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TREATABILITY WORK PLAN (LABORATORY SCREENING) FOR SILOS 1 AND 2 SEPTEMBER 1990

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REPORT

TREATABILITY WORK PLAN
(LABORATORY SCREENING)

FOR

SILOS 1 AND 2

FEED MATERIALS PRODUCTION CENTER
FERNALD, OHIO

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY

SEPTEMBER 1990

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OPERABLE UNIT 4 TREATABILITY WORK PLAN (LABORATORY SCREENING)

1.0 PROJECT DESCRIPTION

The Feed Materials Production Center (FMPC) is a contractor-operated federal facility for the production of pure uranium for the U.S. Department of Energy (DOE). The FMPC is located on 1050 acres in a rural area approximately 20 miles northwest of downtown Cincinnati, Ohio. On July 18, 1986 a Federal Facilities Compliance Agreement (FFCA) was jointly signed by the U.S. Environmental Protection Agency (EPA) and DOE to ensure that impacts associated with past and present activities at the FMPC are thoroughly investigated so that appropriate remedial actions can be assessed and implemented. A Remedial Investigation/Feasibility Study (RI/FS) has been initiated to develop these remedial actions.

A part of this RI/FS is Operable Unit 4 (OU 4), the K-65 silos (Silos 1 and 2) and the metal oxide silos (Silos 3 and 4). The FS for OU 4 is considering remedial actions for the silo structures, waste stored in the silos, and the adjoining silo berms. Historic analysis of the of the K-65 silos residues indicate that approximately 11,200 kilograms of uranium (0.71 percent U-235) are present in the silos. Analytical results of residue samples taken in July 1988 indicated the uranium concentration was 1400 parts per million (ppm) in Silo 1 and 1800 ppm in Silo 2. In addition, approximately 1.6 to 3.7 kilograms of radium were estimated to be in the silo residues.

Data from the 1989 sampling effort conducted by Westinghouse Materials Company of Ohio (WMCO) for Silos 1 and 2 indicate that the concentration of radium-226 (Ra-226) in Silo 1 ranges from 89,280 picocuries/gram (pCi/g) to 192,600 pCi/g; in Silo 2 it ranges from 657 to 145,300 pCi/g. Thorium-230 (Th-230) concentrations in Silo 1 range from 10,569 to 43,771 pCi/g and from 8365 to 40,124 pCi/g in Silo 2. The concentration of lead-210 (Pb-210) in Silo 1 ranges from 48,490 to 181,100 pCi/g and from 77.940 to 399,200 pCi/g in Silo 2. Total uranium concentrations in Silo 1 range from 1189 to 2753 ppm and from 137 to 3717 ppm in Silo 2.

This treatability study is a laboratory screening of various chemical leaching techniques on residues in the K-65 silos. The samples from the 1989 sampling effort will be subjected to this screening process in an attempt to determine the responsiveness of the silo material to various acid and EDTA leaching schemes. The data produced from this laboratory screening will be used to better define the scope of the bench-scale treatability study to be performed on the samples produced from the current silo resampling effort. The most promising leaching methods, as determined by the laboratory screening, will be applied to the samples from the resampling effort. The bench-scale treatability study will also

study leaching kinetics, solids washing, solid/liquid separation, and solidification/stabilization.

2.0 REMEDIAL TECHNOLOGY DESCRIPTION

The remedial technology consists of a separation of contaminants through acid leaching. The waste materials will be added to a nitric acid leaching process which will solubilize the lead as well as the uranium and radium, the major radioactive constituents of the waste. Lead, barium, copper and other metals will also be dissolved in the nitric acid mixture. Following this leaching stage the nonhazardous solids will enter a solid/liquid separation stage and the leachate containing the radioactive and hazardous materials will be sent to a precipitation stage. This precipitation stage will add sodium phosphate and nitric acid to yield a radioactive/hazardous precipitate to be solidified or stabilized for disposal. The nonhazardous components produced from the initial nitric acid leaching will also be disposed of.

3.0 TEST OBJECTIVES

The objective of this laboratory screening is to determine the effectiveness of various acid/EDTA leaching solutions in removing lead and uranium. The leachates resulting from the application of the various acid and EDTA solutions to the samples will be analyzed for lead and uranium and will be compared to one another. Those methods which yield leachates with the greatest concentrations of lead and uranium will be retained for additional treatability testing in the bench-scale treatability program. The results will also provide a rough guide by which the viability of remedial action alternatives 8 and 9 can be preliminarily evaluated.

4.0 EXPERIMENTAL DESIGN AND PROCEDURES

4.1 PRELIMINARY CHARACTERIZATION

During geotechnical testing of the K-65 material the samples were composited according to physical appearance, moisture content, and texture of the material. The material from Silo #1 was composited into three groups; brown, sandy brown, and light brown, and the material from Silo #2 was composited into groups of wet muddy, white, and sandy brown. The material weights listed in Table 1 are the actual weights of the geotechnical samples collected during the 1989 sampling effort. The material from each silo will be composited to form a single composited sample for each silo on the weight percent basis shown in Table 1.

For a physical characterization of the K-65 material see Certificate of Analysis, IT Geotechnical Services project number 482331, dated March 22, 1989.

TABLE 1: SAMPLE COMPOSITING

Silo No.	Soil Type		
SILO 1	BROWN	SANDY BROWN	LIGHT BROWN
	2.3 kg 9.1 kg 12.0 kg 4.2 kg	4.7 kg	35 kg
TOTAL kg	27.6 kg	4.7 kg	35 kg
% w/w	41.0	7.0	52.0
SILO 2	WET MUDDY	WHITE	SANDY BROWN
	12.0 kg	9.4 kg 4.0 kg 2.8 kg 2.3 kg	2.8 kg 2.8 kg
TOTAL kg	12.0 kg	18.5 kg	5.6 kg
% w/w	33.2	51.2	15.5

4.2 METAL EXTRACTIONS

4.2.1 Acid Extractions

Approximately 1 gram aliquots of each silo composite will be weighed in the glove box into HACH COD Digester Vials (rated pressure 10 ATM). Room temperature vials will be shaken with acid for two hours. Room temperature will be the actual temperature inside the glove box and this value will be recorded in a standard laboratory notebook. The digestions will be carried out in a HACH Micro COD Digester (Appendix III). The extractions to be heated at 100°C will be digested for two hours in the HACH Digester within the glove box. The extraction matrix is outlined in the table below:

TABLE 2: MINERAL ACID EXTRACTIONS

RUN NO.	ACID NOMINAL CONC. w/w	DOSE (weight acid/weight sample) 1:1	2:1	3:1	RT	Temp 100°C
1	60% HNO_3 [1]	X	X	X	X	
2	60% HNO_3	X	X	X		X
3	30% HNO_3	X	X	X	X	
4	30% HNO_3	X	X	X		X
5	15% HNO_3	X	X	X	X	
6	15% HNO_3	X	X	X		X
7	36% HCl [2]	X	X	X	X	
8	36% HCl	X	X	X		X
9	18% HCl	X	X	X	X	
10	18% HCl	X	X	X		X
11	9% HCl	X	X	X	X	
12	9% HCl	X	X	X		X
13	50% HOAc [3]	X	X	X	X	
14	50% HOAc	X	X	X		X
15	25% HOAc	X	X	X	X	
16	25% HOAc	X	X	X		X
17	12.5% HOAc	X	X	X	X	
18	12.5% HOAc	X	X	X		X

This test program will comprise 144 discrete samples

(2 Silos X 18 Acids X 4 Treatments).

[1] Nitric acid.

[2] Hydrochloric acid.

[3] Acetic acid.

After digestion, the samples will be separated by decanting into a 20 ml scintillation vial. Solids will be retained in the COD vial until the decision can be made whether to carry them into the next phase or not. This will be based on the lead and uranium content of the extract. If one of the digestions is clearly superior to the others, further treatment of the others will be aborted. A superior digestion will be one that extracts the greatest amount of lead and uranium. If not processed further, solids will be transferred to a 1 pt jar for disposal. Liquids will be syringe-filtered (0.45 μ) into 8 ml scintillation vials. The filtered samples will be diluted (ca 1:1000) into 20 ml scintillation vials and analyzed for lead (Jungreis, "Spot Test Analysis", Appendix IV). The carbon tetrachloride in the original procedure has been replaced by 1,1,1-trichloroethane. Due to WMCO's safety policy. The solutions will be separated by removing the bottom layer with a pasteur pipet rather than a separatory funnel. Samples diluted 1/1000 with D.I. water will then be transferred to a COD vial containing 5 ml of 0.1% potassium cyanide, sealed, shaken, and allowed to settle. Quantification of the lead will be by HACH DRL-3. The HACH DRL-3 is a spectrophotometer used to measure the absorbance of the lead solution. If necessary, the instrument will be modified to fit inside the glove box. It would be preferred, however, if the analyses could be performed outside of the glove box. As an extra precaution, the COD vials containing cyanide buffer have been pre-loaded with reagent so that the maximum amount of reagent handled at any one time will be 5 milliliters. Uranium analysis will be performed on the organic layer after the lead content has been determined. The uranium content will be determined as described in Appendix V (Spot Tests in Inorganic Analysis, F. Feigl).

The second set of samples which require a different digestion approach will be leached with hydrofluoric/hydrochloric acid solutions. The digestions will be performed in specially designed Teflon digestion bombs which are stable up to 250 PSI. The bombs will be heated to 100°C in a sand bath within the glove box. The matrix for this operation can be found in Table 3.

TABLE 3: HF-HCL EXTRACTIONS

RUN NO.	ACID	(NOMINAL CONC.)	DOSE 1:1	2:1	3:1	RT	Temp 100°C
19	36% HCl	5.0% HF [4]	X	X	X	X	
20	36% HCl	5.0% HF	X	X	X		X
21	18% HCl	2.5% HF	X	X	X	X	
22	18% HCl	2.5% HF	X	X	X		X
23	9% HCl	1.25% HF	X	X	X	X	
24	9% HCl	1.25% HF	X	X	X		X

4.2.2 EDTA Extractions

Literature results using EDTA as leachant are contradictory. It appears that EDTA might have some benefit as on extractant. Because of this, a range finding test using 0.2 molar EDTA will also be run.

TABLE 4: EDTA EXTRACTIONS

RUN NO.	EDTA CONC.)	DOSE (PBW) 1:1	2:1	3:1	RT	Temp 100°C
25	0.2M	X	X	X	X	
26	0.2M	X	X	X		X

Samples will be analyzed for lead as before (EDTA samples may require pretreatment nitric acid digestion) and for uranium using a modified Feigl test (F. Feigl, "Spot Tests in Inorganic Analysis", Appendix V). The glove box will be checked for Radon leaks with a survey meter by WMCO personnel and also for air leaks around door seals and glove seals with SNOOP, soapy water and/or ventilation smoke tubes.

[4] Hydrofluoric acid.

Criteria for success will be magnitude of lead and uranium leached compared to the other processes.

5.0 EQUIPMENT AND MATERIALS

See Table 5 for a listing of the equipment to be used during the laboratory screening.

6.0 SAMPLING AND ANALYSIS

The sampling and analysis plan for the samples used for this laboratory screening is contained in "Implementation Plan for the K-65 and Metal Oxide Residue Sampling Project at the Feed Materials Production Center, Fernald, Ohio", Revision 5, December 1988.

7.0 DATA MANAGEMENT

All data will be written into standard laboratory notebooks or on to standard formatted data entry sheets. All records management and reporting will follow standard QA/QC protocol. Standard QA/QC protocol, as it applies to testing within the laboratory, will adhere to the following guidelines:

- 100% verification on all numerical results - all raw data entries, transcriptions, and calculations are checked and recalculated by the laboratory manager.

- Data validation through test reasonableness - summaries of all test results for individual reports are reviewed by the laboratory manager to determine the overall reasonableness of data and to determine the presence of any data that may be considered outliers.

- Routine instrument calibration - all instruments, gauges, and equipment used in testing is calibrated on a routine and timely basis. All instrument calibration follows ASTM or manufacturer's guidelines.

- Maintenance of all past calibration records - records and certification documents of all instruments, gauges, and equipment are updated routinely and maintained in the laboratory manager's office.

- Use of trained personnel conducting tests - all technicians are trained in the application of standard laboratory procedures for analyses as well as the quality assurance measures implemented for internal quality control checks.

8.0 DATA ANALYSIS AND INTERPRETATION

The target metals, lead and uranium, will be evaluated for every extraction technique and presented in tabular form. Parameters will include acid type and concentration, dose ration (weight acid/weight sample), temperature, and percent removals for both target metals.

9.0 HEALTH AND SAFETY

See Appendix II for the site specific health and safety and plan.

10.0 RESIDUALS MANAGEMENT

The laboratory screening will generate four basic waste streams. Stream #1 will consist of approximately 208 grams of radioactive waste residue (K-65 material) resulting from the acid/EDTA leaching process. These residues will be sent to IT Corporation's Radiological Sciences Laboratory in Oak Ridge, Tennessee for analysis and then will be shipped to WMCO for disposal.

Waste stream #2 will be the residue leachate, approximately 9 liters of high lead RCRA waste. This waste will be stored in 5 gallon carboy containers in a secondary containment system. Waste stream #3 will be approximately 2 liters of aqueous cyanide waste generated from the addition of a KCN buffer to the leachate

for the lead analysis. The final waste stream, waste stream #4, will be approximately 1 liter of U-226 RCRA waste generated from the lead analysis. All of the waste materials will be disposed of by WMCO.

11.0 REPORTS

An interim draft report will be issued following the completion of the laboratory screening which will document the results of the extraction procedures. This report will identify those extraction solutions which yielded the best results and will recommend whether those procedures be further tested in the bench-scale treatability program. To verify the success of the recommended extraction solutions it will be necessary to have the residues and leachates analyzed for radium and thorium at IT's Radiological Sciences Laboratory to determine the contaminant removal effectiveness. When the results of these analyses are available they will be incorporated in the interim draft report and a final report on the laboratory screening will be issued.

12.0 SCHEDULE

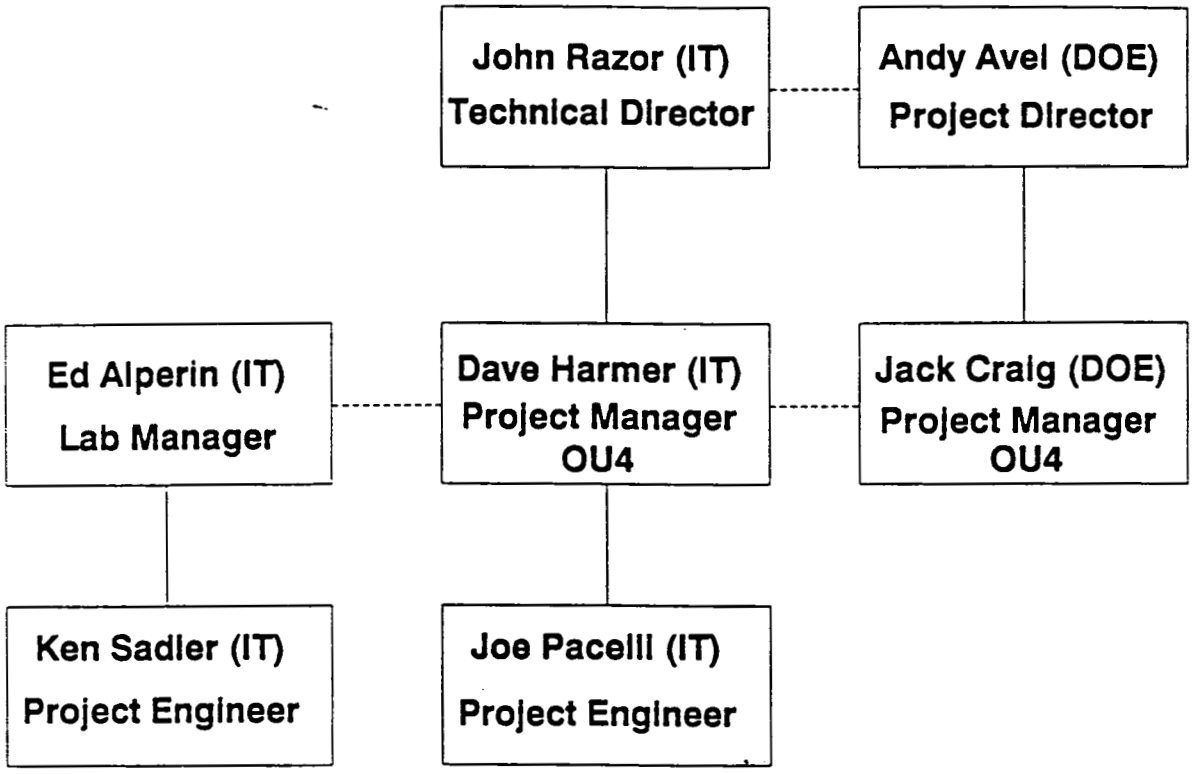
The laboratory screening will commence 5 days following approval of this work plan and will take approximately 2 weeks. The draft interim report of the results of the screening will be issued 2 weeks following completion of the screening. The results from the detailed analysis of the most promising samples by IT's Radiological Sciences Lab will be available approximately three months after receipt. The final report incorporating the analytical results into the draft interim report will be issued 2 weeks later. The duration of this project will be 16 weeks.

13.0 MANAGEMENT AND STAFFING

See Figure 1 for project organization.

TABLE 5
EQUIPMENT AND MATERIALS

ITEM	DESCRIPTION
1	HACH MODEL 41700/41800
1	INTERNATIONAL CLINIC CENTRIFUGE
1	LAB INDUSTRIES PIPETTOR
1	COOLER BOX REAGENT CHEMICALS
1	HACH DIGITAL PH METER
2	HACH COD DIGESTERS MODEL 45600-00
2	RACAL RESPIRATOR SYSTEM WITH 6 BATTERY PACKS AND 144 HEPA CARTRIDGES (P-3)
1	TEK-MAR LABORATORY VIBRATING SHAKER



Management and Staffing

Figure 1

APPENDIX I

WMCO

SPECIAL RADIOLOGICAL SAFETY REQUIREMENTS

FOR VENDORS

SPECIAL RADIOLOGICAL SAFETY REQUIREMENTS FOR
VENDORS
DIAN PATRICK (6088) RADIOLOGICAL ENGINEERING

1. All areas where the vendors will be working shall have current radiation surveys performed, including an initial air monitoring survey performed prior to start of work. Continuous air monitoring shall be done where the vendors will be working based on initial survey and judgement of Radiation Safety.

2. If respiratory protection is required, the workers will complete and pass FMPC Respiratory Training.

3. Vendors working in Controlled Areas shall be issued dosimetry in accordance with IRS&T Safety Procedure OSH-P-32-001. Protective clothing, furnished by FMPC, will be required in Radiological Areas.

4. "Monitored visitors" who will only be observing will be escorted by a FMPC trained Occupational Radiation Worker and will not be required to complete and pass FMPC Radiation Worker Training. "Monitored Visitor's" effective dose equivalent shall not exceed a limiting value of 100 millirem per year from internal irradiation plus the effective dose equivalent from any external irradiation.

5. Vendors who will be working in Radiation Areas shall be classified as "Non-Employee Radiation Workers" and shall comply with requirements as specified in DOE Order 5480.11 dated 12-21-88 and IRS&T Safety Procedure OSH-P-32-001. They will be required to complete and pass FMPC Radiation Worker Training and Criticality Training to have unescorted access to Radiologically-Controlled Areas.

6. Vendors shall be required to provide URINE samples for the Bioassay Program before being issued dosimetry, when requested by Radiation Safety or Medical, and when dosimetry is terminated.

7. The "Non-Employee Radiation Workers" shall have a baseline whole body count before working in Radiation Areas. A termination whole body count shall be required at the end of the project.

8. All individuals and materials that have been in a Radiologically Controlled Area shall be monitored (frisked) for contamination when exiting the Controlled Area. Hand and Foot Monitors shall be use where required.

9. Vendors shall comply with all FMPC Radiation Control Procedures

and DOE Radiological requirements.

10. Individuals who have previous radiation exposure shall provide records of their radiation exposure history.

11. Individuals who will be entering Radiological Areas shall be 18 years of age or older.

12. Vendors needing access to the K-65 Area must notify Radiological Engineering prior to entry.

APPENDIX II

SITE SPECIFIC SAFETY PLAN

FOR THE

FEED MATERIAL PRODUCTION CENTER

SILOS 1 and 2 TREATABILITY

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1.0 TASKS TO BE PERFORMED

Previously collected samples of the K-65 Silo contents will be prepared and analyzed in search of effective treatment methods. Preparations will be performed in a HEPA filtered glove-box located in a foreman's office of the Pilot Plant Maintenance Building.

Dates of Field Work: These samples will be analyzed or treated as time permits during 1990.
Will Site Activities:

no	Disturb Surface Soil	no	Sample Surface Water
no	Disturb Subsurface Soil	no	Sample Lagoons
no	Use Heavy Equipment	no	Use Boat
no	Enter Confined Space	yes	Involve Radioactivity
yes	Disturb Containerized Matter	no	Involve Trenches

2.0 K-65 and PILOT PLANT BACKGROUND INFORMATION

The K-65 silos contain waste from the Manhattan Project, the World War II program that produced the first atomic bombs. For this work, a uranium-rich ore called pitchblende was imported from the Belgian Congo. Pitchblende was treated with nitric acid to dissolve the uranium away from the ore. The remaining residues were mixed with water and pumped into the silos, where the solids settled. The liquids at the surface were pumped back out of the silos into a treatment facility. What remains in the silos now is about 9700 tons of residual solids. The residues in the silos emit radiation. The radioactivity levels of the residues are higher than ordinary tailings from uranium mining and milling. Like other uranium ore tailings, these residues produce radon gas, although in considerably larger quantities.

The Pilot Plant is located in the southwest corner of the process area. The Pilot Plant has been used for a wide variety of activities. These tests will be performed in a section (foreman's office) of the plant that has been previously surveyed and cleared for work in standard process clothing.

3.0 TASK SPECIFIC HAZARD ASSESSMENT

The following hazard assessment is based on historical information and defined task activities. The field team routinely reassesses the hazards before starting work to insure that conditions have not changed. All newly identified hazards will be addressed with the IT health and safety department to determine the degree of hazard and if any changes to the safety plan are needed.

3.1 Physical Hazards

- Noise
- Heat Stress
- Radiological Hazards
  - Th-228 and daughters
  - Th-230 and daughters
  - Ra-226 and daughters

3.2 Chemical Hazards

Contaminant	PEL	Action Level
Acetic Acid	10ppm	5ppm
Hydrochloric Acid	5ppm Ceil	2.5ppm
Hydroflouric Acid	3ppm	1.5ppm
Nitric Acid	2ppm	1ppm
~~Carbon tetrachloride~~	~~10ppm~~	~~5ppm~~
1,1,1,trichloroethane	350ppm	175ppm
Potassium Cyanide	5mg/m3	2.5mg/m3
Sodium Carbonate	2mg/m3*	1mg/m3
Sodium Sulfide	2mg/m3*	1mg/m3
Fly ash	2mg/m3*	1mg/m3
Dolomite Agri. lime	2mg/m3*	1mg/m3
Cement/Sodium silicate	2mg/m3*	1mg/m3

* Alkaline Dust PEL

3.3 Potential Routes of Exposure

The identified site contaminants are either solids or gaseous in nature and the majority of the reagents to be used are liquids. The routes of entry into the body are inhalation, absorption and ingestion in their order of importance. Direct contact with the corrosives may result in destruction of skin tissue and absorption of other contaminants if in solution.

Containment within the glove-box will reduce the probability of an exposure greater than the action level. Handling of samples or reagents before or after processing present the greatest opportunity for worker exposure.

4.0 MONITORING

4.1 Goals

Air monitoring will be performed to insure that contaminant concentrations in the breathing zone do not exceed the concentrations specified by established exposure levels. The action levels include an additional safety factor of two to account for potential inaccuracies associated with the use of field measurements.

IT Corporation policy requires engineering controls or the use of PPE(Personal Protective Equipment) to limit onsite exposures to the action limits values. Exposures to chemicals should be kept as low as possible since there is insufficient data to predict the combined effects of most chemical mixtures.

4.2 Monitoring Equipment and Frequency of Monitoring

Airborne Radioactive Contaminant Monitoring
(Internal Radiation Hazard)

Breathing zone samples will be collected on workers during the preparation/treatment operations. Filters will be counted on a scaler and processed through a muilti-channel analyzer for identification of the isotopes. Conservative resuspension assumptions are then made to arrive at an action level for using respiratory protection.

4.3 External Radiation Hazard Monitoring

A health physics technician from IT Corporation will monitor all locations prior to start of work and will continuously monitor exposures in all areas which exceed the 2 mR/hr action limit. Measures such as increasing shielding, increasing distance or reducing exposure time will be taken to minimize exposures.

4.0 **MONITORING** (continued)

4.4 Action Limits

The following table provides types, scheduling, and actions for air monitoring.

Instrument/chem.	Need	Interval	Limit	Action
Alpha Probe	Y	Pre-Job & Intermittent[3]	500 cpm[1]	APR[2]
Ammonia	Y	Continuous	Odor Detection	
Beta/Gamma Probe	Y	Pre-Job & Intermittent	5000 cpm[1]	APR
External radiation	Y	Pre-Job	>2 mR/hr	Stop
TLD Badge	X	Continuous		
Breathing zone samples	Y	Continuous		
Self-reading dosimeters	Y	Continuous		

1 Above background.
2 Full-face air purifying respirators with organic vapor, acid gas, fume cartridges. Disposable protective clothing, such as Tyvek coveralls and a step-off decontamination will also be required at any time APR are used.
3 At intervals of 30 minutes or less in the breathing zone.

5.0 TASK SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

All employees at the Fernald site will wear at least Level D protection. All employees in the task exclusion area will wear the following personal protective equipment.

ITEM	PPE NEED	JUSTIFICATION
APR	Y	Potential for Contaminant release
Cartridges - Combination OV,AG, HEPA	Y	
Hearing Protection	N	
Hard Hat	Y	Minimum Requirement (When Outside)
Latex Boots	Y	Potential Skin Hazard
Gloves	Y	Potential Skin Hazard
Inner Gloves(Surgical)	Y	Potential Skin Hazard
Leather-Palm Gloves	N	
Nitrile Gloves	Y	For treatment operations
Plain Tyvek	Y	
PE Tyvek	N	
Process Coverall	Y	Minimum Requirement
PVC Gloves	N	
SAR	N	
Safety Glasses	Y	At any time full-face APR not in use
Safety Goggles	N	Optional
Safety Shoes	Y	Minimum Requirement
Saranex Tyvek	N	Potential Skin Hazard

6.0 SITE ACCESS

6.1 Access

Access to the Feed Materials Production Facility is limited by Westinghouse Security. All site personnel and visitors must register and be issued a pass to enter the DOE property.

6.2 Bioassay Samples

A sample of urine is required to be submitted for assay prior to each work period and at the end of the ten day work period.

6.3 Medical Monitoring

In accordance with 29 CFR 1910.120 OSHA requirements, all IT Corporation and subcontractor field personnel are required to participate in a medical monitoring program which includes:

- A baseline medical examination
- Annual medical examination
- Medical examinations may be required after potential exposures.
- Exit medical examination
- WMCO respirator physical

6.4 Training Requirements

All IT and IT subcontractor personnel assigned to the site tasks will, as a minimum, meet OSHA training requirements including:

- 40-hour OSHA training
- 8-hour annual refresher training
- 8-hour supervisory training (for supervisors)
- 24-hour supervised field experience
- Review of site specific hazards and procedures (tailgate meetings)
- WMCO radiation safety training
- WMCO respiratory training and fit test
- MSDS available from the project health and safety.

6.5 Contamination Zones

The Exclusion Zone is the zone of high potential hazard due to physical or chemical dangers. Access to the Exclusion Zone is restricted to employees who are required to enter in order to perform their job functions.

6.0 SITE ACCESS (continued)

6.5 Contamination Zones (continued)

A minimum radius of twenty (20) feet from the glove-box or the room boundaries will be considered to be the Exclusion Zone. The zone may be expanded if airborne hazards are detected. The Exclusion Zone will be marked with signs and barricades or other easily recognizable devices. All areas requiring the use of respiratory protection are included in the exclusion zone.

An informal contamination reduction zone will be placed just outside the Exclusion zone. Respirators and disposable outer clothing will be removed in this area.

7.0 EXPOSURE SYMPTOMS

Acute exposure to solvents and corrosives may produce dizziness or irritation, respectively. Exposure to low levels of radioactivity do not produce acute exposure symptoms. Exposure to radioactivity will be detected during the frisking procedures of decontamination and through the use of self-reading pocket dosimeters and thermoluminescence dosimetry. Such exposures may cause delayed effects such as cancer. Since biological effects from radiation exposures are cumulative, exposures are to be kept as low as reasonably achievable (ALARA).

7.1 First Aid for Exposures

No treatment anticipated for the predicted contaminants and concentrations. See the Contingency Plans and Heat Stress sections.

8.0 SITE ENTRY PROCEDURES

X Each site crew will make radio contact with WMCO CONTROL daily to establish: radio contact, location, start time and stop time.

X Procure radiation work permit from WMCO for treatability testing utilizing a glove-bag operation.
- Identifies degree of radiological hazard.
- May limit allowable work time.
- May specify minimum PPE requirements.

X Perform tailgate meeting to familiarize team with site specific hazards. Chemicals used to prepare the samples will be discussed with special details for handling procedures. The daily work plan will be detailed. Identify exclusion zone and break area. Discuss alternate communications signals (if applicable).

X Calibrate instruments and log calibrations.

X Visually scan the site for signs of contamination.

X Perform respirator check out and fit test prior to use.

X Use buddy system.
Teams of at least two individuals will be used for all activities within an exclusion zone. Team members will monitor each other for signs of heat stroke or other distress and will render aid.

Note: The IT Site Safety Officer and any member of the IT field team have the authority to stop work when imminent or serious safety hazards or conditions exist. Restart of work will be allowed only after the hazard or condition has been abated or reduced to a level deemed acceptable by the SSO (or his designated representative) and Project Manager. If there is a question about what is acceptable, the work should be discontinued and the matter discussed with the IT Site Safety Officer.

9.0 SITE EXITING PROCEDURE

9.1 Contamination Detection

All site personnel are required to decontaminate themselves and then confirm the effectiveness of the decontamination. The effectiveness will be determined by frisking with a hand held radiation monitor.

The monitor must be held within 1/2 inch of the surface and moved at a rate of approximately 1" per second for effective radiation monitoring. If frisking count exceeds DETECTABLE, additional decontamination is required. This decontamination will be conducted by scrubbing with soap and water.

In the event that contamination can not be removed to below the action levels (100 cpm beta/gamma or detectable alpha radiation, above background), notify the project health and safety.

9.2 Decontamination

Decontamination reduces contaminant concentrations to acceptable levels, but does not generally remove it totally. Try to avoid contamination where possible by making minimum contact with the contaminant.

Personnel: Dry removal of disposable protective equipment, wash hands, face and any other exposed skin. Detergent and water should be used to scrub skin surfaces which have contacted potentially contaminated wastes.

The effectiveness of decontamination must be confirmed by frisking or the use of hand and foot monitors.

Monitoring Equipment: Any exposed areas of the monitoring equipment surface will be wiped with a damp paper towel/cloth to remove contamination. Wiping with cloth dampened with detergent solution may be necessary to remove greasy materials.

Heavy Equipment: Heavy equipment generally requires decontamination at the equipment pad for non-production area environmental work. Frisking and/or wipe tests will be performed to confirm the effectiveness of decontamination.

10.0 OPERATIONALLY DERIVED WASTES

Operationally derived wastes are wastes generated in the performance of onsite activities. These wastes include, but are not limited to:

- Disposable PPE such as Tyvek coveralls, gloves, booties.
- Disposable decontamination supplies such as muslin wipes and HEPA vacuum bags.

Protective clothing will be placed in plastic bags, placed in a B-25 box or metal drum for disposal as compactible, potentially contaminated waste through WMCO.

Operationally derived wastes are the property of the client and are to be left onsite unless otherwise specified in the written contract.

The client will be responsible for proper transport, shipment or disposal unless otherwise specified in the written contract.

J. T. BAKER CHEMICAL CO. 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865
M A T E R I A L S A F E T Y D A T A S H E E T
24-HOUR EMERGENCY TELEPHONE -- (201) 859-2151
CHEMTREC # (800) 424-9300 -- NATIONAL RESPONSE CENTER # (800) 424-8802

SECTION IX - STORAGE AND HANDLING PRECAUTIONS (CONTINUED)

AND COMBUSTIBLE MATERIALS.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME	NITRIC ACID (OVER 40%)
HAZARD CLASS	OXIDIZER
UN/NA	UN2031
LABELS	OXIDIZER, CORROSIVE
REPORTABLE QUANTITY	1000 LBS.

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME	NITRIC ACID
HAZARD CLASS	8
UN/NA	UN2031
LABELS	CORROSIVE

(TM) AND (R) DESIGNATE TRADEMARKS.
N/A = NOT APPLICABLE OR NOT AVAILABLE

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-- LAST PAGE --

MATERIAL SAFETY DATA SHEET

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J.T.Baker CHEMICALS

J. T. Baker Chemical Co., 222 Red School Lane, Phillipsburg, N.J. 08865

CHEMICAL NAME	FORMULA
Hydrofluoric Acid	HF (in water)
SYNONYM OR CROSS-REFERENCE	CAS NO: EPA NO:

MATERIAL	NATURE OF HAZARD

BOILING POINT About 226°F	MELTING POINT
VAPOR PRESSURE HF @ 20°C 48%: 10 mm Hg	SPECIFIC GRAVITY 1.1 - 1.2
VAPOR DENSITY (AIR=1) 0.7	PERCENT VOLATILE BY VOLUME (%) 100
WATER SOLUBILITY Complete	EVAPORATION RATE (_____ = 1) Unknown

APPEARANCE
Colorless fuming liquid: sharp, penetrating odor.

FLASH POINT (method used)	FLAMMABLE LIMITS	Lower	Upper
N.A. Non-Flammable	N.A.		

FIRE EXTINGUISHING MEDIA Water spray recommended as giving minimum splashing hazard.

SPECIAL FIRE-FIGHTING PROCEDURES
Wear self-contained breathing apparatus approved by NIOSH; special protective clothing.

UNUSUAL FIRE AND EXPLOSION HAZARD Difficult to contain as it corrodes most substances except lead, wax, polyethylene and platinum. May generate hydrogen in contact with some metals.

CHEMICAL NAME

STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	

INCOMPATABILITY (materials to avoid)

Fluorine, arsenic trioxide, phosphorous pentoxide, alkalies.

HAZARDOUS DECOMPOSITION PRODUCTS

HF gas evolution increases with temperature.

HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	

SPILLS

Flush immediately, neutralize carefully with soda ash or lime and again flush with water.

DISPOSAL

Contact a professional disposal service.

RESPIRATORY PROTECTION (specify type)

Self-contained breathing apparatus or supplied air (hose mask).

VENTILATION	LOCAL Strong natural or forced draft or complete enclosure of material.	SPECIAL
	MECHANICAL (general)	OTHER

PROTECTIVE GLOVES Gauntlet-type, of neoprene, plasticized PVC or equivalent.	EYE PROTECTION Chemical safety goggles and face shield.

OTHER PROTECTIVE EQUIPMENT

See (1) Below

STORAGE & HANDLING Store only in approved containers, avoid glass and some metals. Store below 125°F, preferably below 100°F., in well-ventilated area.

(1) Full coverage of body with clothing including hat at all times (not required with small quantities); also rubber

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Mallinckrodt, Inc., Science Products Division, P.O. Box M, Paris, KY 40361

)INITRILO) TETRAACETIC
IUM SALT

)ENTIFICATION:

ım EDTA; disodium dihydrogen
aacetate; disodium edetate;
ɔis [N-(carboxymethyl), disodium salt,

6381-92-6 (Hydrated)

139-33-3 (Anhydrous)

372.24

$C_{10}H_{14}O_8N_2Na_2 \cdot 2H_2O$

.ns:
Tetraacetic Acid Disodium Salt

)NARY MEASURES

IRRITATION.

eyes, skin and clothing.
her handling.

:Y/FIRST AID

immediately flush skin or eyes with plenty of
5 minutes.

ıss: Not Regulated

SECTION 1 Physical Data

Appearance: White crystals

Odor: Odorless.

Solubility: 10 g in 100 g of water.

Boiling Point: Not applicable.

Melting Point: Decomposes at 252°C (486°F).

Density: No information found.

Vapor Density (Air = 1): No information found.

Vapor Pressure (mm Hg): No information found.

Evaporation Rate: No information found.

SECTION 2 Fire and Explosion Information

Fire:
Not considered to be a fire hazard.

Explosion:
Not considered to be an explosion hazard.

Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire.

Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

SECTION 3 Reactivity Data

Stability:
Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:
May form carbon oxides and nitrogen oxides when heated to decomposition.

Hazardous Polymerization:
This substance does not polymerize.

Incompatibilities:
Oxidizing agent.

SECTION 4 Leak/Spill Disposal Information

Ventilate area of leak or spill. Clean-up personnel require protective clothing and respiratory protection from dust. Spills: Pick up and place in a suitable container for reclamation or disposal in a method that does not generate dust. Disposal: Whatever cannot be saved for reclamation may be disposed in an approved hazardous waste facility.

Ensure compliance with local, state and federal regulations.

3C

2027

(ETHYLENEDINITRILO) TETRAACETIC ACID DISODIUM SALT

| Health Hazard Information

URE / HEALTH EFFECTS

May cause coughing or sneezing.

low toxicity by ingestion. Large amounts may cause
ise to osmotic imbalance through the sequestering of

:t:
May cause reddening or inflamation on prolonged

t:
fects expected but dust may cause mechanical

posure:
ealth effects expected.

. of Pre-existing Conditions:
ealth effects expected.

B. FIRST AID

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:
Give several glasses of water to drink to dilute. If large amounts were swallowed, get medical advice.

Skin Exposure:
Remove any contaminated clothing. Wash skin with soap or mild detergent and water for at least 15 minutes. Get medical attention if irritation develops or persists.

Eye Exposure:
Wash eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

C. TOXICITY DATA (RTECS, 1982)

Anhydrous salt: Oral rat LD50: 2000 mg/kg Mutation data cited. Reproductive effects data cited.

SECTION 6 Occupational Control Measures

Airborne Exposure Limits:
None established.

Ventilation Systems:
In general, dilution ventilation is a satisfactory health hazard control for this substance. However, if conditions of use create discomfort to the worker, a local exhaust system should be considered.

Personal Respirators: (NIOSH Approved)
For conditions of use where exposure to the dust is apparent, a dust/mist respirator may be worn. For emergencies, a self-contained breathing apparatus may be necessary.

Skin Protection:
Wear protective gloves and clean body-covering clothing.

Eye Protection:
Use chemical safety goggles. Contact lenses should not be worn when working with this material. Maintain eye wash fountain and quick-drench facilities in work area.

SECTION 7 Storage and Special Information

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage.

.....

HTTAD

11.0 CONTINGENCY PLANS

WMCO Has an established Emergency Response Plan and this organization will be utilized for any emergency other than minor injuries. IT personnel will not attempt to treat injuries, fight significant fires or control chemical spills.

11.1 Injuries

In the event of injuries, site personnel will try to reduce or eliminate the consequences when possible. The process of determining what is appropriate to do requires that each situation be evaluated on a case by case basis. Workers are not to enter an unknown atmosphere in a confined space without proper respiratory equipment even if a person has collapsed.

All injuries within the process area will be assumed to involve radioactive contamination until proven otherwise by WMCO. Injuries complicated by chemical contamination will be evaluated after considering the hazards associated with the contamination.

If it is safe for the worker to attempt rescue, it should be done without delay to minimize the victim's injuries.

11.1.1 Minor Injuries

Minor injuries (sprains, strains, and cuts) are expected to be controlled by onsite personnel using standard first aid practices. ALL INJURIES WILL BE TREATED BY WMCO MEDICAL AND REPORTED TO IT PROJECT HEALTH AND SAFETY.

11.1.2 Serious Injuries Radio CONTROL

The WMCO Medical Department maintains an emergency life squad crew and ambulance on all shifts, seven days a week. This crew will be notified immediately of any serious injury. The IT crew will use standard first aid procedures to stabilize the injury pending arrival of WMCO response personnel.

CPR should be administered only by persons currently certified in CPR. Prior to performing CPR, the rescuer should consider what caused the victim to collapse. Chemicals around the nose and mouth can endanger the rescuer.

11.0 CONTINGENCY PLANS (continued)

11.1.3 Chemical Splashes

Eyes
Move the victim to an uncontaminated area. Hold the victims eyes open and flush eyes for 15 minutes with water (or isotonic saline).
•Notify Control.
•Tell the Control the name of the chemicals, if known. Tell them what was done to treat the patient(s).
•Tell how many patients to expect.

Skin
Move the victim to an uncontaminated location. Remove contaminated clothing and wash the affected skin areas. Flush the skin for 15-30 minutes and notify Medical.

11.1.4 General Procedures for Injuries

Injuries of persons contaminated with acutely toxic chemicals will be treated so as to minimize the hazard to both the rescuer and the victim. If the rescuer can not safely attempt rescue, he/she should not attempt it.

- The victim should be moved into an uncontaminated area and given a preliminary decontamination.
- Preliminary decontamination generally consists of flushing with water to dilute and remove most of the chemical. It also includes removal of contaminated clothing.
- As soon as the chemical hazard has been reduced to an acceptable level, the rescuer should stabilize the victim.
- More thorough decontamination can be performed at a later time.
- Care should be taken to minimize the spread of contaminant through run off.
- Notify the ambulance dispatcher of the chemical involvement.
- Extent of injuries.
- What treatment has been performed (including decontamination)
- Number of victims.
- Your location.
- Telephone number.

11.0 CONTINGENCY PLANS (continued)

- You HANG UP LAST. The dispatcher is trained to be calm and ask for the appropriate information in the order that it appears on his/her form. In some instances, the facility may be complex and require additional information such as cross streets or an escort from the entrance to the site.
- If you call the hospital, notify the emergency room of the chemical involvement so that they can prepare for the arrival.

11.2 Chemical/Radiological Releases Radio CONTROL

If a release in the form of a spill, leak or vapor cloud is observed, IT personnel will withdraw at least 300 feet upwind and immediately radio control.
If possible, the following information should be included in the notification:

- Cause of release if known
- Location of release
- Time of release
- Chemical identify
- Quantity involved
- If there is radioactive involvement
- If materials are leaving the area as a vapor/gas
- If there is fire involvement
- The number of known exposures or injuries (if any)

Additional information may be requested such as:

- What has been/is being done to minimize the hazard.
- Degree of hazard to responders based on your knowledge of the contaminants.

11.3 Emergency Telephone Numbers

Ambulance: Radio to Control
LOCAL AMBULANCE: 911
Hospital: Radio to Control
Fire: Radio to Control

	Work	Home	Radio
Bill Kwoka, ASI H&S (WMD):	(615)483-1274	(615)482-2885	
Alvin Luttrell, V.P. (WMD):	(615)483-1274	(615)966-4490	
Harry Windecker:	(513)738-3100	(513)771-2525	
Ray Meyer, Site Manager:	(513)738-3100	(513)860-4284	
Randall, Odell, SHSO:	(513)738-3100	(513)829-5579	822
Joe Poliziani, H.P., PHSO:	(513)738-3100	(513)868-1158	810
Bob Galbraith,	(513)738-3100	_____	
Wm. Hertel, Field PM (IT):	(513)738-3100	(812)934-2840	817
Susan Birner, Personnel:	(505)883-0959	-	
Greg McAnarny, H&S (Corp.):	(505)883-0959	(505)293-0794	
Oba Vincent	(513)738-6937	(513)779-6210	
Leo Singleton, WMCO:	(513)738-8908	-	
Dick Kasparek, WMCO:	(513)738-6899	-	
Mark Turner, H.P.:	(513)738-6899	_____	824
Utility Engineer (WMCO):	.....	.....	202
EMERGENCY RESPONSE	**(513)738-6511**	**or**	**CONTROL**
Industrial Hygiene:	(513)738-6207		357
Radiation Safety (WMCO):	(513)738-6889		355
Fire and Safety (WMCO):	(513)738-6235		303

HOSPITALS

The nearest medical facility is the WMCO infirmary. It is the primary choice for onsite injuries. First aid station and ambulance service is available at the FMPC infirmary. Radio contact CONTROL. WMCO maintains an emergency response capability which includes an ambulance and EMT trained personnel.The WMCO ambulance will transport the injured workers to the nearest hospital if necessary.

If WMCO ambulances are unavailable for any reason, Control will call for a community ambulance. Confirm that an ambulance has been called.

If radio contact can not be made with WMCO, call 911 for an ambulance. Estimated response time for community ambulance is 15-20 minutes. Minor injuries should be transported to the WMCO infirmary using available vehicles.

12.0 CONFINED SPACE ENTRY

No Confined Space Entry is Permitted.

13.0 PERSONAL PROTECTIVE EQUIPMENT

This discussion of personal protective equipment is generic in nature. Specific site requirements are presented in the Task Specific Personal Protective Equipment Section.

13.1 Level-B

Hardhat (optional)
Face Shield (optional)
Self contained breathing apparatus (Air line or bottled air)
Disposable coveralls: Saranex, Tyvek or equivalent
Inner gloves: Latex or PVC
Outer gloves: (chemical resistant): Nitrile, butyl etc.
Chemical resistant boots
Latex booties (optional)
Level-B PPE is to be worn in any of the following environments:

- Atmospheres containing chemicals having poor warning properties.
- Unknown atmospheres
- IDLH atmospheres
- Air concentrations exceeding 3X exposure standard
- Contaminants do not pose significant threat of exposure through skin absorption.

13.2 Level-C

Hardhat (optional)
Face Shield (optional)
Air purifying respirator cartridges (organic vapors, acid gas, pesticides, radionuclides, particulates)
Disposable coveralls: Saranex, Tyvek or equivalent
Inner gloves: Latex or PVC
Outer chemical resistant: Nitrile, butyl etc.
Chemical resistant boots
Outer Disposable booties:latex
Level-C is intended to be used where:

- Contaminants have good warning properties
- Cartridges are approved for use with the contaminant
- Oxygen concentrations are between 19.5 and 25%
- Toxic contaminant concentrations are not IDLH
- Concentrations are known and continuously monitored
- **Contaminant concentrations do not exceed 3X exposure**

13.0 **PERSONAL PROTECTIVE EQUIPMENT** (continued)

Cartridges will be changed:

- Daily.
- If color indicator shows that the cartridge is spent.
- If breakthrough is detected.

13.3 Level-D

Hardhat (optional)
Eye protection: safety glasses or goggles
Coveralls
Work boots
Work gloves

Level D PPE is basically a work uniform and provides no protection against chemicals. Level D is intended for sites where there is no risk from contaminants which can enter the breathing zone. Since most nonvolatile chemicals can adhere to particulates and be resuspended in the air, Level D is generally not permitted on contaminated sites. Level D can be used to work in areas where there is no risk of contamination such as upgradient installation of "Background" monitoring wells. Level D is not street clothes.

14.0 CALIBRATION OF SITE ENTRY EQUIPMENT

It is the designated Site Safety Officer's duty to check the log book(s) before site entry to verify that the site entry equipment was calibrated. If the following information is not present, the SSO should notify the team leader who is ultimately responsible for the overall operation. The team leader is then responsible for getting the items corrected.

14.1 Radiation Meter

Semi-annual calibration by manufacturer or NBS traceable standard.
Daily field function check using check source or gas mantle bags.
Record:

- Date
- Time
- Radiation source

Results: Note that the readings should be stable. If the results start to change while testing under the same conditions, notify the IT Health and Safety Department.

16.0 HEAT STRESS

Heating of the body occurs from three sources:

1. Radiant heating from heat sources or sunlight.
2. Convective heating from contact with a warmer object or liquid.
3. Metabolic heating caused by activity.

Cooling occurs through three mechanisms:

1. Respiration: The air we exhale is warm. As the body overheats, the respirations become more rapid.
2. Radiation: Heat is released at the surface of the skin. As the body overheats, the superficial blood vessels dilate and allows more heat to be lost.
3. Evaporation: Perspiration is released to the skin surface and evaporates. The skin is cooled by evaporative cooling.

Personal protective equipment reduces the body's ability to shed excess heat through radiation and evaporation. Personal protective equipment (for chemicals) can also act like a greenhouse and collect radiant heat.

These facts mean that heat stress can be a serious problem to hazardous waste site workers. The following discussion is intended to familiarize personnel with the symptoms of heat stress.

Heat stress is a progressive condition. Its mildest form is a slight elevation of body temperature. Normal body temperature is generally near 98.6 F. Working in high temperatures may elevate the temperature to 100-101 F. By the time that the body temperature reaches 101 F, the worker generally has a headache. This is not a serious condition and can be treated through increased rest periods and cool fluid intake. The worker should not be allowed to work until the body temperature has been reduced to below 99F.

If work continues when the first symptoms occur, the person may develop Heat Cramps. Heat Cramps are brought about by long exposure to heat. The outside temperature does not have to be much higher than the "normal" environment. The person perspires heavily, often drinking large quantities of water. As the sweating continues, salts are lost by the body bringing about painful muscle cramps.

<u>Treatment:</u> Any heat related emergency will be immediately reported to the WMCO medical department for subsequent treatment. The worker should be given rest, cool fluids, and removed from work for at least the remainder of the day. The person is likely to have an increased susceptibility to heat for the next few days.

16.0 HEAT STRESS (continued)

Heat Exhaustion

Heath exhaustion symptoms include a near normal body temperature and profuse sweating. The temperature may reach 103 F.

Treatment of Heat Exhaustion

Remove the person from field work. Have the person rest in a cool area such as an air conditioned car or shaded area. Provide cool liquids to drink. Avoid beverages which contain caffeine or alcohol. Do not allow the victim to go back to work for at least one or two days.

Heat Stroke

Heat stroke is a life threatening condition. The person's body temperature regulating mechanism fail and his body can not rid itself of excess heat. Heat stroke symptoms include high body temperatures and HOT DRY SKIN. Most cases of heat stroke are reported on hot humid days.

HEAT STROKE VICTIMS MUST BE TRANSPORTED TO A HOSPITAL FOR IMMEDIATE TREATMENT. The individual must not be allowed to drive himself, since cases are on record where the victims condition worsens, he lapses into unconsciousness and dies. Heat stroke victims are not to return to field work without the physician's consent.

PREVENTION OF HEAT STRESS

Become acclimatized to heat for several days whenever possible. Work in the cooler portions of the day. Early morning hours and evening hours are cooler.

Take frequent breaks and consume at least one pint of cool fluid every hour. Replenish electrolytes through the consumption of diluted drinks. The body loses more water than electrolytes. Concentrated salt, electrolyte, or juices can make you more suspectable to heat stress.

16.0 HEAT STRESS (continued)

Monitoring:

Heat Stress Monitoring should be performed whenever temperatures exceed 80 F and respiratory protection is required.

Body Temp.:	less than 99:	Continue Work
Pulse Rate:	< 110 bpm	
Body Temp:	>99-100.3 F	Reduce rate of work or take more frequent breaks. Consume more cool fluids.
Pulse Rate:	< 110 bpm	
Body Temp:	> 100.4 F or	Remove from work until temp. reduced to 99 F or less and pulse rate reduced to 110 bpm or less.
Pulse Rate:	> 110 bpm	

If the body temperature exceeds 100.4, or the pulse rate exceeds 110 bpm at rest, the person must not continue to work. These procedures have been found to prevent most heat related illnesses. Occasionally, high heat conditions combined with poor eating, sleeping and drinking habits has resulted in heat stroke occurring in less than 20 minutes.

Heat stress monitoring must be performed at least once per hour for documentation, but may have to be increased under severe circumstances.

Table 3 Signs and Symptoms of Heat Stress

- **Heat rash** may result from continuous exposure to heat or humid air.

- **Heat cramps** are caused by heavy sweating with inadequate electrolyte replacement.

  Signs and symptoms include:
  - muscle spasms
  - pain in the hands, feet, and abdomen

- **Heat exhaustion** occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include:
  - pale, cool, moist skin
  - heavy sweating
  - dizziness
  - nausea
  - fainting

- **Heat stroke** is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool and body before serious injury and death occur. Competent medical help must be obtained. Signs and symptoms include:
  - red, hot, usually dry skin
  - lack of/or reduced perspiration
  - dizziness and confusion
  - strong, rapid pulse
  - coma

17.0 APPROVAL AND COMPLIANCE STATEMENT

This site specific safety plan was produced for the use of IT employees and IT subcontractors. It was intended for the Feed Materials Production Center, Fernald, Ohio.

The undersigned persons have read and understood the attached site specific safety plan and agree to follow its provisions:

Name (lettered)	Signature	Date
_____	_____	_____
TEAM LEADER		
_____	_____	_____
DESIGNATED SITE SAFETY OFFICER		
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

The following individuals are not obligated, by contract, to follow IT safety policies, but have read and understood the safety plan:

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Compliance with the provisions of this plan may be audited through announced or unannounced site visits. Be sure that you document all field actions/changes. Site visits may be performed:

___ By IT Corporation

___ By Client

___ By OSHA

APPENDIX III

HADH MICRO COD DIGESTER

TABLE III
Concentrations of Reagents in COD Digestions

	Macro/50 mL	Macro/10 mL	Micro/High Range	Micro/Low Range
Range:	50-800 mg/L COD	50-800 mg/L COD	50-1500 mg/L COD	0-150 mg/L COD
Sample:	50 mL	10 mL	2 mL	2 mL
H_2SO_4:	75 mL	15 mL	2.5 mL	2.5 mL
$K_2Cr_2O_7$:	0.3065* g	0.0613* g	0.0245 g	0.00245 g
$AgSO_4$:	0.75 g	0.15 g	0.03 g	0.03 g
$HgSO_4$:	1.0 g	0.2 g	0.03 g	0.03 g

*These values can be reduced to 1/10 if running samples with a COD in the range of 0-80

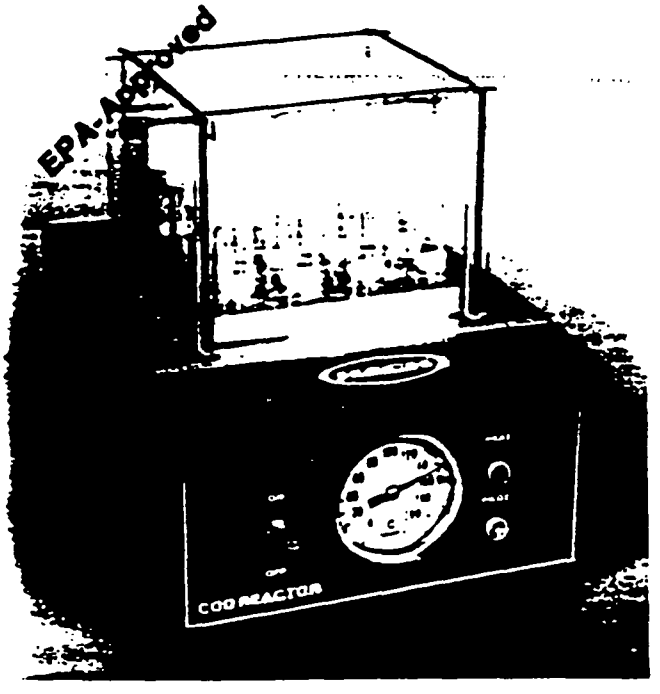

Figure 2: Micro COD Set-up

The oxidation procedure is as follows:

1. Turn on the COD reactor to preheat to 150°C. Remove the cap from a COD Digestion Reagent Vial. While holding the vial at a 45°-angle, carefully pipet 2.00 mL of sample into the vial.

2. Replace the cap and tighten cautiously. Place vial in rubber hose section and, holding by the cap, invert it several times to mix. **CAUTION: THE VIAL WILL BECOME VERY HOT DURING MIXING. DO NOT MIX TUBE NEAR FACE.**

3. Place the vial in the preheated COD reactor. Heat the vial for two hours, remove and measure the COD either colorimetrically or titrimetrically. When determining the COD colorimetrically, it may be possible to shorten the oxidation time. This is discussed in detail later.

Safety Notes for the Micro Oxidation Procedure

The micro method inherently is less hazardous than the macro method because:

3. Pipetting and measurement of hazardous reagents have been eliminated.

4. In case of control failure, sample and mixtures cannot overheat. The Hach COD Reactor is safety-fused to shut down at 181°C.

5. Analysts do not handle reacted samples for colorimetric determination or add additional sulfuric acid to the vials when using a titrimetric procedure.

However, as with any chemical analysis method, analysts should observe certain precautions when using the micro oxidation procedure:

1. Use only the exact volume of sample called for in the procedure. A larger sample will dilute the acid concentration and lower the boiling point of the mixture. This will increase pressure in the vial, causing it to burst or leak. The vials have been tested using pure water at 185°C (perhaps 20 to 30 times greater pressure than the normal reaction mixture) for seven hours without damage, but they can not be guaranteed as pressure vessels.

2. Fit the plexiglass safety shield over the reactor while heating vials. In the unlikely event of vial breakage, this precaution will minimize any resulting hazard.

3. **WEAR SAFETY GLASSES OR GOGGLES.** When mixing the two layers, hold the vial away from the face and body. A great deal of heat is generated, which can crack even borosilicate glass.

Oxidation of Pure Organic Compounds

Because their concentrations can be measured precisely, pure organic compounds often are used in COD research. By oxidizing pure compounds, analysts can measure the extent of oxidation when experimental conditions are varied. Their use also provides information about reactions of various classes of compounds with dichromate. Table IV demonstrates percent of recovery of pure compounds when digested by Hach, Jirka and Carter and *Standard Methods* procedures. It is clear the micro methods produce consistently higher recoveries because they use closed reaction systems which retain all volatile compounds and all volatile compo-

APPENDIX IV

ANALYTICAL PROCEDURE FOR LEAD

SPOT TEST ANALYSIS

ERVIN JUNGREIS

ALYSIS

APHS ON
TS APPLICATIONS

FORDNER
THOFF

G. Mossotti
Smith
a Tremilon
Vest

CATION

ONS

Toronto / Singapore

2027

QD98.S6J86

Spot Test Analysis

CLINICAL, ENVIRONMENTAL, FORENSIC, AND GEOCHEMICAL APPLICATIONS

ERVIN JUNGREIS

The Hebrew University of Jerusalem
Jerusalem, Israel

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The preparation of a plastic rod takes about 5 hours. Castolite is a clear, syrupy liquid that pours easily and forms a crystal-clear solid extremely resistant to heat and chemicals. The addition of a hardener and cold-setting promoter leads to solidification.

5.3.1. Rapid Screening for Copper, Lead, and Zinc in Soils and Rocks

Many rapid methods have been developed for the estimation of copper, lead, and zinc for geochemical prospecting purposes. In most cases the total amount of these metals is not determined; rather, varying amounts of the metals enter the solution depending on the dissolution procedure. The determination of only the readily soluble copper, lead, and zinc is sometimes of greater diagnostic value for prospecting than are the total values.

Various extraction modes have been used successfully in geochemical prospecting. Samples of hard rock were leached, for example, with dilute sulfuric acid or dilute hydrochloric acid (22) for semiquantitative screening for copper, lead, and zinc. Sediments and soils were screened for the same metals by partially dissolving the samples in dilute nitric acid (23, 24).

In contrast to the above-mentioned leaching procedures, the pyrosulfate fusion screening technique dissolves almost totally the copper, lead, and zinc in almost all naturally occurring soils and rocks.

The chromogen for the colorimetric estimation of zinc and lead is dithizone. Carbon tetrachloride solutions of dithizone form red zinc dithizonate when shaken with a buffered sample. Dithizone is also used as a specific reagent for the determination of lead when the masking agent cyanide is used to sequester the interfering ions. Copper is determined on the basis of the formation of the complex of monovalent copper with 2,2′-biquinoline.

PROCEDURE FOR PREPARATION OF THE SAMPLE SOLUTION. Crush the sample to minus 80 mesh. Scoop a 0.1-g sample into a 16 × 150 mm test tube, add by scooping 0.5 g potassium persulfate powder, mix intimately, and heat. Fuse the mixure for about 2 min after the flux melts. After cooling, add 3 ml 50% HCl to the tube and place the tube in a hot water bath until the melt disintegrates completely. Crushing with a glass rod helps the disintegration process. After removal and cooling, dilute the sample to 10 ml with deionized water. Take aliquots from the sample for the lead, zinc, and copper determinations.

PROCEDURE FOR THE ESTIMATION OF LEAD. Put a 2-ml aliquot of the sample solution into a 125-ml separation funnel containing 10 ml lead buffer solution. Add conc. ammonia dropwise in the presence of thymol

blue indicator until the pH range 8.5–9.0 is reached. This point is indicated by a color change from yellow to blue. Add 5 ml 0.001% dithizone solution in carbon tetrachloride and shake the separating funnel for ~15 sec. Drain the carbon tetrachloride layer into a 25-ml glass-stoppered graduated cylinder containing 10 ml 0.1% potassium cyanide solution. Shake the cylinder briefly. Compare the color of the carbon tetrachloride layer with those of similarly prepared standard solutions.

Lead standards (0, 1, 2, and 3 μg) are prepared by pipetting aliquots from a 10-ppm standard lead solution. Calculation of the metal concentration is according to the general formula:

$$\text{ppm} = \frac{\text{volume of sample solution in ml}}{\text{sample weight taken for analysis in g}} \times \frac{\mu\text{g of trace element found}}{\text{aliquot of sample solution in ml}}$$

PREPARATION OF LEAD BUFFER SOLUTION. Put 50 g ammonium citrate, 10 g potassium cyanide, and 8 g hydroxylamine hydrochloride into a large separation funnel. Add 800 ml deionized water and dissolve the materials by shaking. Add 2 ml 0.2% aqueous thymol blue indicator; then add conc. ammonia until the color turns blue (pH 8.5).

PROCEDURE FOR THE ESTIMATION OF ZINC. Transfer a 2-ml aliquot of the sample solution to a 22 × 175 mm test tube containing 8 ml zinc buffer solution. Add 5 ml 0.001% dithizone solution in carbon tetrachloride, cap the tube, and shake for 30 sec. Compare the color of the carbon tetrachloride layer with those of similarly prepared standard zinc solutions (0, 1, 2, 3, and 4 μg).

PREPARATION OF ZINC BUFFER SOLUTION. Dissolve 125 g sodium thiosulfate in ~400 ml deionized water in a large separation funnel. Remove heavy metals by extracting with 0.01% dithizone solution and discarding the colored extract. Dissolve 300 g sodium acetate in 400 ml deionized water, add 60 ml glacial acetic acid, and remove heavy metals as before. Combine these two solutions and dilute to 2 liters.

In the presence of sodium thiosulfate, elements potentially interfering with the zinc determination are masked. Only palladium and bivalent tin react under similar conditions, but palladium is unlikely to occur in significant concentrations, and tin occurs almost always in the stannic form.

APPENDIX V

URANIUM ANALYTICAL PROCEDURE

SPOT TESTS IN INORGANIC ANALYSIS

F. FEIGL

2027

SPOT TESTS IN INORGANIC ANALYSIS

by

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Laboratorio da Produção Mineral, Ministério da Agricultura, Rio de Janeiro; Professor at the University of Brazil; Member of the Austrian, Brazilian and Goiânia Academies of Sciences

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1972

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[redacted]

benzidine, is used in the form of its chloride, sulfates are not precipitated, and molybdates are precipitated only from solutions more concentrated than 10 %. Tungsten, however, is precipitated quantitatively as a white amorphous product.

The precipitation of tungstates by chlorides of polyatomic organic bases does not lead to formula-pure tungstates of the particular bases but to adsorption compounds of WO_3-gel and the bases. This is especially true of the precipitation of small amounts of tungsten from acid solution.

Procedure. A drop of the test solution is mixed with a drop of diphenyline hydrochloride in a micro test tube. A precipitate, or cloudiness, indicates the presence of tungstate. For very small amounts, a blank test should be carried out and compared with the test, after both have stood for 15 minutes.

Limit of Identification: 6 γ tungsten
Limit of Dilution: 1 : 8500
Reagent: 1 % solution of diphenyline chloride in 2 N hydrochloric acid

1. F. Feigl, *Rec. trav. chim.*, 58 (1939) 471.
2. G. v. Knorre, *Z. anal. Chem.*, 47 (1908) 87.

URANIUM

(1) Test with 8-hydroxyquinoline (oxine)[1]

In neutral or masked alkaline solutions of uranyl salts, a quantitative precipitation of a red-brown product is obtained by adding 8-hydroxyquinoline (oxine). In contrast to other metal oxinates, which for the most part are inner complex phenolates[2], the uranium compound contains also a molecule of oxine as neutral part according to the formulation $UO_2(C_9H_6NO)_2 \cdot C_9H_6NOH$.[3] Probably this compound should not be viewed as uranyl oxinate but rather as the oxine ester of uranic acid, in other words as oxine uranate.

The precipitation through oxine also occurs from solutions of the complex alkali uranyl double carbonates, which yield $[UO_2(CO_3)_3]^{-4}$ ions. The latter are produced by adding an excess of alkali carbonate to solutions of uranyl salts. Since all metal ions forming oxinates are precipitated by alkali carbonate, it is thus possible to separate the uranium before conducting the test with oxine.

Procedure. The test solution is treated with an excess of ammonium carbonate solution. Any precipitate is filtered off or removed by centrifuging. One drop of the clear liquid is placed on a spot plate or filter paper and treated with a drop of 5 % alcohol solution of oxine. A red-brown precipitate or stain indicates uranium.

[redacted]

Limit of Identification: 10 γ uranium
Limit of Dilution: 1 : 5,000
Reagent: Ammonium carbonate solution: 2 g of the salt is dissolved in 10 ml of concentrated ammonia and diluted with 10 ml of water

1. A. de Sousa, *Mikrochem. ver. Mikrochim. Acta*, 40 (1953) 319.
2. Compare F. J. Welcher, *Organic Analytical Reagents*, Vol. I, New York, 1947, p. 284ff.
3. F. Hecht and W. Reich-Rohrwig, *Monatsh.*, 53, 54 (1929) 399; F. Hecht and H. Kraft-Ebing, *Z. anal. Chem.*, 106 (1936) 321.

Quantitative methods
B. Hök, *Svensk Kem. Tidskr.*, 65 (1953) 106.
A. de Sousa, *Mikrochemie Mikrochim. Acta*, 40 (1953) 319.
A. Classen and J. Visser, *Rec. trav. chim.*, 65 (1946) 211.
L. Silverman, L. Moudy and D. W. Hawley, *Anal. Chem.*, 25 (1953) 1369.
D. L. Ruth, A. K. De, J. Lacroix and P. J. Elving, *Anal. Chem.*, 27 (1955) 1802.
A. R. M. Al-Salihy, *Dissertation Abstracts*, 21 (1961) 2091.
K. S. Koppiker and K. B. Gajankush, *At. Energy Comm. India Rept. AEET-225*, 1955.

(2) Test with potassium ferrocyanide

Neutral or acetic acid solutions of uranyl salts give a red-brown precipitate with potassium ferrocyanide. Very dilute solutions give only a coloration. Uranyl potassium ferrocyanide or uranyl ferrocyanide is formed.

This test is specific in the absence of ferric and copper salts which also give colored ferrocyanides. In this case, previous separation with alkali carbonate is necessary (see test 1).

Procedure.[1] A drop of the slightly acid test solution is placed on filter paper impregnated with 3 % potassium ferrocyanide, or a drop of the test solution and then the ferrocyanide are placed on filter paper. According to the concentration of uranium, a more or less intense brown stain is formed.

Limit of Identification: 0.92 γ uranium
Limit of Dilution: 1 : 50,000

Test for uranium in the presence of iron and copper[1]

The test for uranium with potassium ferrocyanide can also be carried out in the presence of ferric and cupric salts, if these metals are converted, before the addition of the ferrocyanide, into the nonreacting cuprous and ferrous forms. Reduction with iodide ions in acid solution serves this purpose:

$$2\,Cu^{++} + 4\,I^- \rightarrow Cu_2I_2 + I_2$$
$$2\,Fe^{+3} + 2\,I^- \rightarrow 2\,Fe^{+2} + I_2$$

If the liberated iodine is decolorized (reduced) with thiosulfate, the uranium may then be detected with potassium ferrocyanide.

APPENDIX VI

APPLICABLE MSDS'S

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ATTN: SAFETY DIRECTOR
IT CORPORATION
REGIONAL ACCOUNTING
312 DIRECTORS DRIVE
KNOXVILLE TN 37923
DWAYNE ROOT

DATE: 04/02/87
CUST # 427195 P.O. # 307376

MATERIAL SAFETY DATA SHEET

IDENTIFICATION

PRODUCT # 29899-9 NAME: 1,1,1-TRICHLOROETHANE, ANHYDROUS, UNINHIBITED, 99+%

CAS # 71-55-6

TOXICITY HAZARDS

RTECS # KJ2975000
ETHANE, 1,1,1-TRICHLORO-

IRRITATION DATA

EYE-MAN 450 PPM/8H	BJIMAG 28,286,71
SKN-RBT 5 GM/12D-I MLD	AIHAAP 19,353,58
SKN-RBT 500 MG/24H MOD	28ZPAK -,28,72
EYE-RBT 100 MG MLD	AIHAAP 19,353,58
EYE-RBT 2 MG/24H SEV	28ZPAK -,28,72

TOXICITY DATA

IHL-MAN LCLO:27 GM/M3/10M	JOCMA7 8,358,66
ORL-RAT LD50:10300 MG/KG	NTIS** PB257-185
IHL-RAT LC50:18000 PPM/4H	28ZPAK -,28,72
IPR-RAT LD50:5100 MG/KG	NTIS** PB257-185
ORL-MUS LD50:11240 MG/KG	NTIS** PB257-185
IHL-MUS LC50:3911 PPM/2H	SAIGBL 13,226,71
IPR-MUS LD50:4700 MG/KG	TXAPA9 13,287,68
ORL-DOG LD50:750 MG/KG	FMCHA2 -,C242,83
IPR-DOG LD50:3100 MG/KG	TXAPA9 10,119,67
ORL-RBT LD50:5660 MG/KG	AIHAAP 19,353,58
ORL-GPG LD50:9470 MG/KG	AIHAAP 19,353,58

REVIEWS, STANDARDS, AND REGULATIONS

CARCINOGENIC REVIEW:ANIMAL INDEFINITE IMEMOT 20,515,79
MSHA STANDARD-AIR:TWA 350 PPM (1900 MG/M3) DTLVS* 3,161,71
OSHA STANDARD-AIR:TWA 350 PPM FEREAC 39,23540,74
NIOSH REL TO 1,1,1-TRICHLOROETHANE-AIR:CL 350 PPM/15M MMWR** 34(1S), 29S,85
EPA GENETIC TOXICOLOGY PROGRAM, JANUARY 1984
REPORTED IN EPA TSCA INVENTORY, 1983
EPA TSCA 8(A) PRELIMINARY ASSESSMENT INFORMATION, FINAL RULE FEREAC 47,26992,82
EPA TSCA SECTION 8(E) STATUS REPORT 8EHQ-0283-0471 S:8EHQ-0980-0365: 8EHQ-0982-0457
EPA TSCA SECTION 8(E) STATUS REPORT 8EHQ-0979-0310
NIOSH CURRENT INTELLIGENCE BULLETIN 27, 1978
"NIOSH MANUAL OF ANALYTICAL METHODS, 3RD ED." SEE: METHOD 1003
NCI CARCINOGENESIS BIOASSAY (GAVAGE):RESULTS INDEFINITE:MOUSE,RAT (NCITR* NCI-CG-TR-3,77)
NCI CARCINOGENESIS BIOASSAY COMPLETED:RESULTS NEGATIVE:MOUSE, RAT (NCITR* NCI-CG-TR-3,77)
NTP CARCINOGENESIS STUDIES: TEST COMPLETED, JUNE 1986
MEETS CRITERIA FOR PROPOSED OSHA MEDICAL RECORDS RULE FEREAC 47,30420, 82

ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR COMPLETE INFORMATI

HEALTH HAZARD DATA

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ACUTE EFFECTS

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CATALOG # 29899-9 NAME: 1,1,1-TRICHLOROETHANE, ANHYDROUS, UNINHIBITED, 99+%

CAUSES SKIN IRRITATION.
EXPOSURE TO AND/OR CONSUMPTION OF ALCOHOL
MAY INCREASE TOXIC EFFECTS.
PROLONGED EXPOSURE CAN CAUSE:
NARCOTIC EFFECT.
DERMATITIS

CHRONIC EFFECTS
DAMAGE TO THE LIVER
DAMAGE TO THE KIDNEYS

FIRST AID
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES.
IN CASE OF CONTACT, IMMEDIATELY WASH SKIN WITH SOAP AND COPIOUS AMOUNTS OF WATER.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL RESPIRATION, PREFERABLY MOUTH-TO-MOUTH. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
CALL A PHYSICIAN.
WASH CONTAMINATED CLOTHING BEFORE REUSE.

PHYSICAL DATA

MELTING POINT: -35 C
BOILING POINT: 74 C TO 76 C
SPECIFIC GRAVITY: 1.338

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: NONE

EXTINGUISHING MEDIA
WATER SPRAY.
CARBON DIOXIDE, DRY CHEMICAL POWDER, ALCOHOL OR POLYMER FOAM.

SPECIAL FIRE FIGHTING PROCEDURES
WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.

UNUSUAL FIRE AND EXPLOSION HAZARDS
EMITS TOXIC FUMES UNDER FIRE CONDITIONS.

REACTIVITY DATA

INCOMPATIBILITIES
STRONG OXIDIZING AGENTS
ALUMINUM
AND ITS ALLOYS.
MAGNESIUM
ZINC
STRONG BASES

REACTS VIOLENTLY WITH:
POTASSIUM
SODIUM

HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
TOXIC FUMES OF:
CARBON MONOXIDE, CARBON DIOXIDE
HYDROGEN CHLORIDE GAS
PHOSGENE GAS

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.
COVER WITH DRY LIME OR SODA ASH, PICK UP, KEEP IN A CLOSED CONTAINER AND HOLD FOR WASTE DISPOSAL.
[illegible] STOP [illegible] MATERIAL PICKUP IS COMPLETE

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MATERIAL SAFETY DATA SHEET

CATALOG # 29899-9 NAME: 1,1,1-TRICHLOROETHANE, ANHYDROUS, UNINHIBITED, 99+%

WASTE DISPOSAL METHOD
DISSOLVE OR MIX THE MATERIAL WITH A COMBUSTIBLE SOLVENT AND BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER.

OBSERVE ALL FEDERAL, STATE & LOCAL LAWS.

--- PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE ----

CHEMICAL SAFETY GOGGLES.
RUBBER GLOVES
OSHA/MSHA-APPROVED RESPIRATOR.
SAFETY SHOWER AND EYE BATH.
MECHANICAL EXHAUST REQUIRED.
AVOID CONTACT AND INHALATION.
DO NOT GET IN EYES, ON SKIN, ON CLOTHING.
WASH THOROUGHLY AFTER HANDLING.
IRRITANT.
KEEP TIGHTLY CLOSED.
STORE IN A COOL DRY PLACE.

---------- ADDITIONAL PRECAUTIONS AND COMMENTS ---------

ADDITIONAL INFORMATION
1,1,1-TRICHLOROETHANE HAS BEEN REPORTED TO REACT VIOLENTLY WITH ACETONE, NITRITES, AND OXYGEN.

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT DOES NOT PURPORT TO BE ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. ALDRICH SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING OR FROM CONTACT WITH THE ABOVE PRODUCT. SEE REVERSE SIDE OF INVOICE OR PACKING SLIP FOR ADDITIONAL TERMS AND CONDITIONS OF SALE.

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CHEMTREC # (800) 424-9300 -- NATIONAL RESPONSE CENTER # (800) 424-8802

N3669 -01 NITRIC ACID PAGE 1

EFFECTIVE: 10/01/85 ISSUED 01/23/85

SECTION I - PRODUCT IDENTIFICATION

PRODUCT NAME: NITRIC ACID
FORMULA: HNO3
FORMULA WT: 63.01
CAS NO.: 07697-37-2
NIOSH/RTECS NO.: QU5775000
COMMON SYNONYMS: HYDROGEN NITRATE
PRODUCT CODES: 4801,9602,9598,9606,5371,9597,9600,5113,9616,9605,9601

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA(TM) SYSTEM

HEALTH	-	3	(POISON)
FLAMMABILITY	-	0	
REACTIVITY	-	3	(OXIDIZER)
CONTACT	-	4	(CORROSIVE)

LABORATORY PROTECTIVE EQUIPMENT

GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

PRECAUTIONARY LABEL STATEMENTS

POISON DANGER
STRONG OXIDIZER - CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE
LIQUID AND VAPOR CAUSE SEVERE BURNS - MAY BE FATAL IF SWALLOWED
HARMFUL IF INHALED AND MAY CAUSE DELAYED LUNG INJURY
SPILLAGE MAY CAUSE FIRE OR LIBERATE DANGEROUS GAS

KEEP FROM CONTACT WITH CLOTHING AND OTHER COMBUSTIBLE MATERIALS. DO NOT STORE NEAR COMBUSTIBLE MATERIALS. DO NOT GET IN EYES, ON SKIN, ON CLOTHING. DO NOT BREATHE VAPOR. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF FIRE, FLOOD WITH WATER. FLUSH SPILL AREA WITH WATER SPRAY.

SECTION II - HAZARDOUS COMPONENTS

COMPONENT	%	CAS NO
NITRIC ACID	65-75	7697-37-

SECTION III - PHYSICAL DATA

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BOILING POINT: 120 C (248 F) VAPOR PRESSURE(MM HG): 2.9

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SECTION III - PHYSICAL DATA (CONTINUED)

LUBILITY(H2O): COMPLETE (IN ALL PROPORTIONS) % VOLATILES BY VOLUME 100

PEARANCE & ODOR: COLORLESS LIQUID, WITH CHOKING ODOR.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

ASH POINT: N/A NFPA FOAM RATING: 3-0-0 OXY

E EXTINGUISHING MEDIA
USE WATER SPRAY.

CIAL FIRE-FIGHTING PROCEDURES
FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL.

SUAL FIRE & EXPLOSION HAZARDS
STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE.

IC GASES PRODUCED
NITROGEN OXIDES

SECTION V - HEALTH HAZARD DATA

ESHOLD LIMIT VALUE (TLV/TWA): 5 MG/M3 (2 PPM)

RT-TERM EXPOSURE LIMIT (STEL): 10 MG/M3 (4 PPM)

ECTS OF OVEREXPOSURE
LIQUID MAY CAUSE SEVERE BURNS TO SKIN AND EYES.
INHALATION OF VAPORS MAY CAUSE SEVERE IRRITATION OF THE RESPIRATORY SYSTEM
INHALATION OF VAPORS MAY CAUSE COUGHING, CHEST PAINS, DIFFICULTY BREATHING OR UNCONSCIOUSNESS.
INGESTION MAY BE FATAL.

RGENCY AND FIRST AID PROCEDURES
CALL A PHYSICIAN.
IF SWALLOWED, DO NOT INDUCE VOMITING; IF CONSCIOUS, GIVE WATER, MILK, OR MILK OF MAGNESIA.
IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH PLENTY OF WATER FO AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.
WASH CLOTHING BEFORE RE-USE

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N3660 -01 NITRIC ACID PAGE

EFFECTIVE: 10/01/85 ISSUED 01/23/

SECTION VI - REACTIVITY DATA

STABILITY: STABLE HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID HEAT, LIGHT

INCOMPATIBLES STRONG BASES, COMBUSTIBLE MATERIALS, STRONG REDUCING AGENTS

DECOMPOSITION PRODUCTS OXIDES OF NITROGEN

SECTION VII - SPILL AND DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE

WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING. ST LEAK IF YOU CAN DO SO WITHOUT RISK. VENTILATE AREA. NEUTRALIZE SPILL WI SODA ASH OR LIME. WITH CLEAN SHOVEL, CAREFULLY PLACE MATERIAL INTO CLEA DRY CONTAINER AND COVER; REMOVE FROM AREA. FLUSH SPILL AREA WITH WATER. KEEP COMBUSTIBLES (WOOD, PAPER, OIL, ETC.) AWAY FROM SPILLED MATERIAL.

J. T. BAKER NEUTRASORB(R) OR NEUTRASOL(R) "LOW NA+" ACID NEUTRALIZERS ARE RECOMMENDED FOR SPILLS OF THIS PRODUCT.

DISPOSAL PROCEDURE

DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER: D002, D003 (CORROSIVE, REACTIVE WASTE)

SECTION VIII - PROTECTIVE EQUIPMENT

VENTILATION USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV REQUIREMENTS.

RESPIRATORY PROTECTION RESPIRATORY PROTECTION REQUIRED IF AIRBORNE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS UP TO 100 PPM, A CHEMICAL CARTRIDGE RESPIRATOR WITH ACID CARTRIDGE IS RECOMMENDED. ABOVE THIS LEVEL, A SELF-CONTAINED BREATHING APPARATUS IS ADVISED.

EYE/SKIN PROTECTION: SAFETY GOGGLES AND FACE SHIELD, UNIFORM, PROTECTIVE SUIT, ACID-RESISTANT GLOVES ARE RECOMMENDED.

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SECTION IX - STORAGE AND HANDLING PRECAUTIONS