By not doing a comprehensive literature search before deciding whether enough data is available almost every technology must have treatability study performed on it.	
10	1	Section 5.1.2 ARAR Identification. It is not necessary to spend a lot of time determining ARAR's since they will be site specific and probably change between now and the time the site is actually remediated. IRIS, the risk assessment data base provides health based levels which are updated regularly. The use of IRIS for this and other site-wide documents where some information on ARARs is useful is recommended.	ARARs are an essential element in determining what technologies need to be considered.
11	2	Section 5.2.2. Practical Technologies and Applications, page 5-17. Each of the 26 technologies for water and 16 technologies for soil should have been evaluated on the basis of the six points listed in the IAG (Information on performance, relative cost, applicability,	Screening criteria has been revised as suggested.

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		removal efficiencies, operation and maintenance requirements, implementation of technology).	
12	2	Section 5.2.2.1 Water Technologies, page 5-18. Combination contaminants in media should have been addressed in a more specific manner in this section. For example, on page 4-6, the discussion of contaminants present at 881 Hillside lists radionuclides, chromium, iron, and three volatile chlorinated organics present in the soil. What technology or combination of the technologies could be used to remove all three types of contaminants and what order should the technologies be performed in to minimize cost and maximize removal efficiencies? There are chemical simulating process modeling systems available which given specific input and output concentrations would produce information on all six of the decision parameters listed in the IAG. It is not necessary to perform treatability studies on every technology when information is available in modeling programs or in a comprehensive literature search, in a more timely fashion than 36 months.	The sitewide TSP is not intended to address unique combinations of contaminants applicable to a specific OU. The sitewide TSP is also not intended to minimize costs or maximize performance. This level of effort must be done at the OU-specific level.
13	2	Section 5.2.2.2 Soil Technologies, page 5-24. The factual content of the soil technologies presented in these three pages could be summarized in the following sentence. Solidification/stabilization, soil washing and physical separation technology may be applied to soil contaminated with radionuclides and inorganics, organics may be removed by vacuum extraction, incineration, thermal desorption, or biological treatments in a slurry reactor, land farming, or in situ, an expensive method for treating radionuclides in soil is vitrification. It is difficult to believe that none of these technologies has been used at any other site on earth and no data is available on effectiveness, cost etc.	This section does not state that the technologies listed have not been used at other sites and no data exists.

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14	2	Appendix C Technology Data Sheets Section 2.1.1. Determining the Need for Treatability Studies page 7 in the EPA 540/2-89/058 Guide for Conducting Treatability Studies Under CERCLA December 1989 states, "After information on the physical and chemical characteristics of the waste has been performed. Technical information resources, including information from reports and guidance documents, electronic data bases, and experienced EPA staff are reviewed, and available performance and cost information on each technology is obtained and evaluated with respect to the waste type and site conditions present." Each of the technology data sheets in this appendix is an initial step in performing the analysis required to screen each technology. If this is the format chosen by DOE for analyzing each technology, all of the six points listed in the IAG must be addressed point by point. In addition to the three parts currently included, a description of the process, applications, and advantages and disadvantages currently reviewed for each process, the technology data sheets must address point by point, performance, relative costs, applicability, removal efficiencies, operation and maintenance requirements and implementability. For example, statements such as, "The vapor phase treatment unit may be costly" can hardly be construed as an analysis of relative cost. Nor can the statement, "High removal efficiencies for removal of these compounds is also reported by the American Water Works Association," be construed as a scientific technical analysis of process efficiency.	The six points listed in the IAG have been included in the screening process. It is not possible to provide quantitative, cost or removal efficiency information at this stage of technology evaluation.
15	3	Summary. The final Treatability Studies Plan must contain technical, specific, scientific documented information on each of the six points listed in the IAG for each of the 26 processes listed as "practical and conventional" in addition to a minimum of at least five or six innovative technologies currently not reviewed in the Draft Treatability Studies Plan. All of the technologies	The six points listed in the IAG have been included. Innovative/ emerging technologies have also been added to the screening process.

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		must be rescreened after a through literature search so that all of the technologies not need to undergo treatability studies. The technologies which have been determined to need treatability studies must have specific treatability study workplans outlined. The workplan should include a technology specific experimental procedure, not the content outline of an experimental procedure copied from the treatability study guidance. The workplan must include a data goal, for example a solubility, partition coefficient, reaction rate constants, etc. There are ten parameters for a treatability study workplan outlined in the IAG. For each technology chosen for a treatability study, a treatability study workplan which addresses all ten of the parameters listed in the IAG must be included in the final treatability study. The "Division" does not intend to approve EPA's Guide for Conducting Treatability Studies under CERCLA 540/2-89/053 as the Final Site Wide Treatability Studies Plan for Rocky Flat document.	Detailed workplans for each technology selected for the TSP will be prepared later.

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1	1	General. The content of the treatability studies plan (TSP) does not entirely fulfill the scope of work presented in Article XI, Attachment 2, of the IAG. The TSP does not include information on relative costs, removal efficiencies, operation and maintenance requirements, or implementability of all candidate technologies. Similarly, the TSP does not discuss analytical methods, data management and analysis,health and safety, and residual waste management issues as identified in Article XI. The TSP should address these issues for the screening and selection of candidate technologies for remedial alternatives and design.	Screening criteria now includes removal efficiency, operation and maintenance requirements, residuals and implementability. Costs are considered indirectly in operation and maintenance and were not considered directly since this is very site specific and since innovative technologies were considered for which little or no cost data is available. Analytical methods, data management and analysis and health and safety are not significant screening criteria at this stage of the process.
2	1	General. The TSP differentiates between practical technologies and emerging/innovative technologies. However, the current document only discusses practical (demonstrated, conventional) technologies. Site-wide treatability studies should include all technologies potentially applicable to mitigation of contamination at the site. Identification and evaluation of emerging/innovative treatment technologies should be discussed in the TSP. This should include provisions to evaluate potentially applicable technologies identified after the TSP is finalized.	Emerging/innovative technologies have been added to the screening process.
3	2	General. Applicable or relevant appropriate requirements (ARARs) should be identified during the screening of potential technologies before treatability testing. Chemical-, action-, and location-specific ARARs may restrict implementability of a particular technology at the site or indicate how a selected alternative must be implemented. As part of the TSP, these ARARs will affect the	Potential chemical specific ARARs were identified for use in the screening of potential technologies in the Final Treatability Studies Plan (see Appendix A and Table 4-2). Location and action-specific ARARs were not selected as they would provide little information on how effectively a technology treats waste.

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		selection of candidate technologies for treatability studies, remedial alternatives development, design, and action.	
4	2	General. Cleanup goals for target chemicals or waste groups should be defined in the TSP. The basis for evaluating the effectiveness of a treatment technology is to calculate removal efficiencies and compliance with established cleanup criteria (based on ARARs, see comment 3). Similarly, data quality objectives should be established in the TSP to define the data quality needs of the treatability studies program.	This issue arises at nearly every Superfund Site. The reviewer is correct in concept; however, from a practicability perspective, the concern cannot be addressed at this time because site-specific cleanup goals (action levels) will not be calculated until the early stages of the Feasibility Study. This is because the Baseline Risk Assessment (BRA) is required in order to identify the chemicals and pathways of concern as well as to identify the individual chemical/pathway/media risk contributions. As a practicable alternative, preliminary target cleanup goals can be established at MCL's for groundwater. This will allow the study to be conducted on the basis of the likely range of cleanup goals that technologies will have to achieve. The goal of treatability studies, as will be stated in individual TSPs, is to evaluate a particular technology's capability to reduce contaminants and to determine whether the treatment may have undesirable effects. The removal efficiency of the technology will be based on established criteria including established background levels or ARARs, both of which are presented and discussed in TSPs. Data quality objectives will be established in the Quality Assurance Addendas that will be developed for each TSP. The relationship between the QAPjP and QAAs is explained in Section 6.12. The content of the QAPjP and QAAs is also now summarized in this section.
1	2	Specific Comments Page 3-1, Paragraph 2. The text states that protocol for conducting treatability tests are required to ensure the data collected are accurate,complete and appropriate. A usual objective in data collection is to obtain measurements and samples that meet acceptable standards of accuracy, precision, comparability,	A Quality Assurance Addendum to the Site-Wide Quality Assurance Project Plan (QAPjP) will be developed for each individual Treatability Study Plan (TSP). Site-wide DQOs have been established and are presented in the QAPjP. However, it is more appropriate to establish DQOs on a site- and/or investigation-specific basis, based on the site specific characteristics and data needs of the investigations. Therefore, DQOs will be developed for each TSP and presented in the QAA that is

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		representativeness, and completeness. The text should include these standards in the protocols for conducting treatability studies. Also the data quality objectives for site-wide treatability studies should be defined. Rationale: The implementation of an appropriate quality assurance/quality control (QA/QC) program is required to ensure data of known and documented quality are generated. The quality of treatability testing data required should correspond proportionately to the implications of the decisions that will be based on those data.	developed for that particular TSP. The DQOs will establish acceptable measurements for accuracy, precision, comparability, representativeness, and completeness.
2	2	Page 4-5, Section 4.1. While summarizing the general contaminants of concern at the site, the text should indicate significant levels of acetone and toluene have been detected. Acetone has been detected at various locations through the site, and at (200-300 micrograms/kilogram (ug/kg)) concentrations at operable unit (OU)2 in the vicinity of the mound areas. Similarly, toluene has been detected at concentrations as high as 860 ug/kg at OU1. These contaminants should be considered in the selection of technologies for treatability studies. Rationale: Acetone contamination is difficult to mitigate because it is extremely soluble in water. High concentrations of acetone in waste streams or treatment residuals could affect the selection of a particular technology for remedial action. Toluene can be mitigated with standard technologies for treatment of volatile organic compounds, but should be considered in the technology screening process.	The maximum concentrations of acetone and toluene detected sitewide in soils and sediments were below the ARARs presented in Table 4-2. The potential ARARs selected for acetone and toluene in soils and sediments are based on human health-based criteria for systemic toxicants (reference doses). These are as yet potential and not the final ARARs. Lower ARARs or action levels may be selected during the specific operable unit CMS/FS process. As part of the annual reporting process and OU-specific programs, the selection of technologies will be reviewed where new ARARs are selected or where additional contaminants need to be considered.

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3	3	Page 5-1,Section 5.0. The technology screening and selection process should evaluate performance, implementability, removal efficiencies, relative costs and operation and maintenance requirements of candidate technologies (Article XI,Attachment 2,IAG). Similarly, ARARs should also be identified, including land disposal restrictions, Clean Air Act, fugitive dust and emission standards, transportation regulations and design and operating standards. Rationale: The treatment technologies should be carefully screened and selected after evaluating all relevant criteria. ARARs, in particular, are threshold criteria for eliminating technologies early in the screening process. All ARARs should be identified before beginning treatability and feasibility studies. (Also see general comments 1 and 4.)	These criteria have been added to the screening process. Potential chemical-specific ARARs were selected for use in this plan. These are not final ARARs, however, and will be subject to change during the CMS/FS process. Regulations such as those mentioned here which are not considered as ARARs in this Treatability Studies Plan, will be considered in the specific operable unit programs.
4	3	Page 5-3, Paragraph 1. The text lists three criteria for eliminating practical technologies from treatability tests. However, well-proven technologies should not necessarily be eliminated from laboratory or bench-scale testing during the screening process. Rationale: Laboratory and bench-scale tests are frequently used to evaluate specific waste types and waste streams with proven technologies. For example, biological treatment is well proven, but treatability tests are necessary to determine the waste stream toxicity and the removal efficiency of the treatment system for the specific waste.	Practical technologies, along with innovative and emerging technologies were screened based on the same criteria. Several "well-proven" technologies were selected for testing.

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5	3	Page 5-4, Paragraph 3. The primary objective of the treatability program as stated is to demonstrate the effectiveness of a given technology in reducing contaminant concentrations. Technologies may then be screened to develop remedial alternatives. The data from the treatability studies also should demonstrate the implementability and cost of a given technology. Rationale: Effectiveness, implementability, and cost are the three criteria for technology screening and development of remedial alternatives. If the results from treatability studies are to provide necessary information for planning OU-specific programs, these criteria should be evaluated. (Also see general comment 1.)	Treatability studies are not intended to address "implementability", which should be considered during the OU-specific remedy selection process. Detailed cost information also will not be developed during the treatability studies. However, the treatability studies will provide input to a cost evaluation, such as reagent dosage requirements, sludge production rates, etc.
6	4	Page 5-7, Section 5.1.2. Chemical specific ARARs should be identified and evaluated more carefully and included in the text. Similarly, location- or action-specific ARARs should not be deferred to full-scale implementation of the remedial alternative. Rationale: Chemical-specific ARARs establish the acceptable level of concentration of a chemical that may be found in, or discharged to, the ambient environment. For example, the national ambient air quality standards (NAAQS) under the federal and state clean air act are chemical-specific ARARs. Action-specific ARARs may affect the implementability of a particular technology at the site. Action-specific requirements do not in themselves determine the remedial alternative; rather they indicate how a selected alternative must be implemented. Location-specific ARARs may restrict the conduct of remedial activities or the concentration of hazardous substances solely because they are occurring in a particular place.	Potential chemical-specific ARARs were identified for use in the screening of potential technologies in the Final Treatability Studies Plan (see Appendix A and Table 4-2). NAAQS were not included as potential chemical-specific ARARs in this plan in that the requirements related to attainment of NAAQS are ARARs only when the remedial activity is a "major source" of emissions. Emissions from CERCLA activities generally are not expected to qualify as "major sources" according to EPA guidance (EPA/540/G-89/009). Location and action-specific ARARs were not selected as they would provide little information how effectively a technology treats waste. Location and action-specific ARARs and any additional chemical-specific ARARs will be considered as part of the OU-specific CMS/FS program.

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7	4	Page 5-7, paragraph 1. The toxicity characteristic leaching procedure (TCLP) is included in the text as a potential ARAR. The TCLP is the method to identify Resource Conservation and Recovery Act (RCRA)-characteristic or -listed wastes. The TCLP itself is not a regulatory level or potential ARAR. This should be corrected in the text. Rationale: Correct usage of terms minimizes the potential for misinterpretation.	This has been corrected in the text (see Section 4.2).
8	4	Page 5-15,Section 5.2.1. For practical purposes, the contaminants at the site were divided into five major groups. The text should also identify indicator or target chemicals of concern within each contaminant grouping that will be used to screen technologies. Indicator chemicals are selected based on concentrations and common contaminant fate and transport characteristics. Rationale: Contaminant groupings are practical for preliminary identification of technologies. However, selection of technologies should also be based on effectiveness of treatment of indicator chemicals at the site. Treatability processes can be screened for a group of contaminants (for example, volatile organic compounds (VOCs). However, individual chemicals will behave differently within that group. For example, toluene and p-xylene are relatively biodegradable, but o-xylene, m-xylene, and ethylbenzene are relatively undegradable. Similarly, trichloroethene is readily adsorbed on granular activated carbon, but vinyl chloride is only adsorbed in trace amounts.	The text has been revised to include the selection of target contaminants for use in the screening of practical technologies. Target contaminants were identified based on a review of maximum concentrations sitewide and a compilation of contaminants present at levels above ARARs in two or more operable units for groundwater surface water, soils, and sediments (see Section 5.2.1).

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9	5	Page 5-17, Section 5.2.2. This section identifies practical technologies and applications for treatment of the five categories of contaminants. However, the identification of the practical technologies for treatment of contaminants in soil and ground water is limited. The text should be expanded to include additional technologies and variations of listed technologies. Similarly, technologies for treatment of output streams and side streams generated as a result of treatment processes (for example, off-gas or aqueous effluent polishing from an air stripper) should be considered and listed in the text. Finally, technologies for treatment of light or dense nonaqueous phase liquids should be considered. Rationale: There are additional practical technologies which have not been considered in the TSP. Practical technologies for water and soils that should also be considered are listed below. These technologies have all been demonstrated at full scale. WASTE GROUP / WATER / SOILS Inorganic contaminants: Thermal treatment - wet air oxidation - pyrolysis; Carbon adsorption; Neutralization / Thermal treatment; In-situ chemical treatment; Vitrification (in-situ or ex-situ); Solidification/stabilization Radionuclides: Chemical extraction / Cement-based stabilization; In-situ vitrification Metals: Precipitation/ flocculation/ sedimentation; Oxidation/reduction / Cement-based stabilization; In-situ vitrification; Soil flushing	The list of technologies for treatment of soil and groundwater has been greatly expanded. Treatment of output streams and side streams is only considered indirectly, since many of the technologies screened could be used for this purpose. Treatment of light and/or dense nonaqueous phase liquids was not considered because no data indicating their presence was available. Additionally, these liquids are not "treated", rather, they are generally removed from an aquifer in bulk using special equipment.

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		Volatile and semi-volatile organic compounds Ultraviolet photolysis Incineration - liquid injection - rotary kiln - fluidized bed - pyrolysis Liquid-liquid extraction Microbial degradation (in-situ) Glycolate dechlorination Steam stripping In-situ vitrification Chemical extraction Glycolate dechlorination Pyrolysis	
10	6	Page 5-27, Paragraph 3. The text states effectiveness refers to the ability of a technology to treat a given volume of waste based on cleanup goals. However, cleanup goals have not been set. Cleanup goals for contaminants or waste groups at the site should be defined in the treatability studies plan. Rationale: Evaluating effectiveness without knowing cleanup goals or desired removal efficiencies is not appropriate. (Also see general comment 3.)	Cleanup goals are included as a criterion for the preliminary screening of treatment technologies in this Treatability Studies Plan (see Section 5.1.2). Although cleanup goals have not been set, potential cleanup goals were proposed based on the ARARs shown in Table 4-2 of the final document.
11	6	Page 5-28, Section 5.2.3. The rationale for selection or elimination of practical technologies for stage I treatability studies is not clear. With few exceptions, most treatment processes require treatability testing to determine the effectiveness for site-specific compounds,mixtures, and hydrogeologic conditions. Many conventional, demonstrated technologies require treatability studies to reduce cost and performance uncertainties for treatment alternatives to acceptable levels to support the selection of the alternative and remedial	Treatability testing to determine the effectiveness of site specific compounds, mixtures, and hydrogeologic conditions is better left to the OU-specific programs. This also applies to cost and performance optimization.

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		design. For an area-wide technology evaluation, each candidate technology should be evaluated with respect to data needs and treatment goals for the site. Criteria should be defined for selecting practical technologies for treatability studies with respect to effectiveness, implementability, and cost for mitigation of specific contaminants at the site. Rationale: It is difficult to identify treatment technologies applicable to all contaminant groups or even all individual contaminants within a group. Treatability testing should generate information for site-wide target compounds. The best technology for specific contaminants and contaminant groups should be evaluated and combinations of the technologies can then be selected for effective remediation of contaminants throughout the site and each OU.	Criteria for screening now includes effectiveness, implementability, and very general cost considerations.
12	6	Page 5-30, Paragraph 4. Granular activated carbon (GAC) adsorption should be considered for stage I treatability tests. GAC technology requires treatability tests to evaluate applicability to organic contamination on the site. For mixtures of contaminants known to exist at the site, liquid-phase adsorption isotherm tests should be performed. Subsequent dynamic column studies (batch tests) can be used to determine optimum contact time, mass transfer zones, and system configuration. Rationale: Treatability studies are necessary to evaluate the effectiveness, implementability, and cost of GAC technology for conditions at Rocky Flats.	Granular activated carbon was screened per the established criteria.

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13	7	Page 5-31, Paragraph 2. Membrane processes such as reverse osmosis and electrodialysis should be considered for stage I treatability tests. Although these are demonstrated technologies for certain metals, they should be evaluated for specific conditions at Rocky Flats. For example, for an efficient reverse osmosis process, the chemical and physical properties of the semipermeable membrane must be compatible with waste stream characteristics. Simple (bench scale) treatability studies could evaluate the optimum membrane requirements (geometry, chemistry, pore size) for effective removal of contaminants at Rocky Flats. Finally, the text should indicate what water quality parameters (concentration limits) are required for testing of these processes. Rationale: Treatability tests are necessary to evaluate reverse osmosis and electrodialysis technologies for conditions at Rocky Flats.	Membrane processes such as reverse osmosis and electrodialysis were screened using the established criteria.
14	7	Page 5-31, Paragraph 5. In-situ and above ground biological treatment are conventional and commercially available technologies and should not be deferred to the innovative/emerging technology assessment. These treatment processes, although sufficiently demonstrated, still require treatability tests to predict biological toxicity in the treatment plant. Rationale: Biological treatment processes are well demonstrated and not innovative or emerging. These treatment processes almost always require treatability tests to evaluate effectiveness and implementability for site-specific conditions.	In-situ and above ground biological treatment were added to the screening list.

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15	7	Page 6-1, Paragraph 3. The text states DQOs levels II and III will be used for all treatability studies. However, DQOs for the treatability tests will vary depending on significance and magnitude of the study. The text should be corrected to indicate the DQOs will be established for individual treatability studies. Rationale: In general, analytical levels I and II apply to laboratory screening treatability studies, and analytical levels III, IV and V apply to bench- and pilot-scale treatability studies.	This comment is essentially correct. DQO's should be established relative to the desired end-use of the data. This should include an evaluation of requisite detection levels as well as Precision, Accuracy, Representativeness, Completeness, and Comparability (PARCC) parameters. Once this step is completed, the proper analytical technique and corresponding level (i.e., Level I, II, etc.) can be specified. It is possible that, upon completion of the DQO process, certain analytical techniques with corresponding level IV and V may be required, particularly with respect to radionuclides.
16	7	Page 6-1, Paragraph 4. The text implies that the median and average contaminant concentrations for waste distributions will be the same. However, this is not necessarily true, and in general, the median and average values will be different. The text should state whether treatability tests will be performed with waste containing either the median or the average concentrations. Rationale: Unless the concentrations are normally distributed, which is seldom the case with chemical analyte populations, the median will not equal the average (mean). It is important to differentiate between median and mean for treatability testing as they may be significantly different depending on the distribution of values.	The text has been corrected to read "average (mean) and high contaminant concentrations" (see p. C-1).
17	8	Page 6-2, Paragraph 1. The text indicates that multivariable analysis will be provided, where appropriate, on additional tests to supplement treatability studies. The text should indicate the types of multivariable analyses to be performed during additional tests.	This level of information will be included in the individual Treatability Study Work Plans where appropriate.

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		Rationale: The utility of providing multivariable analyses (where appropriate) is not clear without the identification of specific tests.	
18	8	Page 6-5, Paragraph 2. While discussing the test approach for oxidation/reduction(redox) treatability studies, the text should specify the need for sampling waste stream and side stream residuals for evaluation during screening and selection. The text should indicate the need to identify/characterize the disadvantages and limitations of a particular process in addition to its effectiveness. Rationale: Chemical redox is an indiscriminant process and can result in incomplete reactions or unwanted side reactions. When using chemical redox techniques with chlorinated organic compounds the possibility of producing hydrochloric acid exists. Leach tests will need to be conducted or residual solids to determine the need for stabilization, and the liquid effluent should be analyzed to determine the need for further treatment.	This will be discussed in the detailed Treatability Study Work Plans.
19	8	Page 6-8,Paragraph 2. The TSP considers soil washing for organic compounds an innovative/emerging technology. However, soil washing for organic compounds is a demonstrated, practical technology and should be part of the TSP. Rationale: Soil washing for organic compounds has been effectively demonstrated using alkaline agent, surfactants, and biodegradable polysaccharides.	The TSP no longer specifically distinguishes between "Practical" technologies and "Innovative/Emerging" technologies.

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20	8	Page 6-12, Paragraph 1. The test objectives of the solidification/stabilization treatability tests should include determination of the waste-to-additive ratios, mixing and curing conditions. The short-term environmental impact of stabilizing wastes may be small, but long-term reliability is not well known. Provisions for monitoring all applicable parameters for the technology screening process should also be included in the objectives. Rationale: Leachate produced as a result of the curing process should be collected and analyzed. The heat generated by the curing or stabilization can drive off volatile organic compounds and may necessitate gas monitoring or screening. The determination of optimum waste-to-additive ratios, mixing, and curing conditions should be primary considerations during the treatability study.	This will be addressed in the detailed Treatability Study Work Plans.
21	9	Page 6-16, Paragraph 2. Phase 2 of the biological treatment treatability study should also establish optimum slurry densities, pH, temperature, and residence time. The need to monitor these parameters should be included in the statement of work. Rationale: The treatability study should monitor all parameters which are used to evaluate a technology in terms of implementability, cost, and effectiveness for technology selection and design.	Biological treatment technologies did not pass the final screening.
22	9	Page 7-1, Section 7.0. This section discusses schedules and deliverables for the treatability studies program, but only includes practical technologies. Schedules and deliverables for emerging/innovative treatment technologies treatability studies and treatability study work plans should be included.	The TSP no longer distinguishes between "Practical" technologies and "Innovative/Emerging" technologies.

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		Rationale: The evaluation of emerging/innovative technologies is an integral component of the treatability studies or Rocky Flats, but is not included in this document. Based on existing information, the treatability study plan should provide a statement of work for evaluating candidate technologies. This includes innovative/emerging technologies. Examples of these technologies from the Superfund Innovative Technology Evaluation (SITE) program are membrane microfiltration, solvent extraction, plasma reactor, infrared thermal destruction, and freezing separation. (Also see general comment 2.)	

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1	1	General Comments. As indicated in verbal comments provided during the meeting held November 27, 1990, the separation of the Treatability Study Plan (TSP) into two documents is inconsistent with the IAG requirements. A plan for identifying, testing and evaluating innovative and alternative technologies must be incorporated in this document. This should include both innovative technologies which show a potential to address problems for which conventional treatment options do not exist and technologies which may offer improved performance or cost advantages over those currently in use. Preparation of the plan must include a thorough review of available literature and ongoing work within DOE and elsewhere. Results of efforts completed at RFP for other purposes (such as TARs) should be incorporated as appropriate.	The TSP has been expanded and revised to include innovative and emerging technologies. Review of literature and ongoing work within DOE and EPA has been included. Screening criteria includes whether or not a technology includes advantages over more conventional, proven technology.
2	1	Various sections of the TSP discuss Future Treatability Study Workplans, Treatability Study Work Plans, Executable-level Plans, and Scopes of Work. These terms are not clearly defined or consistently used, so it is unclear what documentation will be prepared before work begins on a particular study. The TSP should define this clearly and propose a means by which EPA can participate in the scoping and planning process for each study.	Text has been revised.
3	1	The discussion of the role of the sitewide program and its interface with OU-specific treatability studies provided in the Program Objectives is not reflected in later sections. The objectives indicate the site wide program will reduce, often eliminate the need for OU-specific studies. The scopes of work provided for the five studies identified appear to defer everything beyond rudimentary jar testing to the OU-specific studies; this is not necessary or appropriate. Any testing, including bench and pilot scale, which addresses a problem reasonably expected to occur in more than one OU should be conducted under the sitewide program.	The discussion on the role of the sitewide program and its relationship with OU-specific studies has been greatly expanded (Section 3.1). Criteria for sitewide studies now is based on two or more OUs. Proposed testing, however, for the sitewide program is limited to lab/benchscale testing at this time. Pilot testing, which is generally used for obtaining design information for a specific application will be reviewed after completion of the bench tests and after additional review of technology data, contaminant data, and ARARs.

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4	1	Several sections of the TSP address the question of compliance with and preparation of other program documents. In many instances the terminology used is inconsistent and the text provided indicates general confusion over how all these documents fit together. These passages must be revised in accordance with verbal comments provided for the TSP and written comments on the SOPs and QAPjP; all treatability testing must be performed within the SOP/QAPjP framework, and test-specific documentation (SOPAs/QAAs) provided as needed.	All treatability tests will be performed within the SOP/QAPjP framework. Section 6.2.11 now explains the relationship between the site-wide QAPjP and TSP-specific QAAs. QAAs will reference the applicable SOPs and any SOPAs that will be adhered to during the conduct of the treatability studies.
5	1	The schedule information provided is incomplete and internally contradictory in some respects. A detailed schedule must be provided to show the various studies to be performed and the sequence of events leading to meeting established deliverable deadlines. Use of a larger scale and inclusion of more detail on the bar charts would help a great deal.	The schedule referenced in this comment has been deleted from this report. A new schedule, Figure 7-1, for the sitewide TSP has been included.
1	2	After discussing the technology selection process that will be used (Section 5.1), the TSP jumps directly to the technologies that were selected (Table 5.3). The actual selection process, which should be a major element of this presentation, is never directly addressed. The description of what technologies are and how they work can be adequately covered by data sheets such as those provided in Appendix C. The text should concentrate on presenting the how and why of the selection. Tabular and graphical format can be used very effectively to present this information in a concise form. Much of the other material presented here is valuable supporting information, but badly needs reorganization to present a coherent argument.	The TSP has been revised to better explain the screening process utilized and the how and why of the final selection. Numerous tables (Tables 5-3 A, B through 5-8) have been added to further clarify the process.

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2	2	Executive Summary. The TSP must present a scheme for evaluating the effectiveness of both innovative and emerging technologies as well as practical technologies which have a potential application to Rocky Flats (RF). The intent behind the language requiring delivery of the TSP within the proposed Interagency Agreement (IAG) is to utilize the literature to identify both practical and innovative technologies which have potential applicability to RF problems. The purpose of testing both innovative and practical technologies is to narrow the focus of the site specific treatability tests and support the site specific feasibility studies. All technologies potentially applicable should have been preliminarily identified through a search of the literature. Preliminary selection of potentially advantageous technologies should be predicated upon advantages in implementability, fewer adverse impacts than other available approaches, less process waste, or lower costs for similar levels of performance, in addition to the standard selection criteria of cost, effectiveness and implementability. The preliminary screening should have been completed as a prerequisite to developing this plan and should have included an evaluation of all emerging and innovative technologies as well as the practical and proven technologies. The proposed IAG does not anticipate more than this submittal. After developing this preliminary list of emerging and practical technologies, all technologies identified must then be carried through the screening process defined within this TSP.	Innovative and emerging technologies have been included in the revised TSP.
3	2	Section 1.0, page 1-4. Fig. 1-1 separates the treatability studies into two phases. This is not coordinated with the requirements of IAG in which only one document was anticipated to define a sitewide	The revised sitewide treatability study work plan will incorporate both practical and innovative/emerging technologies consistent with the requirements.

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		Treatability Study. Treatability studies for both practical and innovative/emerging technologies must be included in this document.	
1	3	Section 1.0, page 1-5. Fig 1-2 presents a schedule for sitewide treatability studies and OU specific feasibility studies. It is important to acknowledge that treatment activities ongoing for a specific OU, may have application in more than one particular OU and impact the direction taken within the sitewide treatability studies plan.	This figure has been deleted. A new figure (Fig. 7-1) is included which specifically addresses the sitewide TSP only. Provisions will be made for adding new technologies to the sitewide program, if appropriate.
2	3	Section 3.0, page 3-1. Treatability studies may also identify data voids which need to filled through implementation of RFI/RI workplans in order to quantatively evaluate the effectiveness of a technology preliminarily evaluated within the scope of the TSP. Treatability study workplans for each treatability study to be conducted should also include a section addressing the potential for additional work needed to fill any site characterization data gaps. In other words, information on additional field sampling work and quality assurance potentially necessary to fully evaluate an applicable technology should be included within the treatability study work plan so that the RFI/RI Workplans can be modified or focused to present the proper supporting information.	At this time it is not known in detail what data gaps exist for each operable unit. The sitewide plan will not itemize every data gap for each operable unit. These gaps will be identified during the OU specific treatability programs.
3	3	Section 3.0, page 3-2. Any specific field or quality assurance activities required to conduct the treatability studies should be incorporated by the use of a mechanism that does not require modification of the Sitewide Sampling and Analysis Plan (SAP) or the Sitewide Quality Assurance Project Plan (QAPjP), since these are generic documents. One way to do this, is to include the required addenda within the treatability study workplans and then incorporate them into the Sitewide SAP and QAPjP by reference.	As is not stated in Section 6.2.11, a Quality Assurance Addenda (QAA) to the sitewide Quality Assurance Project Plan (QAPjP) will be developed.

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		The FSP and QAPjP are not conducted within the sitewide treatability studies program and they should not be modified to meet the needs of each treatability study.	
		The meaning of the third item in the dot-list is not clear, since the documents referenced are not "conducted within" the subject program. The final, and overall, objective is to prepare a comprehensive Sitewide Treatability Study report for use as a basic reference document in the completion of Feasibility Studies.	The third item in the dot-list has been revised to read "review and modify, as required, the FSP and QAPjP."
4	3	Section 3.1, page 3-3. Given the extended timeframe between approval of this plan and the required submittal of the Treatability Studies Report, it seems that the TSP schedules could be adapted to provide information pertinent to the priority OUs and that preliminary reports could be published to provide the important information to the preparer of the CMS/FS reports for those OUs which are scheduled to get to the CMS/FS stage sooner than others.	Both interim and annual reports will be prepared to facilitate transfer of information.
1	4	Section 4.0, page 4-1. The data presented in this section needs to be updated to present the most resent sampling and analyses. This is important as much of the data collected prior to 1988 is of questionable validity and may in fact not represent contamination on the site.	The data presented in Table 4-1 in Section 4.0 of the draft report have been completely updated and are the most recent available (as of April 1991) from the 1990 and 1991 source documents. These source documents are listed in Table 4-1 of the April 22, 1991 Final Treatability Studies Plan. The data themselves are presented in Table 4-2 of the final report. Only data for those chemicals reported to have been detected in these recent documents are presented in Table 4-2.
		The data presented within the tables must not be prejudiced by unsupported conclusions regarding the presence or non-presence of various constituents whose presence is still a point of contention.	
2	4	Section 5.0, page 5-3. The text indicates an interest only in laboratory and bench-scale testing ; this is only a small part of the treatability testing program that needs to be described. Reference is also made to "other databases" showing results	The sitewide treatability study program is limited to only laboratory and bench scale testing. Pilot testing will be conducted during OU specific treatability studies only. A more concise description of the databases is included in the revised plan.

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		differing from those included here. A better description is required of where the data came from and how it was manipulated.	
3	4	Section 5.0, page 5-4. In the paragraph beginning "The technology evaluations" it is not at all clear how the approach described in the second sentence facilitates accomplishment of the goal stated in the first.	Section 5.0, Technical Approach has been modified to present a concise approach to identify and screen the technologies for inclusion in the sitewide program.
4	4	Section 5.1, page 5-5. The technology assessment report identified within this section must be submitted with the TSP as this report documents the selection process. Submittal of this report will aid an evaluation as to whether all the available options have been considered and to justify selection of the to be tested alternatives.	Text has been revised to delete reference to a Technology Assessment Report.
5	4	Section 5.1.3, page 5-9. Final decisions regarding the implementability or effectiveness of a selected technology which has application to more than one OU , should also be considered in a subsequent step internal to the sitewide treatability studies program and not just in the individual OU CMS/FS.	The sitewide program will overlap certain OU-specific programs. Final decisions on implementability or effectiveness of selected technologies are not appropriate for the sitewide program and will be considered in the OU specific programs only due to scheduling constraints.
4	4	Section 5.1.5, page 5-13. This section states that innovative technologies were not considered due to the limited site characterization data currently available. Site characterization data needed to fill data gaps can be collected during the RI/FS Treatability Studies process. Therefore, innovative technologies should also be considered at this stage of the treatability studies.	Both innovative technologies and practical technologies are included in the revised plan.
5	4	Section 5.2, page 5-14. This section presents the results of the technology selection process for practical technologies. Documentation of the process used to select the alternatives is	The report has been revised to better explain and document the selection process, which now includes innovative technologies.

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		essential to approving this document. It is also mentioned that a similar technology assessment report will be issued for innovative technologies. This report must be a part of the TSP. The document must justify the selection of only five technologies. What were their advantages over the others?	
1	5	Section 5.2.3.1, page 5-27. In section 5.1.2 it was mentioned that chemical specific ARARs will be used as another screening tool. However this section only considered three criteria: effectiveness, implementability and cost. At this stage of the screening process chemical specific ARARs must be also considered.	Chemical specific ARAR's are included as a screening criteria in the revised plan.
2	5	Section 5.2.3.2, page 5-28. Where is the documentation of the selection process? Why were only five technologies selected and not more? The process of applying the selection criteria which the first sentence here says took place is what must be presented completely and in detail. The "rationale for the selection or elimination" presented in the next few subsections is the only support the document provides for the selection decisions. It is vague , unsubstantiated, and incomplete. No mention at all is made of at least half the candidate technologies listed in Table 5-2.	A major revision was done to the sitewide treatability study plan. It now provides a documented identification process along with the rationale for the selection or elimination of treatment technologies.
		Table 5-3 does not present any technologies to be tested to evaluate treatment for organics in water. It is true that there are technologies available that have been proven successful for removing organics in water. However, this is not a valid reason for not considering treatability studies on innovative/emerging technologies to address this problem. It is possible that a new technology may offer a higher level of performance, at less cost, available at this moment.	The approach for identifying and screening applicable technologies has been modified in the revised plan to include innovative technologies and criteria to evaluate innovative technologies.

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3	5	Section 5.2.3.3, page 5-30. It is important to mention which proven technologies are planned to be used at RF. For example, carbon adsorption and membrane processes have been already selected as an IM/IRA for OU2.	The proven technologies that are planned to be utilized at RFP only apply to OU1 and OU2. These applications are noted.
4	5	Section 5.2.3.4, page 5-33. This section states that in-situ biological treatment will not be considered for treatability studies at this time because more specific site hydrogeologic data needs to be collected. This technology should not be eliminated from consideration for this reason. There exists hydrogeologic data for some OUs, for example, the solar ponds, OU1 and OU2.	The applicability of in-situ bioremediation is a function of contaminant type and site specific conditions. It would be inappropriate to evaluate in-situ bioremediation on a sitewide basis. In-situ bioremediation will be considered only during the OU specific programs.
5	5	Section 5.2.3.5, page 5-33. Oxidation/reduction methods for inorganics, metals and radionuclides in water were selected in this initial stage of treatability studies. This is not presented in Table 5-4 on page 5-34. This inconsistency must be corrected.	This inconsistency has been corrected.
1	6	Table 5-4,Page 5-34. The information displayed here does not agree with the text or with Table 5-3. Also classification of "Stage I" studies as opposed to "Future" doesn't carry over to the next section, where "Future" apparently means something else.	Table 5-4 has been deleted.
2	6	Section 6.0, page 6-1. The assertion made in the first sentence of this section is false; some "Statements of Work" are presented along with guidelines for Work Plans. The workplans themselves do not appear,nor should they. The "Scopes of Work" are so skeletal as to be of little use, and it is not clear what purpose they serve in this context.	The individual statements of work are included in Appendix C. Their primary intent is to provide general guidelines for scoping the actual workplans.
3	6	Section 6.1, page 6-1. FSP and QA/AC procedures specific to the treatability studies to be conducted must be included in the treatability studies workplan and as addenda to the generic FSP and QA/QC procedures.	EG&G Standard Operating Procedures (SOPs) for IAG required activities have been submitted to EPA and CDH for review and approval. These SOPs and the QAPjP together comprise the SAP required by the IAG. The SOPs include field sampling procedures and appropriate QA/QC procedures.

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			Additional QA/QC controls are included in the QAPjP. Where the implementation of a treatability study requires the use of an SOP or QA/QC control described in the QAPjP, the specific SOP or QAPjP will be referenced, but not included, in either the work plan or the quality assurance addendum, or both. Any sampling or QA/QC procedures that are specific to the treatability study will be included in the work plan for each TSP. The sitewide SAP, which consists of the SOPs and QAPjP, will not be modified, since, as you correctly point out, these are generic documents that address all IAG activities.
4	6	Section 6.1.1.1, page 6-2. The level of treatability studies (laboratory, bench or pilot scale studies must be justified. For example, in this case, bench scale was selected to be appropriate because the chemistry of the process was to be studied.	The justification to determine the level of treatability testing has been included in the revised sitewide plan.
5	6	Section 6.1.1.3, page 6-3. It would help to present the reactions expected to take place for each of the oxidation and reduction processes in order to fully understand the chemistry. This will help in evaluation if the expected reactions are likely to occur, and will also allow evaluation of whether any adverse reactions may occur.	There are potentially thousands of reaction mechanisms that could be encountered with the wide variety of organic contaminants present on a sitewide basis. Specific reactions will be delineated for OU specific treatability studies if appropriate.
6	6	Section 6.1.1.3, page 6-4. The chemistry of plutonium is very complicated. It would help to list in the reference section the sources used to gather information.	Appropriate references have been included in the revised plan.
7	6	Section 6.1.3.3, page 6-10. Why is the third phase to be conducted as part of CMS/FS for a specific OU? This is a technology that has application to more than one OU. The treatability studies should be conducted as part of the sitewide treatability studies.	The third phase of testing is designed to optimize conditions for a specific waste treatment. One set of optimal conditions would not be applicable to the wastes on a sitewide basis. This third phase type of testing will be conducted only during the OU specific programs.

ROCKY FLATS ENVIRONMENTAL RESTORATION PROGRAM
REVIEW/COMMENT RESOLUTION FORM

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Reviewer Name(s): ENVIRONMENTAL PROTECTION AGENCY Date: _____

REVIEWER'S COMMENTS			RESPONSE
COMMENT NO.	PAGE NO.	COMMENTS	DISCUSSION
8	6	Section 6.2, page 6-19. The guidelines provided will require some revision to reflect verbal comments on incorporating and/or amending SOP/QAPjP requirements. A detailed, annotated standard outline should be provided for Treatability Study Work Plans. Interim reports on specific studies will be reviewed if provided by DOE, but the final result of this program as required by the IAG is a comprehensive report, for which an outline (based on Table 6-2) should be provided.	Section 6 does represent a detailed, annotated outline for the Treatability Study work Plans. The outline for the Final Treatability Studies Report is included as Table 6-2 and is based on EPA Guidance for Conducting Treatability Studies under CERCLA.