

**CENTER FOR NUCLEAR WASTE  
REGULATORY ANALYSES**

Proc. AP-010

Revision 0

**ADMINISTRATIVE PROCEDURE**

Page 1 of 7

Title Laboratory Chemical Hygiene Plan and Standard Operating Procedures (SOP) for the Center for Nuclear Waste Regulatory Analyses Laboratory

**EFFECTIVITY AND APPROVAL**

Revision 0 of this procedure became effective on 9/26/91. This procedure consists of the pages and changes listed below.

<u>Page No.</u>	<u>Change</u>	<u>Date Effective</u>
1 - 7	0	9/26/91

**SUPERSEDED**

*Superseded by Rev 1, Chgo 4/16/96*

Supersedes Procedure No. N/A

**Approvals**

Written By

*James D. Puhay*

Date

*9/17/91*

Cognizant Director

*Samuel Adams*

Date

*9/26/91*

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**LABORATORY CHEMICAL HYGIENE PLAN  
AND STANDARD OPERATING PROCEDURES (SOP)  
FOR THE CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES LABORATORY**

1. **LABORATORY CHEMICAL HYGIENE OFFICER:** James D. Prikryl is the Division 20 Laboratory Chemical Hygiene officer designated to coordinate all aspects of the Chemical Hygiene Plan for the laboratories in Building 57 for the period of 1/91 to 6/92.
2. **GENERAL OVERVIEW:** The Center for Nuclear Waste Regulatory Analyses (Division 20) is utilizing Building 57 on the SwRI campus for in-house Laboratory work. Division 20 was organized in October of 1987 and started laboratory work in late 1988. The Division is currently concentrating on the Geologic Setting (GS), Engineered Barrier System (EBS), and Repository Design, Construction, and Operations (RDCO) Program Element laboratory activities. Research is being conducted in the general areas of geochemistry, thermohydrology, corrosion, and rock mechanical properties. Many laboratory activities involve the use of hazardous chemicals for sample preparation and analysis. General types of hazardous chemicals include acids, heavy liquids, and organic reagents. Hazardous chemicals are stored in approved areas, separate from general chemical storage and work being performed.
3. **SPECIFIC LABORATORY PROCEDURES:** The Center staff is involved in regulatory analysis, technical assistance, and research for the Nuclear Regulatory Commission. Since much of the work in the laboratory is "prototyping" or one-time testing, use of Laboratory or Scientific Notebooks is the primary method of documenting work accomplished. Standardized procedures (ASTM, and others as required) are utilized whenever possible, and are referenced in Center Operations Plans and Project Plans. For repetitive analytical work in the Center's Laboratory, staff personnel are encouraged to develop and implement a Technical Operating Procedure. This has been accomplished in many cases. Those Technical Operating Procedures (TOPs) and Quality Assurance Procedures (QAPs), are maintained in Room 113 (Geochemistry Office) in the Center Laboratory for ready reference.
  - A. Hazardous chemicals in the Center Laboratory are listed below. Note that this list is subject to change as laboratory activities and capabilities progress.

Acids and Corrosives

1-amino-2-naphthol-4-sulfonic acid

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acetic acid  
ammonium hydroxide  
hydrochloric acid  
hydrofluoric acid  
nitric acid  
oxalic acid  
perchloric acid  
phosphomolybdic acid  
sodium hydroxide  
sulfuric acid

Organics and Heavy Liquids

1,1,2,2,-tetrabromoethane  
acetone  
arsenazo III  
bromoform  
carbon tetrachloride  
N,N-dimethyl formamide  
toluene  
tributyl phosphate

Oxidizers

ammonium nitrate  
calcium nitrate  
hydrogen peroxide  
potassium bromate  
potassium nitrate  
potassium permanganate  
sodium nitrate  
sodium nitrite

Toxic and Reactive Reagents

8-hydroxyquinoline  
ammonium metavanadate  
barium chloride  
cerium sulfate  
eriochrome cyanine R  
hydrazine sulfate  
lithium chloride  
mercuric chloride  
potassium chromate  
potassium ferricyanide  
potassium ferrocyanide  
potassium fluoride  
sodium fluoride

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sodium hydrosulfite  
sodium molybdate

Metals

aluminum powder  
mercury  
zinc powder

Center personnel authorized and trained to work with hazardous chemicals are those who have read this Chemical Hygiene Plan and signed the acknowledgement sheet attached to the Center Laboratory copy of this Plan. Laboratory personnel, including Principal Investigators, new Center staff, and Student Scientists, and those who work for Center staff, are to follow this Chemical Hygiene Plan.

B. Safety requirements:

- (1) Characteristics of the hazardous chemicals involved.

Material Safety Data Sheets (MSDS) on all chemicals are kept in a ring binder in Room 113 in the Center laboratory. When a chemical is ordered, the MSDS sheet is expected to arrive with the order. If not, the Aldrich MSDS System is accessed through the Ether Net Banyan Vines System to print out MSDS sheets.

- (2) Notification and emergency reporting procedures.

Laboratory personnel will be familiar with the nearest location of emergency eye wash and shower facilities, fire alarm switches, fire extinguishers, and chemical spill kits. Laboratory personnel will be knowledgeable on the proper use of these items. The Material Safety Data Sheet Notebook is readily available in the Laboratory and shall be consulted in case of accident. Should a chemical emergency occur, the general procedure is as follows:

- a) Remove the chemical from contact with the body, flushing the affected area with copious amounts of water, if appropriate. If the accident involves an inhalation victim, remove the person to fresh air.
- b) Dial 2222 if a major emergency requiring medical attention occurs during working hours. Individuals requiring medical help after work hours should be

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transferred to Methodist Hospital Emergency Room.

- c) Any areas contaminated with a chemical spill should be cleaned with the use of the chemical spill kit or paper towels, depending on the severity of the spill. Proper protective clothing (gloves, etc.) shall be worn while cleaning chemical spills especially acids. Materials used to clean a contaminated area should be disposed of properly.
- d) File an accident report with the Institute Nurse and Division Safety Point of Contact as soon as possible.

(3) Storage and transportation of hazard chemicals.

MSDS sheets, storage codes, and NFPA (National Fire Protection Association) hazard codes are used to determine the proper storage location for all chemicals in the Center laboratory. Hazardous chemicals are stored in approved areas, separate from general chemical storage and work being performed. Hazardous chemicals are separated into three categories for the purpose of storage. These categories are:

Flammables

- kept in ventilated cabinets labelled "FLAMMABLE" under fume hoods.

Acids and corrosives

- kept in ventilated cabinets labelled "ACIDS" under fume hoods.

Toxic, oxidizing, and reactive reagents

- kept in secure storage cabinets that are locked when authorized personnel are not present.

Hazardous waste generated by laboratory activities will be collected in properly labelled glass or plastic containers and regularly removed from the Center Laboratory to the Institute central waste storage facility. Containers will be labelled with the type of chemical present or if the waste is a mixture, the label will include the correct percentage of each chemical or compound. A disposal form, provided by

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the Safety Office, will be completed for all hazardous waste and the Safety Office will be notified to arrange for transport to the waste storage facility.

(4) Provisions for information/training.

Center Laboratory staff are employed because they possess the skills required for work in the Laboratory. They have been trained previously in school or on-the-job training at other locations. New employees working in the Center Laboratory shall be immediately trained on the duties and safety requirements of the job to which they are assigned. This Chemical Hygiene Plan and the Operating Procedures of the Center shall be reviewed by each new employee. The appropriate Supervisor shall walk the new employee through the Laboratory, showing him or her safety equipment and the hazards of working with certain chemicals and/or equipment. Ample opportunity shall be afforded for the new employee to ask questions and become fully safety conscious in the new job. Specialized safety training, via video tapes and classroom instruction, is available to Center staff by contacting the Institute Safety and Industrial Hygiene Office.

C. Safety Policies and Personal Protective Clothing and Equipment:

- 1) Lab coats, gloves, safety goggles, face shields, and half-mask respirators will be available for working with acids or fuming chemicals.
- 2) Vented hoods will be used to reduce the possibility of accumulated fumes and vapors from chemicals.
- 3) All chemicals must have a label describing the hazards involved with it. This includes all chemicals in manufacturer's containers, lab bottles, jars, squirt bottles, impingers, flasks, beakers, and polyethylene reagent bottles. All chemical reagents made will be labeled with chemical names, hazards, date made (or date not to be used after), and initials of the employee who made them.
- 4) Records of regular inspections will be maintained on the vented fume hoods, the fire extinguishers, and other "inspectable" safety equipment.

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- 5) Shoes must have closed toes and preferably have rubber soles.
- 6) ANSI approved safety glasses must be worn at all times by persons working with hazardous chemicals.
- 7) Safety gloves, laboratory coats, face shields, and/or goggles will be made available for use when individuals working with hazardous chemicals require them.
- 8) No food or drink will be taken into the experiments area of the Laboratory. In addition, smoking will not be allowed in or in the vicinity of the interior of the Laboratory.

NOTE: Although it is the ultimate responsibility of the Laboratory Supervisor to ensure that good safety procedures are followed in the Center Laboratory, the safety of the Lab rests on the combined attention to safety of each individual. It is fully expected that each individual will do his or her part in maintaining a safe working environment for everyone.

Laboratory Chemical Hygiene Plan  
and Standard Operating Procedures (SOP)

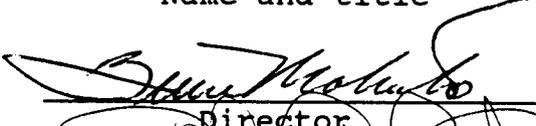
for the CNWRA Laboratory # 1, Bldg. 57.

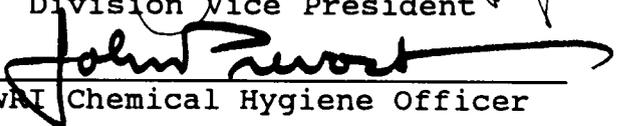
The supervisor of this laboratory is James Prikryl.

**REFERENCE:** 29 CFR 1910.1450, the current SwRI Chemical Hygiene Plan, and the current SwRI Safety Manual.

**APPLICABILITY:** Procedures specified in this document and in the above referenced documents are applicable to all staff\* working in this laboratory when work involves the use of hazardous chemicals. A copy of the SwRI Chemical Hygiene Plan and this SOP will be readily available to all staff in this laboratory.

Prepared by: Bruce Mabrito  
Division Safety Representative  
Name and title

Approved by:   
Director  
  
Division Vice President

  
SwRI Chemical Hygiene Officer

Date approved 2/1/91

\* This includes temporary, permanent, custodial workers, and contractors.

Laboratory Chemical Hygiene Plan  
and Standard Operating Procedures (SOP)

for the CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES Laboratory

- e. Use of special equipment or controls:
    - (1) Fume hood(s),
    - (2) Other engineering controls,
    - (3) Special monitoring required.
  - f. Inspection, cleanup, and disposal procedures. If hazardous waste is generated by this laboratory, describe the specific procedures for handling hazardous waste.
  - g. Attach copies of Material Safety Data Sheets (MSDS).
  - h. Include a statement that all concerned staff have reviewed and understand the MSDS(s) and this SOP.
4. This guidance is not all inclusive. In the interest of accident prevention, add any other pertinent/special information or guidance to ensure the safety/protection of all personnel and/or facilities involved.
5. It is the laboratory supervisor's responsibility to enforce this guidance.

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Title Laboratory Chemical Hygiene Plan and Standard Operating Procedures (SOP) for the Center for Nuclear Waste Regulatory Analyses

**EFFECTIVITY AND APPROVAL**

Revision 1 of this procedure became effective on 04/16/96. This procedure consists of the pages and changes listed below.

<u>Page No.</u>	<u>Change</u>	<u>Date Effective</u>
1-7	0	04/16/96

**SUPERSEDED**

*Superseded by Rev 2, Chg 0 7/10/98*

Supersedes Procedure No. Revision 0 dated 09/26/91.

**Approvals**

Written By

*James W. Long*

Date

*4/16/96*

Cognizant Director

*Samuel J. ...*

Date

*4/16/96*

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**LABORATORY CHEMICAL HYGIENE PLAN  
AND STANDARD OPERATIONS PROCEDURES (SOP)  
FOR THE CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES**

1. LABORATORY CHEMICAL HYGIENE OFFICER

James D. Prikryl is the Division 20 Laboratory Chemical Hygiene officer designated to coordinate all aspects of the Chemical Hygiene Plan for the laboratories in Buildings 57 and 51.

2. GENERAL OVERVIEW

The Center for Nuclear Waste Regulatory Analyses (CNWRA) is utilizing Buildings 57 and 51 on the Southwest Research Institute (SwRI) campus for in-house Laboratory work. The CNWRA was organized in October of 1987 and started laboratory work in late 1988. Lab work is being conducted in the general areas of geochemistry, thermohydrology, corrosion, biochemistry, radiochemistry, structural deformation, and rock mechanical properties. Many laboratory activities involve the use of hazardous chemicals for sample preparation and analysis. General types of hazardous chemicals include acids, heavy liquids, and organic reagents. Hazardous chemicals are stored in approved areas, separate from general chemical storage and work being performed. Radioactive materials are handled in accordance with procedures set forth in the SwRI Radiological Health and Safety Manual. Specific methods for the handling and disposal of radioisotopes have been developed for the CNWRA Laboratory and are on file with the Institute Radiation Safety Officer.

CNWRA personnel authorized and trained to work with hazardous chemicals are those who have read this Chemical Hygiene Plan and signed the acknowledgement sheet attached to the CNWRA Laboratory copy of this Plan. Laboratory personnel (including Principal Investigators, new CNWRA staff, and Student Scientists) and those who work for CNWRA staff are to follow this Chemical Hygiene Plan.

3. SPECIFIC LABORATORY PROCEDURES

The CNWRA staff is involved in regulatory analysis, technical assistance, and laboratory work for the Nuclear Regulatory Commission and others. Since much of the work in the laboratory is "prototyping" or one-time testing, use of Laboratory or Scientific Notebooks is the primary method of documenting work accomplished. Standardized procedures (ASTM, and others as required) are utilized whenever possible, and are referenced in CNWRA Operations Plans, proposals, and Project Plans. For repetitive analytical work in the CNWRA's Laboratory, staff personnel are encouraged to develop and implement a Technical Operating Procedure. This has been accomplished in many cases. Those Technical Operating Procedures (TOPs) and Quality Assurance Procedures (QAPs), are maintained in Building 57 for ready reference.

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3.1 Hazardous Chemicals

Hazardous chemicals in the CNWRA Laboratory are listed below. Note that this list is subject to change as laboratory activities and capabilities progress.

Acids and Corrosives

- 1-amino-2-naphthol-4-sulfonic acid
- acetic acid
- ammonium hydroxide
- hydrochloric acid
- hydrofluoric acid
- nitric acid
- oxalic acid
- perchloric acid
- phosphomolybdic acid
- sodium hydroxide
- sulfuric acid
- ammonium oxalate
- phosphoric acid
- sodium sulfide
- sodium bisulfate

Organics and Heavy Liquids

- 1,1,2,2-tetrabromoethane
- acetone
- arsenazo III
- bromoform
- carbon tetrachloride
- N,N-dimethyl formamide
- toluene
- tributyl phosphate
- benzene
- xylenes

Oxidizers

- ammonium nitrate
- calcium nitrate
- hydrogen peroxide
- potassium bromate
- potassium nitrate
- potassium permanganate
- sodium nitrate
- sodium nitrite

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Toxic and Reactive Reagents

8-hydroxyguinoline  
ammonium metavanadate  
barium chloride  
cerium sulfate  
eriochrome cyanine R  
hydrazine sulfate  
lithium chloride  
mercuric chloride  
potassium chromate  
potassium ferricyanide  
potassium ferrocyanide  
potassium fluoride  
sodium fluoride  
sodium hydrosulfite  
sodium molybdate

Metals

aluminum powder  
mercury  
zinc powder

3.2 Safety Requirements

- (i) Characteristics of the hazardous chemicals involved.

Material Safety Data Sheets (MSDS) on all chemicals are kept in a ring binder in Room L106 in the CNWRA Laboratory. When a chemical is ordered, the MSDS sheet is expected to arrive with the order. If not, the Aldrich MSDS System is accessed through the Ethernet Banyan Vines System to print out MSDS sheets.

- (ii) Notification and emergency reporting procedures.

Laboratory personnel will be familiar with the nearest location of emergency eye wash and shower facilities, fire alarm switches, fire extinguishers, and chemical spill kits. Laboratory personnel will be knowledgeable on the proper use of these items. The Material Safety Data Sheet Notebook is readily available in the Laboratory and shall be consulted in case of accident. Should a chemical emergency occur, the general procedure is as follows:

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- Remove the chemical from contact with the body, flushing the affected area with copious amounts of water, if appropriate. If the accident involves an inhalation victim, remove the person to fresh air.
- Dial 2222 if a major emergency requiring medical attention occurs during working hours. Individuals requiring medical help after work hours should be transferred to Methodist Hospital Emergency Room.
- Any areas contaminated with a chemical spill should be cleaned with the use of the chemical spill kit or paper towels, depending on the severity of the spill. Proper protective clothing (gloves, etc.) shall be worn while cleaning chemical spills, especially acids. Materials used to clean a contaminated area should be disposed of properly.
- File an accident report with the Institute Nurse and Division Safety Point of Contact as soon as possible.

(iii) Storage and transportation of hazard chemicals.

MSDS sheets, storage codes, and NFPA (National Fire Protection Association) hazard codes are used to determine the proper storage location for all chemicals in the CNWRA Laboratory. Hazardous chemicals are stored in approved areas, separate from general chemical storage and work being performed. Hazardous chemicals are separated into three categories for the purpose of storage. These categories are:

- Flammables kept in ventilated cabinets labelled "FLAMMABLE" under fume hoods.
- Acids and corrosives kept in ventilated cabinets labelled "ACIDS" under fume hoods.
- Toxic, oxidizing, and reactive reagents kept in secure storage cabinets that are locked when authorized personnel are not present.

Hazardous waste generated by laboratory activities will be collected in properly labelled glass or plastic containers and regularly removed from the CNWRA Laboratory to the Institute central waste storage facility. Containers will be labelled with the type of chemical present or if the waste is a mixture, the label will include the correct percentage of each chemical

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or compound. A disposal form, provided by the Safety Office, will be completed for all hazardous waste and the Safety Office will be notified to arrange for transport to the waste storage facility.

- (iv) Provisions for information/training.

CNWRA Laboratory staff are employed because they possess the skills required for work in the Laboratory. They have been trained previously in school or on-the-job training at other locations. New employees working in the CNWRA Laboratory shall be immediately trained on the duties and safety requirements of the job to which they are assigned. The Chemical Hygiene Plan and the Operating Procedures of the CNWRA shall be reviewed by each new employee. The appropriate Supervisor shall walk the new employee through the Laboratory, showing him or her safety equipment and the hazards of working with certain chemicals and/or equipment. Ample opportunity shall be afforded for the new employee to ask questions and become fully safety conscious in the new job. Specialized safety training, via video tapes and classroom instruction, is available to CNWRA staff by contacting the SwRI Safety and Industrial Hygiene Department.

**3.3 Safety Policies and Personal Protective Clothing and Equipment**

- (i) Lab coats, gloves, safety goggles, face shields, and half-mask respirators will be available for working with acids or fuming chemicals.
- (ii) Vented hoods will be used to reduce the possibility of accumulated fumes and vapors from chemicals.
- (iii) All chemical reagents made will be labelled with chemical names, date made (or date not to be used after), and initials of the employee who made them.
- (iv) Records of regular inspections will be maintained on the vented fume hoods, the fire extinguishers, and other "inspectable" safety equipment.
- (v) Shoes must have closed toes and preferably have rubber soles.
- (vi) ANSI approved safety glasses, with side shields, must be worn at all times by persons working with hazardous chemicals.

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- (vii) Safety gloves, laboratory coats, face shields, and/or goggles will be made available for use when individuals working with hazardous chemicals require them.
- (viii) No food or drink will be taken into the experiments area of the Laboratory. In addition, smoking will not be allowed in or in the vicinity of the interior of the Laboratory.

**NOTE:**

Although it is the ultimate responsibility of the Principal Investigator to ensure that good safety procedures are followed on their project work, the safety of the Laboratory rests with the combined attention to safety by each individual. It is fully expected that each individual will do his or her part in maintaining a safe working environment for everyone. Coordination with the Chemical Hygiene Officer in CNWRA Laboratories is of utmost importance.

Laboratory Chemical Hygiene Plan  
and Standard Operating Procedures (SOP)

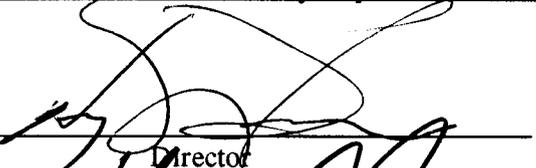
for the CNWRA Laboratory # 1 & 2, Buildings 57 & 51.

The supervisor of this laboratory is James Prikryl.

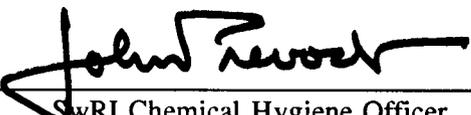
**REFERENCE:** 29 CFR 1910.1450, the current SwRI Chemical Hygiene Plan, and the current SwRI Safety Manual.

**APPLICABILITY:** Procedure specified in this document and in the above referenced documents are applicable to all staff\* working in this laboratory when work involves the use of hazardous chemicals. A copy of the SwRI Chemical Hygiene Plan and this SOP will be readily available to all staff in this laboratory.

  
Prepared by: Bruce Mabrito, Division Safety Representative

Approved by:   
Director

  
Division Vice President

  
SwRI Chemical Hygiene Officer

Date approved 4.19.96

\* This includes temporary, permanent, custodial workers, and contractors.

# CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

January 28, 1991

TO: John Prevost  
Institute Safety Office

FROM: Bruce Mabrito   
Division 20

SUBJECT: Description of Division 20 Laboratory Activities

Thank you for your educational briefing on the OSHA Laboratory Chemical Hygiene Plan and the associated Standard Operating Procedures.

The following is an overview of our Division 20 Laboratory work:

The Center for Nuclear Waste Regulatory Analyses (Division 20) is utilizing the remodeled Building 57 for our in-house Laboratory work. The Division is currently concentrating on the Geologic Setting (GS), Engineered Barrier System (EBS), and Repository Design, Construction, and Operations (RDCO) Program Element laboratory activities. Research is being conducted in the area of geochemistry, corrosion, and rock mechanical properties. The hazardous chemicals include various acids which are diluted and utilized in the geochemistry and corrosion work. These acids are stored in an approved area, separate from other chemicals and the work being performed. The Division is continuing its start-up activities and has recently hired a Laboratory Supervisor.

We appreciate the assistance the Safety Department has provided Division 20 as we staff our new Laboratory facility. Feel free to contact me to obtain more information on our Lab.

Laboratory Chemical Hygiene Plan  
and Standard Operating Procedures (SOP)

for the CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES Laboratory

1. LABORATORY CHEMICAL HYGIENE OFFICER: James Prikryl  
is the Laboratory Chemical Hygiene Officer designated to coordinate  
all aspects of the Chemical Hygiene Plan for this laboratory for  
the period 01/91 to 06/92.  
Date Date

2. GENERAL OVERVIEW: Give an overview of the laboratory operations  
that involve hazardous chemicals and the general types of hazardous  
chemicals involved.

3. SPECIFIC PROCEDURES: Detail the procedures for accomplishing  
specific tasks related to hazardous chemicals. Highlight safety  
warnings (may cause injury or an unreliable system), cautions (may  
cause equipment damage or unusable operation), or Notes  
(information). Allow the reader to follow in a logical manner.  
Include the following items, if pertinent:

a. List all hazardous chemicals and the operations  
performed with these chemicals. Include a list personnel  
authorized and trained to work with hazardous chemicals in this  
laboratory.

b. Safety requirements:

- (1) Characteristics of the hazardous chemicals involved  
(Refer to relevant MSDS),
- (2) Notification procedures of affected agencies. i.e.  
Fire Department, Medical, etc. (if necessary),
- (3) Storage (temporary/permanent) and transportation of  
hazard chemicals,
- (4) Provisions for information/training.

c. Emergency procedures:

- (1) Fire protection plan,
- (2) Chemical/hazardous material spill procedures,
- (3) Medical,
- (4) Special emergency procedures for non-standard hours  
(nights, weekends).

d. Personal Protective Clothing and Equipment (PPE), be  
specific (Type, selection, etc.):

- (1) Eye protection,
- (2) Hearing protection,
- (3) Hand, foot, body, head protection,
- (4) Respirator.

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Title Laboratory Chemical Hygiene Plan and Standard Operating Procedures (SOP) for the Center for Nuclear Waste Regulatory Analyses

**EFFECTIVITY AND APPROVAL**

Revision 2 of this procedure became effective on 7/6/98 . This procedure consists of the pages and changes listed below.

<u>Page No.</u>	<u>Change</u>	<u>Date Effective</u>
1-11	0	7/6/98

**SUPERSEDED**

Supersedes Procedure No. Revision 1 dated 4/16/96.

**Approvals**

Written By



Date

7/6/98

Cognizant Director



Date

7/7/98

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FOR THE CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES**

1. LABORATORY CHEMICAL HYGIENE OFFICER

Darrell S. Dunn is the Division 20 Laboratory Chemical Hygiene officer designated to coordinate all aspects of the Chemical Hygiene Plan for the Division 20 laboratories in Buildings 57 and 51.

2. GENERAL OVERVIEW

The Center for Nuclear Waste Regulatory Analyses (CNWRA) is utilizing Buildings 57 and 51 on the Southwest Research Institute (SwRI) campus for in-house laboratory work. Laboratory work is being conducted in the general areas of geochemistry, thermohydrology, corrosion, biochemistry, radiochemistry, structural deformation, and rock mechanical properties. Many laboratory activities involve the use of hazardous chemicals for sample preparation and analysis. General types of hazardous chemicals include acids, heavy liquids, and organic reagents. Hazardous chemicals are stored in approved areas, separate from general chemical storage and work being performed. Radioactive materials are handled in accordance with procedures set forth in the SwRI Radiological Health and Safety Manual. Specific methods for the handling and disposal of radioisotopes have been developed for the CNWRA laboratories and are on file with the Institute Radiation Safety Officer.

CNWRA personnel authorized and trained to work with hazardous chemicals are those who have read this Chemical Hygiene Plan and signed the attached acknowledgment sheet. A current copy of the CNWRA Chemical Hygiene Plan will be posted at all CNWRA laboratories. Laboratory personnel (including Principal Investigators, new CNWRA staff, and Student Scientists) and those who work for CNWRA staff are to follow this Chemical Hygiene Plan.

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**LABORATORY CHEMICAL HYGIENE PLAN AND STANDARD OPERATIONS PROCEDURES (SOP)  
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3.1 Chemical Inventory

A listing of hazardous chemicals in the Division 20 laboratory is provided in this section. A complete chemical inventory list is located in Bldg 57 Room L111. Note that this list is subject to change as laboratory activities and capabilities change.

Acids and Corrosives

1-amino-2-naphthol-4-sulfonic acid  
acetic acid  
ammonium hydroxide  
hydrochloric acid  
hydrofluoric acid  
nitric acid  
oxalic acid  
perchloric acid  
phosphomolybdic acid  
sodium hydroxide  
sulfuric acid  
ammonium oxalate  
phosphoric acid  
sodium sulfide  
sodium bisulfate

Organics and Heavy Liquids

1,1,2,2-tetrabromoethane  
acetone  
arsenazo III  
bromoform  
carbon tetrachloride  
N,N-dimethyl formamide  
toluene  
tributyl phosphate  
benzene  
xylenes

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Oxidizers

ammonium nitrate  
calcium nitrate  
hydrogen peroxide  
potassium bromate  
potassium nitrate  
potassium permanganate  
sodium nitrate  
sodium nitrite

Toxic and Reactive Reagents

8-hydroxyguinoline  
ammonium metavanadate  
barium chloride  
cerium sulfate  
eriochrome cyanine R  
hydrazine sulfate  
lithium chloride  
mercuric chloride  
potassium chromate  
potassium ferricyanide  
potassium ferrocyanide  
potassium fluoride  
sodium fluoride  
sodium hydrosulfite  
sodium molybdate

Metals

aluminum powder  
mercury  
zinc powder

Airborne Particulate Matter

silica  
fine clays  
ceramic powders

Threshold limit values (TLVs) for hazardous chemicals and airborne particulate matter are available from the SwRI Safety Department.

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A list of qualified personnel who are authorized and trained to work with hazardous chemicals can be found on the acknowledgment page in this Chemical Hygiene Plan.

**3.2 Safety Requirements**

**(i) Hazardous chemicals**

Characteristics of the hazardous chemicals involved in laboratory experiments are located in the Material Safety Data Sheets (MSDS) located in Building 57, rooms L111 and L106.

**(ii) Notification and emergency reporting procedures**

In the event of an emergency, employees should immediately dial 2222 and report the emergency (six SwRI locations are alerted by this one call during normal working hours). The same number is used after hours and on weekends which connects with the security supervisor on duty.

**(iii) Storage (temporary/permanent) and transportation of hazardous chemicals**

MSDS, storage codes, and NFPA (National Fire Protection Association) hazard codes are used to determine the proper storage location for all chemicals in the CNWRA laboratories. Hazardous chemicals are stored in approved areas, separate from general chemical storage and work being performed. Flammable chemicals are stored in specially marked flammable storage cabinets. Desiccants are used to store hygroscopic chemicals. Spent chemicals are collected in appropriate containers and labeled such that the contents of the containers can be clearly determined by all laboratory personnel. Chemical waste containers are then transported to the Institute chemical waste storage facility.

**(iv) Provisions for information/training**

All laboratory personnel have access to MSDS located in Building 57. Safety information is distributed by the Chemical Hygiene Officer. Safety training aids are available from the Safety Office. New employees working in the CNWRA laboratories shall be immediately trained on the duties and safety requirements of the job to which they are assigned. The Chemical Hygiene Plan and the Operating Procedures of the CNWRA shall be reviewed by each new employee.

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The appropriate supervisor shall walk the new employee through the laboratories, showing him or her safety equipment and the hazards of working with certain chemicals and/or equipment. Ample opportunity shall be afforded for the new employee to ask questions and become fully safety conscious in the new job.

#### 3.3 Emergency Procedures

##### (i) Fire

Personnel have been familiarized with building exits and all exits are marked. Fire extinguisher training is provided to all employees. Fire extinguishers are located outside each laboratory in Building 57 and, in some cases, inside the laboratories. The Division 20 laboratories in Building 51 are equipped with three fire extinguishers. In the case of a major fire, extension 2222 is dialed for assistance.

##### (ii) Chemical/hazardous material spill procedures for acids, bases and solvents

- Notify the supervisor and Chemical Hygiene Officer (Richard Atiyeh, ext. 2323) of the spill. Assess the situation, and prepare a plan of action.
- Any areas contaminated with a chemical spill should be cleaned in accordance with the proper MSDS and instructions provided with the spill kit. Proper protective clothing (gloves, etc.) shall be worn while cleaning chemical spills, especially acids. Materials used to clean a contaminated area should be disposed of properly.
- For a large or dispersed spill, contact the Safety Department immediately.

##### (iii) Medical

In the event that laboratory personnel come in contact with hazardous chemicals the chemical should be removed from contact with the body and the affected area flushed with copious amounts of water, if appropriate. If the accident involves an inhalation victim, remove the person to fresh air.

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Dial 2222 if medical attention is required. If the exposure requires medical attention, file an accident report with the Institute Nurse and Division Safety Point of Contact as soon as possible.

- (iv) Special emergency procedures for non standard hours (nights, weekends)

The emergency number is 2222 .

After normal hours and on weekends and holidays the Security Officer Manager answers the emergency number, asks whether an emergency vehicle is needed, and summons the proper emergency assistance if required. The individual reporting the emergency relays necessary information (location, nature of emergency). If possible, the individual reporting the accident should immediately send another employee to the main gate to meet the security guard and escort the emergency vehicle to the accident site. At this time the Institute security officer will dispatch a security guard to the main gate and proceed to make appropriate notifications to provide residence numbers of the Safety Department, Buildings and Grounds, Communications, and Security. After an employee has been dispatched to the main gate (if possible), the individual reporting the accident should notify the appropriate supervisor/manager. The supervisor/manager will then make any remaining notifications.

After normal hours and on weekends or holidays if an emergency vehicle is not required and an injured employee needing medical attention can be safely transported to a hospital, the individual transporting the injured employee should exit through the main gate and relay to the gate guard the following information:

- injured employee's name and employee number
- building number where the accident occurred and specify if the building is unattended
- hospital where the injured employee is being taken

In the event of an extended power failure and telephones are inoperable and emergency assistance is needed, the individual reporting the accident should go to the main gate and notify the security of the circumstances and call 911 from

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the nearest operable phone or report incident to the Fire Station located near the intersection of Loop 410 and Culebra. After reporting the incident, the individual should escort the emergency vehicle(s) from the main gate to the accident site.

#### 3.4 Personal protective equipment (PPE)

- (i) Lab coats, gloves, safety goggles, face shields, and half-mask respirators will be available for working with acids or fuming chemicals.
- (ii) ANSI approved safety glasses with side shields are required for any laboratory activity where there is a possibility of flying objects striking laboratory personnel.
- (iii) Safety goggles are required for handling chemicals that may splash.
- (iv) Shoes must have closed toes and preferably have rubber soles.
- (v) Ear plugs are available in the Division 01 stockroom if required.
- (vi) Chemical resistant gloves are required for when a barrier is needed for handling chemicals.
- (vii) Insulated thermal gloves are available when handling hot materials such as hot glassware and test specimens which are placed in an oven. The employee should have knowledge of the gloves performance and limitations.
- (viii) Dust masks are available if needed.
- (ix) Respirators may be used by personnel who have been properly fitted by the Safety Department.

#### 3.5 Use of special equipment and controls

- (i) Annual inspections are conducted by the Safety Department to assure proper operation of the fume hoods.

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#### 3.6 Inspection and cleanup

- (i) Safety inspections are conducted by the Division 20 Safety Point of Contact on a monthly basis. An Institute self inspection form is completed and filed for each monthly inspection. Corrective actions are listed on the back of the self inspection form. Formal safety inspections are performed by the Institute Safety department.
- (ii) All Division 20 laboratories will be kept in a neat and orderly manner by all laboratory personnel.

#### 3.7 Chemical waste disposal procedures

- (i) Chemical waste including spent, excess, and out-of-date chemicals from laboratory activities will be placed in appropriate containers and stored according to the recommendations provided in the MSDS until the containers are transported to the Institute chemical waste facility.
- (ii) All chemical waste containers will be properly marked and will include the contents of the containers. For mixed chemical waste the container label will indicate the percentages of each chemical component.
- (iii) A waste data sheet, will be completed and provided to the Safety Department upon delivery of the chemical waste to the Institute chemical waste facility.
- (iv) Employees will not use private vehicles for the transportation of chemical waste.

3.8 MSDS - Material Safety Data Sheets are located in Building 57 in laboratories L111 and L106.

3.9 HAZCOM - a copy of the HAZCOM Program (CNWRA AP-016) must be read by all personnel who are actively involved in laboratory activities where chemicals are used.

#### 4. LIMITATIONS OF THIS DOCUMENT

This document is designed to provide general safety guidelines. For specific guidelines regarding general policies or safety procedures, employees can consult the Safety Policies and Procedures Manual the Division 20 Safety committee representative, or the Division 20 Safety Point of Contact.

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5. ENFORCEMENT AND LABORATORY SUPERVISION RESPONSIBILITIES

The responsibility to enforcing all aspects of the Chemical Hygiene Plan for each Laboratory in Building 51 and 57 is assigned to the following Division 20 staff.

Darrell S. Dunn—Building 57 laboratories: L104, L105, L111, L113, Building 51 Rock Mechanics Laboratory.

James Prikryl—Building 57 laboratories: L101, L102, L106.

Ron Green—Building 51 Hydraulic Characterization Laboratory.

6. REVIEW AND REVISION OF THIS DOCUMENT

The Laboratory Chemical Hygiene Plan is reviewed, revised and updated annually and resubmitted to the Safety Office for approval and authorization. Any significant change in the scope of laboratory operation or designation of a new Chemical Hygiene Officer (Richard Atiyeh, ext. 2323) requires submittal of a revised Chemical Hygiene Plan. The scope of the Chemical Hygiene Plan on file with the safety office must reflect current operations and staff assignments.

**LABORATORY CHEMICAL HYGIENE PLAN  
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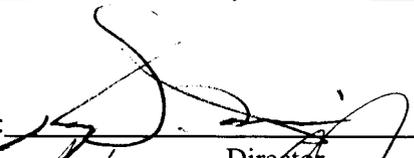
for the Division 20 Laboratories in Buildings 51 & 57.

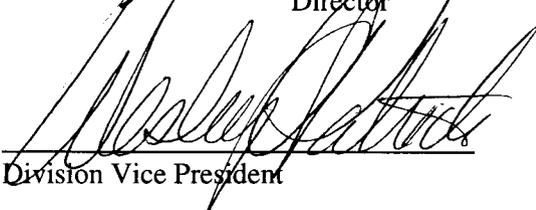
The Division 20 Chemical Hygiene Officer is Darrell S. Dunn.

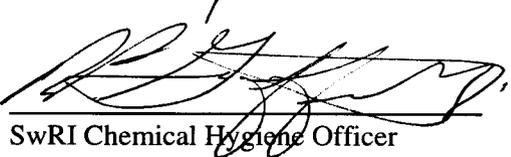
**REFERENCE:** 29 CFR 1910.1450, the current SwRI Chemical Hygiene Plan, and the current SwRI Safety Manual.

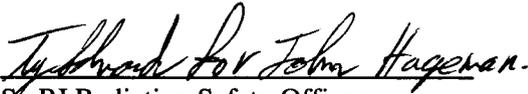
**APPLICABILITY:** Procedure specified in this document and in the above referenced documents are applicable to all staff\* working in this laboratory when work involves the use of hazardous chemicals. A copy of the SwRI Chemical Hygiene Plan and this SOP will be readily available to all staff in this laboratory.

Prepared by: Darrell Dunn, Safety POC

Approved by:   
Director

  
Division Vice President

  
SwRI Chemical Hygiene Officer

  
SwRI Radiation Safety Officer

Date approved 7-10-98

\*This includes temporary, permanent, custodial workers, and contractors.

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**Title: Laboratory Chemical Hygiene Plan and Standard Operating Procedures (SOP) for the Center for Nuclear Waste Regulatory Analyses**

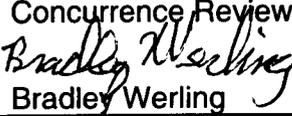
### EFFECTIVITY AND APPROVAL

Revision 3 of this procedure became effective on 05/13/2002. This procedure consists of the pages and changes listed below.

<u>Page No.</u>	<u>Change</u>	<u>Date Effective</u>
All	0	05/13/2002

Supersedes Procedure No. AP-010, Revision 2 Change 0 dated 7/6/98.

#### Approvals

Written By  Bruce Mabrito	Date 5/9/2002	Concurrence Review  Bradley Werling	Date 5/9/2002
Quality Assurance  Mark Ehnstrom	Date 05/13/02	Cognizant Director  Henry Garcia	Date 5/13/02

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### LABORATORY CHEMICAL HYGIENE PLAN AND STANDARD OPERATIONS PROCEDURES (SOP) FOR THE CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

#### 1. LABORATORY CHEMICAL HYGIENE OFFICER

Bradley Werling is the Division 20 Laboratory Chemical Hygiene officer designated to coordinate all aspects of the Chemical Hygiene Plan for the Division 20 laboratories in Buildings 57 and 51.

#### 2. GENERAL OVERVIEW

The Center for Nuclear Waste Regulatory Analyses (CNWRA) is utilizing Buildings 57 and 51 on the Southwest Research Institute (SwRI) campus for in-house laboratory work. Laboratory work is being conducted in the general areas of geochemistry, thermohydrology, corrosion, biochemistry, radiochemistry, structural deformation, and rock mechanical properties. Many laboratory activities involve the use of hazardous chemicals for sample preparation and analysis. General types of hazardous chemicals include acids, heavy liquids, and organic reagents. Hazardous chemicals are stored in approved areas, separate from general chemical storage and work areas. Radioactive materials are handled in accordance with procedures set forth in the SwRI Radiological Health and Safety Manual. Specific methods for the handling and disposal of radioisotopes have been developed for the CNWRA laboratories and are on file with the Institute Radiation Safety Officer.

CNWRA personnel authorized and trained to work with hazardous chemicals are those who have read this Chemical Hygiene Plan and signed the attached acknowledgment sheet. A current copy of the CNWRA Chemical Hygiene Plan will be posted at all CNWRA laboratories. Laboratory personnel (including Principal Investigators, new CNWRA staff, and Student Scientists) and those who work for CNWRA staff are to follow this Chemical Hygiene Plan.

#### 3. SPECIFIC LABORATORY PROCEDURES

The CNWRA staff is involved in regulatory analysis, technical assistance, and laboratory work for the U.S. Nuclear Regulatory Commission and others. Since much of the work in the laboratory is "prototyping" or one-time testing, use of Laboratory or Scientific Notebooks is the primary method of documenting work accomplished. Standardized procedures (ASTM, and other developed procedures) are utilized whenever possible, and are referenced in CNWRA Operations Plans, proposals, and Project Plans. For repetitive analytical work in the CNWRA laboratories, staff personnel are encouraged to develop and implement a Technical

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Operating Procedure. Technical Operating Procedures (TOPs) and Quality Assurance Procedures (QAPs) applicable to laboratory activities, are maintained in Building 57 for ready reference.

### 3.1 Chemical Inventory

Each laboratory or group of laboratories will maintain a current chemical inventory. Laboratories under the same supervision may maintain a single inventory document in a central location. A hard copy of this inventory document will be kept readily available to supervisor personnel.

Threshold limit values (TLVs) for hazardous chemicals and airborne particulate matter are available from the SwRI Safety Department.

Supervisors will ensure that controlled copies of the Chemical Hygiene Plan are provided to personnel who work in CNWRA laboratories. The personnel will sign and date the cover sheet to the Chemical Hygiene Plan. This cover sheet is returned to the Quality Assurance (QA) department. A list of qualified personnel who are authorized to work with hazardous chemical can be found by contacting the QA department.

### 3.2 Safety Requirements

#### (i) Hazardous chemicals

Characteristics of the hazardous chemicals involved in laboratory experiments are located in the Material Safety Data Sheets (MSDS). Each laboratory or group of laboratories will maintain a hard copy MSDS for each chemical on the inventory. MSDS notebooks will be kept current, orderly maintained, and readily available.

#### (ii) Notification and emergency reporting procedures

In the event of an emergency, employees should immediately dial 2222 and report the emergency (six SwRI locations are alerted by this one call during normal working hours). The same number is used after hours and on weekends which connects with the security supervisor on duty.

#### (iii) Storage (temporary/permanent) and transportation of hazardous chemicals

Chemicals will be stored in proper locations with compatible materials. MSDS, manufacturer storage codes, National Fire Protection Association (NFPA), hazard codes are tools that may be used to

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determine the proper storage location for a chemical. Hazardous chemicals are stored in approved areas, separate from general chemical storage and work space. Flammable chemicals are stored in specially marked flame retardant storage cabinets. Spent chemicals are collected in appropriate containers and labeled such that the contents of the containers can be clearly determined by all laboratory personnel. Chemical waste containers are then transported to the Institute chemical waste storage facility.

### (iv) Provisions for information/training

All laboratory personnel have access to MSDS. Safety training aids are available from the Safety Office. New employees working in the CNWRA laboratories shall be immediately trained on the duties and safety requirements of the job to which they are assigned. The Chemical Hygiene Plan and the Operating Procedures of the CNWRA shall be reviewed by each new employee.

The appropriate supervisor or his/her designee shall walk the new employee through the laboratories, showing him or her safety equipment and the hazards of working with certain chemicals and/or equipment. Ample opportunity shall be afforded for the new employee to ask questions and become fully safety conscious in the new job.

### 3.3 Emergency Procedures

#### (i) Fire

Personnel have been familiarized with building exits and all exits are marked. Fire extinguisher training is provided to all employees. Fire extinguishers are located outside each laboratory in Building 57 and, in some cases, inside the laboratories. The Division 20 laboratories in Building 51 are equipped with three fire extinguishers. In the case of a major fire, extension 2222 is dialed for assistance.

#### (ii) Chemical/hazardous material spill procedures for acids, bases and solvents

— Notify the supervisor and the SwRI Chemical Hygiene Officer of the spill. Assess the situation, and prepare a plan of action.

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— Any areas contaminated with a chemical spill should be cleaned in accordance with the proper MSDS and instructions provided with the spill kit. Proper protective clothing (gloves, etc.) shall be worn while cleaning chemical spills, especially acids. Materials used to clean a contaminated area should be disposed of properly.

— For a large or dispersed spill, contact the Safety Department immediately.

(iii) Medical

In the event that laboratory personnel come in contact with hazardous chemicals, the chemical should be removed from contact with the body and the affected area flushed with copious amounts of water, if appropriate. If the accident involves an inhalation victim, remove the person to fresh air.

Dial 2222 if medical attention is required. If the exposure requires medical attention, file an accident report with the Institute Nurse and Division Safety Point of Contact as soon as possible.

(iv) Special emergency procedures for non standard hours (nights, weekends)

The emergency number is 2222 .

After normal hours and on weekends and holidays the Security Officer Manager answers the emergency number, asks whether an emergency vehicle is needed, and summons the proper emergency assistance if required. The individual reporting the emergency relays necessary information (location, nature of emergency). If possible, the individual reporting the accident should immediately send another employee to the main gate to meet the security guard and escort the emergency vehicle to the accident site. At this time the Institute security officer will dispatch a security guard to the main gate and proceed to make appropriate notifications to provide residence numbers of the Safety Department, Buildings and Grounds, Communications, and Security. After an employee has been dispatched to the main gate (if possible), the individual reporting the accident should notify the appropriate supervisor/manager. The supervisor/manager will then make any remaining notifications.

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After normal hours and on weekends or holidays if an emergency vehicle is not required and an injured employee needing medical attention can be safely transported to a hospital, the individual transporting the injured employee should exit through the main gate and relay to the gate guard the following information:

- Injured employee's name and employee number
- Building number where the accident occurred and specify if the building is unattended
- Hospital where the injured employee is being taken

In the event of an extended power failure and telephones are inoperable and emergency assistance is needed, the individual reporting the accident should go to the main gate and notify the security of the circumstances and call 911 from the nearest operable phone or report incident to the Fire Station located near the intersection of Loop 410 and Culebra. After reporting the incident, the individual should escort the emergency vehicle(s) from the main gate to the accident site.

### 3.4 Personal Protective Equipment (PPE)

- (i) Lab coats, gloves, safety goggles, face shields, and half-mask respirators will be available for working with acids or fuming chemicals.
- (ii) ANSI approved safety glasses with side shields are required for any laboratory activity where there is a possibility of flying objects striking laboratory personnel.
- (iii) Safety goggles are required for handling chemicals that may splash.
- (iv) Shoes must have closed toes and preferably have rubber soles.
- (v) Ear plugs are available in the Division 01 stockroom if required.
- (vi) Chemical resistant gloves are required when a barrier is needed for handling chemicals.

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(vii) Insulated thermal gloves are available when handling hot materials such as hot glassware and test specimens which are placed in an oven. The employee should have knowledge of the gloves performance and limitations.

(viii) Dust masks are available if needed.

(ix) Respirators may be used by personnel who have been properly fitted by the Safety Department.

### 3.5 Use of special equipment and controls

(i) Annual inspections are conducted by the Safety Department to assure proper operation of the fume hoods.

### 3.6 Inspection and cleanup

(i) Safety inspections are conducted by the Division 20 Safety Point of Contact on a monthly basis. An Institute self inspection form is completed and filed for each monthly inspection. Corrective actions are listed on the back of the self inspection form. Formal safety inspections are performed by the Institute Safety department.

(ii) All Division 20 laboratories will be kept in a neat and orderly manner by all laboratory personnel.

### 3.7 Chemical waste disposal procedures

(i) Chemical waste including spent, excess, and out-of-date chemicals from laboratory activities will be placed in appropriate containers and stored according to the recommendations provided in the MSDS until the containers are transported to the Institute chemical waste facility.

(ii) All chemical waste containers will be properly marked and will include the contents of the containers. For mixed chemical waste the container label will indicate the percentages of each chemical component.

(iii) A waste data sheet, will be completed and provided to the Safety Department upon delivery of the chemical waste to the Institute chemical waste facility.

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(iv) Employees will not use private vehicles for the transportation of chemical waste.

3.8 MSDS—Each laboratory or group of laboratories will maintain a hard copy MSDS for each chemical on the chemical inventory.

3.9 HAZCOM—A copy of the HAZCOM Program (CNWRA AP-016) must be read by all personnel who are actively involved in laboratory activities where chemicals are used.

#### 4. LIMITATIONS OF THIS DOCUMENT

This document is designed to provide general safety guidelines. For specific guidelines regarding general policies or safety procedures, employees can consult the Safety Policies and Procedures Manual, the Division 20 Safety committee representative, or the Division 20 Safety Point of Contact.

#### 5. ENFORCEMENT AND LABORATORY SUPERVISION RESPONSIBILITIES

The responsibility to enforce all aspects of the Chemical Hygiene Plan for each Laboratory in Building 51 and 57 is assigned to the following Division 20 staff.

Darrell Dunn—Building 57 laboratories: L101, L104, L105, L111, and L113.

Bradley Werling—Building 57 laboratories: L102, and L106.

Ron Green—Building 51 Laboratories: All.

#### 6. REVIEW AND REVISION OF THIS DOCUMENT

The Laboratory Chemical Hygiene Plan is reviewed, revised and updated annually and resubmitted to the Safety Office for approval and authorization. Any significant change in the scope of laboratory operation or designation of a new Chemical Hygiene Officer requires submittal of a revised Chemical Hygiene Plan. The scope of the Chemical Hygiene Plan on file with the safety office must reflect current operations and staff assignments.

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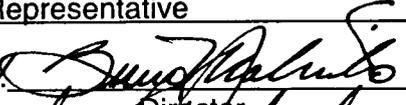
for the Division 20 Laboratories in Buildings 51 & 57.

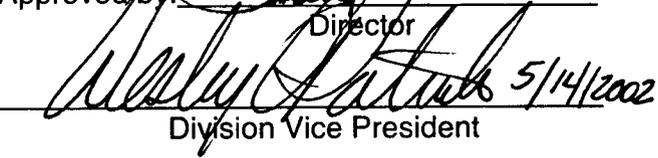
The Division 20 Chemical Hygiene Officer is Bradley Werling.

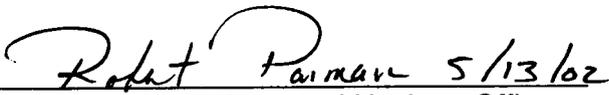
**REFERENCE:** 29 CFR 1910.1450, the current SwRI Chemical Hygiene Plan, and the current SwRI Safety Manual.

**APPLICABILITY:** Procedure specified in this document and in the above referenced documents are applicable to all staff\* working in this laboratory when work involves the use of hazardous chemicals. A copy of the SwRI Chemical Hygiene Plan and this SOP will be readily available to all staff in this laboratory.

Prepared by: Bruce Mabrito, Safety  
Committee Representative

Approved by:   
Director

 5/14/2002  
Division Vice President

 5/13/02  
SwRI Chemical Hygiene Officer

 5/13/2002  
SwRI Radiation Safety Officer

Date approved 5/14/2002

\*This includes temporary, permanent, custodial workers, and contractors.