Department of Energy
Albuquerque Operations Office
Los Alamos Area Office
Los Alamos, New Mexico 87544

SEP 12 1996

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Benito J. Garcia, Bureau Chief
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
2044 Galisteo St., Bldg. A
P. O. Box 26110
Santa Fe, NM 87505

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SEP 16 1996

RED FILE LANL '96

Dear Mr. Garcia:

Subject: Treatability Study Notification

The purpose of this letter is to provide notification of intent to conduct nine mixed waste treatability studies at Los Alamos National Laboratory (LANL). The studies will be conducted by the Advanced Technology Group (NMT-6). The waste samples to be studied are transuranic mixed waste. However, these waste streams are currently not included in the Compliance Plan Volume of LANL's Federal Facility Compliance Order Site Treatment Plan.

These treatability studies are intended to determine the effectiveness of low temperature, low pressure, aqueous strong oxidizing agent-based treatment technology known as Mediated Electrochemical Oxidation (MEO) on mixed waste. The MEO technology will destroy the hazardous organic constituents in the mixed waste and facilitate the recovery of radionuclides in the waste. The studies will be conducted at the Technical Area 55 Plutonium Facility.

The waste samples to be treated were generated during solvent extraction experiments and from analytical procedures. Initially, solvent extraction uses tributyl phosphate and carbon tetrachloride to separate plutonium from acid solutions. Later, experiments to improve the process were conducted that resulted in solutions that also contain acetone, chlorobenzene, chloroform, trichloroethylene, 1,1,2-trichloroethane, 1,1,2,2-tetrachloroethane and xylene. Also to be studied is a 1,1,1-trichloroethane and mineral spirits solution used in the polishing of metallography samples. These experiments generated nine different mixed wastes. Because LANL wants to evaluate all

12886

nine waste types, a treatability study project description has been prepared for each waste stream. These descriptions begin on Page 3 of the enclosed treatability study write-ups. A total of 20.5 kilograms of waste samples will be treated in the studies.

If you have any questions, please contact me at (505) 665-5042.

Sincerely,

H. L. "Jody" Plum
Office of Environment and Projects

LAAMEP:3JP-017

Enclosure:
Treatability Studies Process Description,
Mediated Electrochemical Oxidation

cc w/enclosure:
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ENCLOSURE

TREATABILITY STUDIES PROCESS DESCRIPTION,

MEDIATED ELECTROCHEMICAL OXIDATION

Los Alamos
NATIONAL LABORATORY

Hazardous & Solid Waste Group
Los Alamos National Laboratory
Los Alamos, New Mexico 87545

Facility Name:	**Los Alamos National Laboratory Nuclear Materials Technology Division Advanced Technology Group (NMT-6)**
Facility EPA ID Number:	**NM0890010515**
Project Title:	**Mediated Electrochemical Oxidation**
Number of Projects:	**Nine**
Location of Projects:	**TA-55, Building PF-4, Rooms 420 and 208**
Project Contacts:	**Wayne H. Smith, Ph. D. NMT-6, Mail Stop E510 (505) 667-2365**
Other Contacts:	**Doug Wedman, Ph. D. NMT-6, Mail Stop E510 (505) 665-7140**

Project Description:

This project consists of nine separate treatability studies involving nine different mixed wastes that were generated at Los Alamos National Laboratory's (LANL) Plutonium Facility, located at TA-55. This project is intended to determine the effectiveness of a low temperature, low pressure aqueous strong oxidizing agent based treatment technology know as Mediated Electrochemical Oxidation (MEO) on mixed waste (i.e., wastes that contain both hazardous constituents and radioactive constituents). The MEO technology will destroy the hazardous organic constituents in the mixed waste and facilitate the recovery of radionuclides.

Project Goals and Objectives:

The goals of this project are to demonstrate:

1. The feasibility of the MEO treatment technology for the safe, economical, and effective treatment of organic contaminated mixed waste, and;

2. To evaluate the ease of retrieving radionuclides from the treatment process residues using standard aqueous recovery processes already in place at TA-55.

The objective of these treatability studies is to evaluate MEO technology on solvents used for analytical procedures, on solvents used in solvent extraction processes, and on solvents used for bench scale fundamental research. At the completion of this study, the MEO technology will be

compared with other technologies that are being developed concurrently to determine which technology may be adopted for future use in the treatment of organic contaminated mixed wastes.

Project Tasks:

1. Obtain mixed waste samples from identified sources.
2. Treat the mixed waste using MEO technology.
3. Determine the destruction efficiency of the MEO process and identify treatment products.

Surrogate Waste Treatment Studies:

MEO treatment technology has been successfully demonstrated by a number of independent researchers on a wide variety of organic compounds. Surrogate waste solutions including carbon tetrachloride, chloroform, benzene, and ethylene glycol are a few of the compounds that have been shown to undergo complete conversion to carbon dioxide. In addition, the application of MEO technology for the treatment of mixed waste has been demonstrated by researchers in France who used it to destroy spent styrene-divinyl benzene based ion exchange resins from actinide recovery operations.

Project Milestones:

1. Begin waste treatment studies	10/25/96
2. Complete testing of solvent extraction waste	12/1/96
3. Complete testing of analytical waste	1/1/97
4. Complete testing of miscellaneous organic waste	4/1/97

Qualifications:

Key Staff: Wayne Smith: Ph.D. in Electrochemistry, University of Texas, 1974. Current position LANL technical staff member in NMT-6. Over twelve years experience in process development and fundamental actinide research and for the past three years focused on the development of processes for the treatment of radioactive and mixed waste and the recovery and recycle of strategic metals.

Doug Wedman: Ph.D in Electrochemistry, University of Colorado, 1993. Current position LANL technical staff member in NMT-6. Two years experience in setting up and using electrochemical equipment for Pu recovery operations from process residues.

Equipment and Facilities:

Both pilot scale and bench scale equipment are in place in a "cold" lab environment for carrying out organic destruction experiments on surrogate mixed waste solutions. In addition, a pilot scale MEO apparatus has been installed in a "hot " environment, TA-55/PF-4, for processing real waste solutions. Also available is a Perkin-Elmer GC/MS system to analyze for the completeness of the destruction process, to detect reaction intermediates, and for the analysis of organics in the off gas scrubbers.

Project Discussion Treatability Study 1

Description of Waste to Be Treated: The waste to be treated was generated during solvent extraction experiments and from analytical procedures. These solvent extraction experiments use tributyl phosphate to separate plutonium (Pu) from acid solutions.

Sample Waste Amounts to be Treated: 1.0 kg

RCRA Waste Code(s): Mixed - D002

Site Treatment Plan Information: This waste stream is currently not included in the Compliance Plan Volume of LANL's Federal Facility Compliance Order Site Treatment Plan.

Description of The Waste Treatment Technology: MEO treatment technology is an aqueous based waste treatment process in which the destruction of organic compounds is brought about by the action of a strong oxidizing agent generated at the anode in an electrochemical cell. The organic matter is converted to carbon dioxide, with water serving as the source for oxygen atoms. The spent oxidizing agent is then fed back into the electrochemical cell where it is regenerated for use in further oxidations.

The central component of the MEO technology is a commercially available electrochemical system. This system consists of a flat plate, divided electrochemical cell, anolyte and catholyte reservoirs and a constant direct current power supply. The anolyte solution contains the electron transfer mediator dissolved in nitric or sulfuric acid. The catholyte solution contains only concentrated acid. On application of current to the cell, the electron transfer mediator is oxidized to a higher oxidation state, at which point it becomes a powerful oxidizing agent. Any organics present in the anolyte are oxidized to carbon dioxide by the action of the oxidizing agent, with water as the source of oxygen. During this reaction the mediator is reduced to its original oxidation state. By recycling the anolyte back through the cell, the oxidizing agent is regenerated for use in further oxidations. Thus a small amount of mediator can be used to destroy a large amount of organic material by continually recycling the solution through the electrochemical cell.

Only a few redox couples have all the desirable characteristics of an electron transfer mediator which includes: two stable oxidation states; high positive redox potential; and solubility in acid media. Thus far developmental work has focused on the silver (I/II), cobalt (II/III), and the cerium (III/IV) couples. Silver has the distinct disadvantage of being a toxicity characteristic (TC) metal which makes process waste solution disposal more difficult. Therefore, this study will only make use the cobalt and cerium couples.

The MEO technology is also environmentally friendly, since this process operates at ambient pressure and at ambient or slightly elevated temperatures below 100° Celsius. In addition, the anolyte and catholyte reservoirs of the electrochemical system are fitted with condensers and scrubbers that will capture and prevent the escape of any volatile organic gases or radionuclie from the electrochemical system. Because of these safeguards there is almost no chance that hazardous or radioactive air emissions could occur from this treatment process.

LANL is in the process of evaluating several different treatment technologies, including this technology, for possible submittal to NMED as a new regulated treatment unit. This would involve revision of the TA-55 Part B permit application, If this treatment technology is permitted, the treatment unit will be connected to the TA-55 acid waste line as part of the process. The acid waste line would discharge the treatment unit's effluent to the TA-50 Radioactive Waste Treatment Plant. Effluent from the permitted unit that is of sufficient actinide concentration would be managed as a commodity and sent to the TA-55 actinide recovery line for retrieval.

Waste Management: Any untreated waste sample will be returned to TA-55's mixed waste interim status storage unit. All waste treatment effluents and scrubber solutions will be analyzed for proper characterization. If the effluent/scrubber solutions do not exhibit the characteristic of a hazardous waste, they will be managed as radioactive waste.

Project Discussion Treatability Study 2:

Description of Waste to Be Treated: The waste to be treated was generated during solvent extraction experiments where xylene in an acidic solution was used to separate americium from Pu.

Sample Waste Amounts to be Treated: 0.5 kg

RCRA Waste Code(s): Mixed F003

Site Treatment Plan Information: This waste stream is currently not included in the Compliance Plan Volume of LANL's Federal Facility Compliance Order Site Treatment Plan.

Description of The Waste Treatment Technology: MEO treatment technology is an aqueous based waste treatment process in which the destruction of organic compounds is brought about by the action of a strong oxidizing agent generated at the anode in an electrochemical cell. The organic matter is converted to carbon dioxide, with water serving as the source for oxygen atoms. The spent oxidizing agent is then fed back into the electrochemical cell where it is regenerated for use in further oxidations.

The central component of the MEO technology is a commercially available electrochemical system. This system consists of a flat plate, divided electrochemical cell, anolyte and catholyte reservoirs and a constant direct current power supply. The anolyte solution contains the electron transfer mediator dissolved in nitric or sulfuric acid. The catholyte solution contains only concentrated acid. On application of current to the cell, the electron transfer mediator is oxidized to a higher oxidation state, at which point it becomes a powerful oxidizing agent. Any organics present in the anolyte are oxidized to carbon dioxide by the action of the oxidizing agent, with water as the source of oxygen. During this reaction the mediator is reduced to its original oxidation state. By recycling the anolyte back through the cell, the oxidizing agent is regenerated for use in further oxidations. Thus a small amount of mediator can be used to destroy a large amount of organic material by continually recycling the solution through the electrochemical cell.

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The MEO technology is also environmentally friendly, since this process operates at ambient pressure and at ambient or slightly elevated temperatures below 100° Celsius. In addition, the anolyte and catholyte reservoirs of the electrochemical system are fitted with condensers and scrubbers that will capture and prevent the escape of any volatile organic gases or radionuclie from the electrochemical system. Because of these safeguards there is almost no chance that hazardous or radioactive air emissions could occur from this treatment process.

LANL is in the process of evaluating several different treatment technologies, including this technology, for possible submittal to NMED as a new regulated treatment unit. This would

involve a revision to the TA-55 Part B permit application. If this treatment technology is permitted, the treatment unit will be connected to the TA-55 acid waste line as part of the process. The acid waste line would discharge the treatment unit's effluent to the TA-50 Radioactive Waste Treatment Plant. Effluent from the treatment unit that is of sufficient actinide concentration will be managed as a commodity and sent to the TA-55 actinide recovery line for retrieval.

Waste Management:

Any untreated waste sample will be returned to TA-55's mixed waste interim status storage unit. All waste scrubber solutions will be analyzed for proper characterization. Waste scrubber solutions, regardless of whether any VOC's are detected, will be managed as mixed waste based on the Derived-From Rule.

Effluent from the treated waste sample is not expected to exhibit the characteristic of ignitability. However, if the effluent from the treatment unit exhibits the characteristic of ignitability, it will be rerun through the treatment unit or managed as a mixed waste. Effluent that does not exhibit the characteristic of ignitability will retain the listing (F003) due to the Derived-From Rule. However, LANL proposes to discharge this effluent into the TA-55 acid waste line that flows to the TA-50 Radioactive Waste Treatment Plant. As the treatment process, by necessity, combines the effluent with a solid waste (liquid in the acid waste line) the resulting mixture would loose its Derived-From listing pursuant to the mixture rule exemption described in 20 NMAC 4.1, 40 CFR 261.3(a)(2)(iii). This exemption allows that a mixture of a solid waste and a waste listed in Subpart D for characteristics (described in Subpart C) that no longer exhibits such characteristics is not a hazardous waste. Because this effluent is not expected to retain any characteristics for which it may have been listed, it would no longer be a hazardous waste. Effluent and waste scrubber solutions from the treatment process will be profiled and submitted with analysis to the Chemistry and Mixed Waste Science Group (CST-5) for approval prior to discharge.

Project Discussion Treatability Study 3

Description of Waste to Be Treated: The waste to be treated was generated by using a product called Hyprez OS Lubricant for polishing metallography samples. The Hyprez OS Lubricant contains mineral spirits and 1,1,1-Trichloroethane.

Sample Waste Amounts to be Treated: 7 kg

RCRA Waste Code(s): Mixed F002, D001

Site Treatment Plan Information: This waste stream is currently not included in the Compliance Plan Volume of LANL's Federal Facility Compliance Order Site Treatment Plan.

Description of The Waste Treatment Technology: MEO treatment technology is an aqueous based waste treatment process in which the destruction of organic compounds is brought about by the action of a strong oxidizing agent generated at the anode in an electrochemical cell. The organic matter is converted to carbon dioxide, with water serving as the source for oxygen atoms. The spent oxidizing agent is then fed back into the electrochemical cell where it is regenerated for use in further oxidations.

The central component of the MEO technology is a commercially available electrochemical system. This system consists of a flat plate, divided electrochemical cell, anolyte and catholyte reservoirs and a constant direct current power supply. The anolyte solution contains the electron transfer mediator dissolved in nitric or sulfuric acid. The catholyte solution contains only concentrated acid. On application of current to the cell, the electron transfer mediator is oxidized

to a higher oxidation state, at which point it becomes a powerful oxidizing agent. Any organics present in the anolyte are oxidized to carbon dioxide by the action of the oxidizing agent, with water as the source of oxygen. During this reaction the mediator is reduced to its original oxidation state. By recycling the anolyte back through the cell, the oxidizing agent is regenerated for use in further oxidations. Thus a small amount of mediator can be used to destroy a large amount of organic material by continually recycling the solution through the electrochemical cell.

Only a few redox couples have all the desirable characteristics of an electron transfer mediator which includes: two stable oxidation states; high positive redox potential; and solubility in acid media. Thus far developmental work has focused on the silver (I/II), cobalt (II/III), and the cerium (III/IV) couples. Silver has the distinct disadvantage of being a TC metal which makes process waste solution disposal more difficult. Therefore, this study will only use the cobalt and cerium couples.

The MEO technology is also environmentally friendly, since this process operates at ambient pressure and at ambient or slightly elevated temperatures below 100° Celsius. In addition, the anolyte and catholyte reservoirs of the electrochemical system are fitted with condensers and scrubbers that will capture and prevent the escape of any volatile organic gases or radionuclie from the electrochemical system. Because of these safeguards there is almost no chance that hazardous or radioactive air emissions could occur from this treatment process.

LANL is in the process of evaluating several different treatment technologies, including this technology, for possible submittal to NMED as a new regulated treatment unit. This would involve a revision to the TA-55 Part B permit application. If this treatment technology is permitted, the treatment unit will be connected to the TA-55 acid waste line as part of the process. The acid waste line would discharge the treatment unit's effluent to the TA-50 Radioactive Waste Treatment Plant. Effluent from the treatment unit that is of sufficient actinide concentration will be managed as a commodity and sent to the TA-55 actinide recovery line for retrieval.

Waste Management: Any untreated waste sample will be returned to TA-55's mixed waste interim status storage unit. All waste treatment effluent and scrubber solutions will be analyzed for proper characterization. Waste effluent/scrubber solutions, regardless of whether any VOC's are detected, will be managed as mixed waste. Effluent/scrubber solutions from the treatment process will be profiled and submitted with analyses to CST-5 for approval prior to discharge to LANL's Radioactive Waste Treatment Plant.

The F002 Derived-From effluent would loose its listing and would no longer be a hazardous waste if the effluent met the New Mexico Hazardous Waste Management Regulations 20 NMAC 4.1, 40 CFR 261.3(a)(2)(iv)(A&B) wastewater exemption.

Project Discussion Treatability Study 4:

Description of Waste to Be Treated: The waste to be treated was generated during solvent extraction experiments and from analytical procedures. These solvent extraction experiments used tributyl phosphate and carbon tetrachloride to separate Pu from acid solutions.

Sample Waste Amounts to be Treated: 6.0 kg

RCRA Waste Code(s): Mixed D019, D002

Site Treatment Plan Information: This waste stream is currently not included in the Compliance Plan Volume of LANL's Federal Facility Compliance Order Site Treatment Plan.

Description of The Waste Treatment Technology: MEO treatment technology is an aqueous based waste treatment process in which the destruction of organic compounds is brought about by the action of a strong oxidizing agent generated at the anode in an electrochemical cell. The organic matter is converted to carbon dioxide, with water serving as the source for oxygen atoms. The spent oxidizing agent is then fed back into the electrochemical cell where it is regenerated for use in further oxidations.

The central component of the MEO technology is a commercially available electrochemical system. This system consists of a flat plate, divided electrochemical cell, anolyte and catholyte reservoirs and a constant direct current power supply. The anolyte solution contains the electron transfer mediator dissolved in nitric or sulfuric acid. The catholyte solution contains only concentrated acid. On application of current to the cell, the electron transfer mediator is oxidized to a higher oxidation state, at which point it becomes a powerful oxidizing agent. Any organics present in the anolyte are oxidized to carbon dioxide by the action of the oxidizing agent, with water as the source of oxygen. During this reaction the mediator is reduced to its original oxidation state. By recycling the anolyte back through the cell, the oxidizing agent is regenerated for use in further oxidations. Thus a small amount of mediator can be used to destroy a large amount of organic material by continually recycling the solution through the electrochemical cell.

Only a few redox couples have all the desirable characteristics of an electron transfer mediator which includes: two stable oxidation states; high positive redox potential; and solubility in acid media. Thus far developmental work has focused on the silver (I/II), cobalt (II/III), and the cerium (III/IV) couples. Silver has the distinct disadvantage of being a TC metal which makes process waste solution disposal more difficult. Therefore, this study will only use the cobalt and cerium couples.

The MEO technology is also environmentally friendly, since this process operates at ambient pressure and at ambient or slightly elevated temperatures below 100° Celsius. In addition, the anolyte and catholyte reservoirs of the electrochemical system are fitted with condensers and scrubbers that will capture and prevent the escape of any volatile organic gases or radionuclie from the electrochemical system. Because of these safeguards there is almost no chance that hazardous or radioactive air emissions could occur from this treatment process.

LANL is in the process of evaluating several different treatment technologies, including this technology, for possible submittal to NMED as a new regulated treatment unit. This would involve a revision to the TA-55 Part B permit application. If this treatment technology is permitted, the treatment unit will be connected to the TA-55 acid waste line as part of the process. The acid waste line would discharge the treatment unit's effluent to the TA-50 Radioactive Waste Treatment Plant. Effluent from the treatment unit that is of sufficient actinide concentration will be managed as a commodity and sent to the TA-55 actinide recovery line for retrieval.

Waste Management: Any untreated waste sample will be returned to TA-55's mixed waste interim status storage unit. All waste treatment effluent and scrubber solutions will be analyzed for proper characterization. If the effluent/scrubber solutions do not exhibit the characteristics of a hazardous waste, they will be managed as radioactive waste.

Project Discussion Treatability Study 5:

Description of Waste to Be Treated: The waste to be treated was generated during solvent extraction experiments and from analytical procedures. These solvent extraction experiments used acetone to separate Pu from an acid solution.

Sample Waste Amounts to be Treated: 1.0 kg

RCRA Waste Code(s): Mixed F003, D002

Site Treatment Plan Information: This waste stream is currently not included in the Compliance Plan Volume of LANL's Federal Facility Compliance Order Site Treatment Plan.

Description of The Waste Treatment Technology: MEO treatment technology is an aqueous based waste treatment process in which the destruction of organic compounds is brought about by the action of a strong oxidizing agent generated at the anode in an electrochemical cell. The organic matter is converted to carbon dioxide, with water serving as the source for oxygen atoms. The spent oxidizing agent is then fed back into the electrochemical cell where it is regenerated for use in further oxidations.

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The MEO technology is also environmentally friendly, since this process operates at ambient pressure and at ambient or slightly elevated temperatures below 100° Celsius. In addition, the anolyte and catholyte reservoirs of the electrochemical system are fitted with condensers and scrubbers that will capture and prevent the escape of any volatile organic gases or radionuclie from the electrochemical system. Because of these safeguards there is almost no chance that hazardous or radioactive air emissions could occur from this treatment process.

LANL is in the process of evaluating several different treatment technologies, including this technology, for possible submittal to NMED as a new regulated treatment unit. This would involve a revision to the TA-55 Part B permit application. If this treatment technology is permitted, the treatment unit will be connected to the TA-55 acid waste line as part of the process. The acid waste line would discharge the treatment unit's effluent to the TA-50 Radioactive Waste Treatment Plant. Effluent from the treatment unit that is of sufficient actinide concentration will be managed as a commodity and sent to the TA-55 actinide recovery line for retrieval.

Waste Management:

Any untreated waste sample will be returned to TA-55's mixed waste interim status storage unit. Waste scrubber solutions, regardless of whether any VOC's are detected, will be managed as mixed waste based on the Derived-From Rule.

The effluent from the treated waste sample is not expected to exhibit the characteristic of ignitability. However, if the effluent from the treatment unit exhibits the characteristic of ignitability, it will be rerun through the treatment unit or managed as a mixed waste. Effluent that does not exhibit the characteristic of ignitability will retain the listing (F003) due to the Derived-From Rule. However, LANL proposes to discharge this effluent into the TA-55 acid waste line which flows to the TA-50 Radioactive Waste Treatment Plant. As the treatment process, by necessity, combines the effluent with a solid waste (liquid in the acid waste line) the resulting mixture would loose its Derived-From listing pursuant to the mixture rule exemption described in 20 NMAC 4.1, 40 CFR 261.3(a)(2)(iii). This exemption allows that a mixture of a solid waste and a waste listed in Subpart D for characteristics (described in Subpart C) that no longer exhibits such characteristics is not a hazardous waste. Because this effluent is not expected to retain any characteristics for which it may have been listed, it would no longer be a hazardous waste. Effluent and waste scrubber solutions from the treatment process will be profiled and submitted with analysis to the Chemistry and Mixed Waste Science Group (CST-5) for approval prior to discharge.

Project Discussion Treatability Study 6:

Description of Waste to Be Treated: The waste to be treated was generated during solvent extraction experiments and from analytical procedures. These solvent extraction experiments used tributyl phosphate, carbon tetrachloride, and acetone to separate Pu from acid solutions.

Sample Waste Amounts to be Treated: 2.0 kg

RCRA Waste Code(s): Mixed F003, D019, D002

Site Treatment Plan Information: This waste stream is currently not included in the Compliance Plan Volume of LANL's Federal Facility Compliance Order Site Treatment Plan.

Description of The Waste Treatment Technology: MEO treatment technology is an aqueous based waste treatment process in which the destruction of organic compounds is brought about by the action of a strong oxidizing agent generated at the anode in an electrochemical cell. The organic matter is converted to carbon dioxide, with water serving as the source for oxygen atoms. The spent oxidizing agent is then fed back into the electrochemical cell where it is regenerated for use in further oxidations.

The central component of the MEO technology is a commercially available electrochemical system. This system consists of a flat plate, divided electrochemical cell, anolyte and catholyte reservoirs and a constant direct current power supply. The anolyte solution contains the electron transfer mediator dissolved in nitric or sulfuric acid. The catholyte solution contains only concentrated acid. On application of current to the cell, the electron transfer mediator is oxidized to a higher oxidation state, at which point it becomes a powerful oxidizing agent. Any organics present in the anolyte are oxidized to carbon dioxide by the action of the oxidizing agent, with water as the source of oxygen. During this reaction the mediator is reduced to its original oxidation state. By recycling the anolyte back through the cell, the oxidizing agent is regenerated for use in further oxidations. Thus a small amount of mediator can be used to destroy a large amount of organic material by continually recycling the solution through the electrochemical cell.

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process waste solution disposal more difficult. Therefore, this study will only use the cobalt and cerium couples.

The MEO technology is also environmentally friendly, since this process operates at ambient pressure and at ambient or slightly elevated temperatures below 100° Celsius. In addition, the anolyte and catholyte reservoirs of the electrochemical system are fitted with condensers and scrubbers that will capture and prevent the escape of any volatile organic gases or radionuclie from the electrochemical system. Because of these safeguards there is almost no chance that hazardous or radioactive air emissions could occur from this treatment process.

LANL is in the process of evaluating several different treatment technologies, including this technology, for possible submittal to NMED as a new regulated treatment unit. This would involve a revision to the TA-55 Part B permit application. If this treatment technology is permitted, the treatment unit will be connected to the TA-55 acid waste line as part of the process. The acid waste line would discharge the treatment unit's effluent to the TA-50 Radioactive Waste Treatment Plant. Effluent from the treatment unit that is of sufficient actinide concentration will be managed as a commodity and sent to the TA-55 actinide recovery line for retrieval.

Waste Management:

Any untreated waste sample will be returned to TA-55's mixed waste interim status storage unit. All waste scrubber solutions will be analyzed for proper characterization. Waste scrubber solutions, regardless of whether any VOC's are detected, will be managed as mixed waste based on the Derived-From Rule.

Effluent from the treated waste sample is not expected to exhibit the characteristic of ignitability. However, if the effluent from the treatment unit exhibits the characteristic of ignitability it will be rerun through the treatment unit or managed as a mixed waste. Effluent that does not exhibit the characteristic of ignitability will retain the listing (F003) due to the Derived-From Rule. However, LANL proposes to discharge this effluent into the TA-55 acid waste line that flows to the TA-50 Radioactive Waste Treatment Plant. As the treatment process, by necessity, combines the effluent with a solid waste (liquid in the acid waste line) the resulting mixture would loose its Derived-From listing pursuant to the mixture rule exemption described in 20 NMAC 4.1, 40 CFR 261.3(a)(ii)(3). This exemption allows that a mixture of a solid waste and a waste listed in Subpart D for characteristics (described in Subpart C) that no longer exhibits such characteristics is not a hazardous waste. Because this effluent is not expected to retain any characteristics for which it may have been listed, it would no longer be a hazardous waste. Effluent and waste scrubber solutions from the treatment process will be profiled and submitted with analysis to the Chemistry and Mixed Waste Science Group (CST-5) for approval prior to discharge.

Project Discussion Treatability Study 7:

Description of Waste to Be Treated: The waste to be treated was generated during solvent extraction experiments and from analytical procedures. These solvent extraction experiments used carbon tetrachloride and acetone to separate Pu from acid solutions.

Sample Waste Amounts to be Treated: 1.0 kg

RCRA Waste Code(s): Mixed F003, D019, D002

Site Treatment Plan Information: This waste stream is currently not included in the Compliance Plan Volume of LANL's Federal Facility Compliance Order Site Treatment Plan.

Description of The Waste Treatment Technology: MEO treatment technology is an aqueous based waste treatment process in which the destruction of organic compounds is brought about by the action of a strong oxidizing agent generated at the anode in an electrochemical cell. The organic matter is converted to carbon dioxide, with water serving as the source for oxygen atoms. The spent oxidizing agent is then fed back into the electrochemical cell where it is regenerated for use in further oxidations.

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The MEO technology is also environmentally friendly, since this process operates at ambient pressure and at ambient or slightly elevated temperatures below 100° Celsius. In addition, the anolyte and catholyte reservoirs of the electrochemical system are fitted with condensers and scrubbers that will capture and prevent the escape of any volatile organic gases or radionuclie from the electrochemical system. Because of these safeguards there is almost no chance that hazardous or radioactive air emissions could occur from this treatment process.

LANL is in the process of evaluating several different treatment technologies, including this technology, for possible submittal to NMED as a new regulated treatment unit. This would involve a revision to the TA-55 Part B permit application. If this treatment technology is permitted, the treatment unit will be connected to the TA-55 acid waste line as part of the process. The acid waste line would discharge the treatment unit's effluent to the TA-50 Radioactive Waste Treatment Plant. Effluent from the treatment unit that is of sufficient actinide concentration will be managed as a commodity and sent to the TA-55 actinide recovery line for retrieval.

Waste Management:

Any untreated waste sample will be returned to TA-55's mixed waste interim status storage unit. All waste scrubber solutions will be analyzed for proper characterization. Waste scrubber solutions, regardless of whether any VOC's are detected, will be managed as mixed waste based on the Derived-From Rule.

Effluent from the treated waste sample is not expected to exhibit the characteristic of ignitability. However, if the effluent from the treatment unit exhibits the characteristic of ignitability, it will be rerun through the treatment unit or managed as a mixed waste. Effluent that does not exhibit the characteristic of ignitability will retain the listing (F003) due to the Derived-From Rule. However, LANL proposes to discharge this effluent into the TA-55 acid waste line that flows to

the TA-50 Radioactive Waste Treatment Plant. As the treatment process, by necessity, combines the effluent with a solid waste (liquid in the acid waste line) the resulting mixture would loose its Derived-From listing pursuant to the mixture rule exemption described in 20 NMAC 4.1, 40 CFR 261.3(a)(2)(iii). This exemption allows that a mixture of a solid waste and a waste listed in Subpart D for characteristics (described in Subpart C) that no longer exhibits such characteristics is not a hazardous waste. Because this effluent is not expected to retain any characteristics for which it may have been listed, it would no longer be a hazardous waste. Effluent and waste scrubber solutions from the treatment process will be profiled and submitted with analysis to the Chemistry and Mixed Waste Science Group (CST-5) for approval prior to discharge.

Project Discussion Treatability Study 8:

Description of Waste to Be Treated: The waste to be treated was generated during solvent extraction experiments and from analytical procedures. These solvent extraction experiments used carbon tetrachloride, chlorobenzene, and acetone to separate Pu from an acid solution.
Sample Waste Amounts to be Treated: 1.0 kg

RCRA Waste Code(s): Mixed F002, F003, D019, D002

Site Treatment Plan Information: This waste stream is currently not included in the Compliance Plan Volume of LANL's Federal Facility Compliance Order Site Treatment Plan.

Description of The Waste Treatment Technology: MEO treatment technology is an aqueous based waste treatment process in which the destruction of organic compounds is brought about by the action of a strong oxidizing agent generated at the anode in an electrochemical cell. The organic matter is converted to carbon dioxide, with water serving as the source for oxygen atoms. The spent oxidizing agent is then fed back into the electrochemical cell where it is regenerated for use in further oxidations.

The central component of the MEO technology is a commercially available electrochemical system. This system consists of a flat plate, divided electrochemical cell, anolyte and catholyte reservoirs and a constant direct current power supply. The anolyte solution contains the electron transfer mediator dissolved in nitric or sulfuric acid. The catholyte solution contains only concentrated acid. On application of current to the cell, the electron transfer mediator is oxidized to a higher oxidation state, at which point it becomes a powerful oxidizing agent. Any organics present in the anolyte are oxidized to carbon dioxide by the action of the oxidizing agent, with water as the source of oxygen. During this reaction the mediator is reduced to its original oxidation state. By recycling the anolyte back through the cell, the oxidizing agent is regenerated for use in further oxidations. Thus a small amount of mediator can be used to destroy a large amount of organic material by continually recycling the solution through the electrochemical cell.

Only a few redox couples have all the desirable characteristics of an electron transfer mediator which includes: two stable oxidation states; high positive redox potential; and solubility in acid media. Thus far developmental work has focused on the silver (I/II), cobalt (II/III), and the cerium (III/IV) couples. Silver has the distinct disadvantage of being a TC metal which makes process waste solution disposal more difficult. Therefore, this study will only use the cobalt and cerium couples.

The MEO technology is also environmentally friendly, since this process operates at ambient pressure and at ambient or slightly elevated temperatures below 100° Celsius. In addition, the anolyte and catholyte reservoirs of the electrochemical system are fitted with condensers and scrubbers that will capture and prevent the escape of any volatile organic gases or radionuclie

from the electrochemical system. Because of these safeguards there is almost no chance that hazardous or radioactive air emissions could occur from this treatment process.

LANL is in the process of evaluating several different treatment technologies, including this technology, for possible submittal to NMED as a new regulated treatment unit. This would involve a revision to the TA-55 Part B permit application. If this treatment technology is permitted, the treatment unit will be connected to the TA-55 acid waste line as part of the process. The acid waste line would discharge the treatment unit's effluent to the TA-50 Radioactive Waste Treatment Plant. Effluent from the treatment unit that is of sufficient actinide concentration will be managed as a commodity and sent to the TA-55 actinide recovery line for retrieval.

Waste Management:

Any untreated waste sample will be returned to TA-55's mixed waste interim status storage unit. All waste scrubber solutions will be analyzed for proper characterization.

Effluent and waste scrubber solutions from the treatability study would retain the listings (F002 and F003) due to the Derived-From Rule. Regarding the F002 listing; effluent from the treatment process will be sent, pending approval, to LANL's Radioactive Waste Treatment Plant. The F002 Derived-From effluent would loose its listing and would no longer be a hazardous waste if the effluent met the New Mexico Hazardous Waste Management Regulations 20 NMAC 4.1, 40 CFR 261.3(a)(2)(iv)(A&B) wastewater exemption.

Regarding the F003 listing; effluent from the treated waste sample is not expected to exhibit the characteristic of ignitability. However, if the effluent from the treatment unit exhibits the characteristic of ignitability it will be rerun through the treatment unit or managed as a mixed waste. Effluent that does not exhibit the characteristic of ignitability will retain the listing (F003) due to the Derived-From Rule. However, LANL proposes to discharge this effluent into the TA-55 acid waste line that flows to the TA-50 Radioactive Waste Treatment Plant. As the treatment process, by necessity, combines the effluent with a solid waste (liquid in the acid waste line) the resulting mixture would loose its Derived-From listing pursuant to the mixture rule exemption described in 20 NMAC 4.1, 40 CFR 261.3(a)(2)(iii). This exemption allows that a mixture of a solid waste and a waste listed in Subpart D for characteristics (described in Subpart C) that no longer exhibits such characteristics is not a hazardous waste. Because this effluent is not expected to retain any characteristics for which it may have been listed, it would no longer be a hazardous waste.

Effluent and waste scrubber solutions from the treatment process will be profiled and submitted with analysis to the Chemistry and Mixed Waste Science Group (CST-5) for approval prior to discharge.

Project Discussion Treatability Study 9:

Description of Waste to Be Treated: The waste to be treated was generated during solvent extraction experiments and from analytical procedures. These solvent extraction experiments used carbon tetrachloride, chloroform, acetone, trichloroethylene, 1,1,2-tricholorethane, and 1,1,2,2-tetrachloroethane to separate Pu from acid solutions.

Sample Waste Amounts to be Treated: 1.0 kg

RCRA Waste Code(s): Mixed F002, F003, D022, D019, D002

Site Treatment Plan Information: This waste stream is currently not included in the Compliance Plan Volume of LANL's Federal Facility Compliance Order Site Treatment Plan.

Description of The Waste Treatment Technology: MEO treatment technology is an aqueous based waste treatment process in which the destruction of organic compounds is brought about by the action of a strong oxidizing agent generated at the anode in an electrochemical cell. The organic matter is converted to carbon dioxide, with water serving as the source for oxygen atoms. The spent oxidizing agent is then fed back into the electrochemical cell where it is regenerated for use in further oxidations.

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Only a few redox couples have all the desirable characteristics of an electron transfer mediator which includes: two stable oxidation states; high positive redox potential; and solubility in acid media. Thus far developmental work has focused on the silver (I/II), cobalt (II/III), and the cerium (III/IV) couples. Silver has the distinct disadvantage of being TC metal which makes process waste solution disposal more difficult. Therefore, this study will only use the cobalt and cerium couples.

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Waste Management:

Any untreated waste sample will be returned to TA-55's mixed waste interim status storage unit. All waste scrubber solutions will be analyzed for proper characterization.

Effluent and waste scrubber solutions from the treatability study would retain the listing (F002 and F003) due to the Derived-From Rule. Regarding the F002 listing; effluent from the treatment process will be sent, pending approval, to LANL's Radioactive Waste Treatment Plant. The F002 Derived-From effluent would loose its listing and would no longer be a hazardous

waste if the effluent met the New Mexico Hazardous Waste Management Regulations 20 NMAC 4.1, 40 CFR 261.3(a)(2)(iv)(A&B) wastewater exemption.

Regarding the F003 listing; effluent from the treated waste sample is not expected to exhibit the characteristic of ignitability. However, if the effluent from the treatment unit exhibits the characteristic of ignitability it will be rerun through the treatment unit or managed as a mixed waste. Effluent that does not exhibit the characteristic of ignitability will retain the listing (F003) due to the Derived-From Rule. However, LANL proposes to discharge this effluent into the TA-55 acid waste line which flows to the TA-50 Radioactive Waste Treatment Plant. As the treatment process, by necessity, combines the effluent with a solid waste (liquid in the acid waste line) the resulting mixture would loose its Derived-From listing pursuant to the mixture rule exemption described in 20 NMAC 4.1, 40 CFR 261.3(a)(2)(iii). This exemption allows that a mixture of a solid waste and a waste listed in Subpart D for characteristics (described in Subpart C) that no longer exhibits such characteristics is not a hazardous waste. Because this effluent is not expected to retain any characteristics for which it may have been listed, it would no longer be a hazardous waste.

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