110958

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Job No. 14501, FUSRAP Project
DOE Contract No. DE-AC05-91OR21949
Code: 7190/WBS: 116,134,140,153

NOV 24 1993

U.S. Department of Energy
Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, TN 37831-8723

Attention: David G. Adler, Site Manager
Former Sites Restoration Division

Subject: St. Louis Site - Health and Safety Plan - Publication

Dear Mr. Adler:

Enclosed is a controlled copy of the subject document, which is being published in accordance with DOE-FSRD approval of the standard HSP (CCN 110395).

A teleconference was held with Mr. Marz on September 23 (CCN 108844) to resolve any comments on the St. Louis site-specific portions. During the teleconference, Mr. Marz's only comment was that other valance forms of chromium (besides trivalent) should be listed in Appendix B. At present, however, environmental sampling protocols for the site specify only total chromium analytes. Process knowledge and historical data also do not indicate the presence of other forms of chromium. If information becomes available that indicates the presence of these forms of chromium at the site, health hazard information for them will be added to Appendix B.

This document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that the information submitted was properly gathered and evaluated. To the best of my knowledge and belief, it is true, accurate, and complete.

If you have any questions concerning this document, please contact me at 576-1710 or Mike Falzone at 574-4032.

Sincerely,

G. L. Palau
Project Manager - FUSRAP

GLP:gmh:LR_1282

Enclosure: As stated

cc: L. Marz (w/e)

Concurrence: M. A. Falzone B. A. Fogelman

ACTION REQ'D | | YES |V| NO DUE DATE _____

RESPONSE TO CHRON NO. _____

☐ FFA ☐ Permit ☐ Milestone ☐ OcR ☐ CCN ☐ CAR ☐ Mid-Yr ☐ Yr-End ☐ Periodic Rpt

Formerly Utilized Sites Remedial Action Program (FUSRAP)
Contract No. DE-AC05-91OR21949

Health and Safety Plan for the St. Louis Site

St. Louis, Missouri

November 1993

DOE FUSRAP
116/134/140/153-HSP, Rev. 0
11/24/93

HEALTH AND SAFETY PLAN FOR THE ST. LOUIS SITE

Prepared for

United States Department of Energy
Oak Ridge Operations Office
Under Contract DE-AC05-91OR21949

By

Bechtel National, Inc.
Oak Ridge, Tennessee

Bechtel Job No. 14501

HEALTH AND SAFETY PLAN FOR THE ST. LOUIS SITE

Prepared by:	Mike Falzone Mike Falzone, Health and Safety Coordinator	11-22-93 Date
Reviewed:	Using delley for Jim Tompinian Jim Tarpinian, Health Services Manager	11-23-93 Date
Reviewed:	Ben Martin, Safety Services Manager	11-22-93 Date
Approved:	Tom Morris, Environment, Safety, Health, and Waste Management Manager	11/23/93 Date
Approved:	Gerald Palau, Project Manager	11/22/93 Date

EMERGENCY ASSISTANCE SERVICES

LOCAL EMERGENCY ASSISTANCE SERVICES

(on call 24 hours a day)

AMBULANCE:	
Ambulance Service	**911** [or (314) 534-1323]
FIRE:	
Fire Department	**911** [or (314) 534-2244]
HOSPITAL	
For SLAPS, HISS, and Vicinity Properties:	
Christian Hospital-Northeast 11133 Dunn Road St. Louis County (North County), MO 63136	(314) 355-2500
For SLDS:	
Barnes Hospital One Barnes Hospital Plaza St. Louis, MO	(314) 362-9123
Radiation Safety Officer **Dr. Robert Turco**	(314) 653-5255 or (314) 355-2300
POLICE:	
Police Department	**911** [or (314) 231-1212]
ELECTRIC:	(314) 342-1000
GAS:	(314) 621-6969
WATER:	(314) 991-3404

INFORMATION SERVICES

CHEMTREC:	(800) 424-9300
POISON CONTROL CENTER: Cardinal Glennon Hospital	(314) 772-5200
REAC/TS:	(615) 576-3098
DIG RITE:	(800) DIG-RITE

ADMINISTRATIVE PERSONNEL

GENERAL:

Bechtel National, Inc. Oak Ridge, Tennessee	**(615) 220-2000** (Monday through Friday, 7:30 a.m. EST to 5:15 p.m. EST)
Project executive secretary	**(615) 576-1757** (business hours only)
FUSRAP switchboard	**(615) 576-1699** (business hours only)
FUSRAP answering service	**(615) 576-1699** (weekends, holidays, after hours)

DEPARTMENT OF ENERGY (DOE) CONTACTS:
(to be contacted by the Program Manager ONLY)

Les Price	**(615) 576-0730** (business hours only)
William Seay	**(615) 576-1830** (business hours only)
DOE emergency line, Oak Ridge, Tennessee	**(615) 576-1005** (after hours)
DOE emergency line, Knoxville, Tennessee	**(615) 525-7885** (after hours)

BNI SITE PERSONNEL:

Site Superintendent[a,b]	Home (Redacted - Privacy Act)
(Emergency Onsite Coordinator)	Work (314) 524-3329
Steve Thieme	Mobile Phone (Redacted - Privacy Act)
	Pager (314) 538-1235
Site Safety and Health Officer[a,b]	Work (314) 524-5142
Roger Hall	Home (Redacted - Privacy Act)

PROJECT OFFICE PERSONNEL (Oak Ridge):

Program Manager	(615) 576-3998
Dick Harbert	
Deputy Program Manager	(615) 576-9467
Phil Crotwell	
Project Manager	Work (615) 576-1710
Gerald Palau	Home (Redacted - Privacy Act)
Environment, Safety, Health, and Waste Management	(615) 574-3355
Tom Morris	
Safety and Health Supervisor	(615) 574-3520
Nevin Thomas	
Safety and Health Coordinator	(615) 574-4032
Mike Falzone	
Industrial Safety Supervisor	(615) 220-2000
Ben Martin	
Emergency Response Coordinator	(615) 574-3974
Roger Halsey	

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[a]FUSRAP site and project office personnel will be assigned before work begins onsite. An updated list of personnel and telephone numbers will be maintained onsite when FUSRAP personnel are present. An updated list will also be maintained by the safety and health supervisor or designee.

[b]Telephone numbers for the site superintendent and the site safety and health officer will change periodically; however, the site superintendent will carry a portable beeper after hours and can be contacted in the event of an emergency. To obtain nonemergency assistance or current phone numbers for site personnel, contact the safety and health supervisor at the Bechtel National, Inc., office in Oak Ridge, Tennessee [(615) 574-3520].

FOREWORD

The Department of Energy's Formerly Utilized Sites Remedial Action Program (FUSRAP) is responsible for managing sites contaminated with waste generated during Manhattan Engineer District and Atomic Energy Commission activities. The principal contaminants at FUSRAP sites are uranium ore (with uranium daughters), uranium metal, and isotopes of thorium. The remedial investigation and remedial action activities are therefore comparable at all FUSRAP sites.

Bechtel National, Inc., the project management contractor for FUSRAP, has developed health and safety requirements that are uniformly specific to all FUSRAP sites. In this site-specific health and safety plan, the information contained in Sections 1.0 through 8.0 is applicable to all FUSRAP sites. Site-specific information is provided in the front matter, including the emergency assistance services pages, and in Appendixes A through G.

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FIGURES

TABLES

ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
BNI	Bechtel National, Inc.
CFR	Code of Federal Regulations
CPR	cardiopulmonary resuscitation
CRZ	contamination reduction zone
DAC	derived air concentration
DOE	Department of Energy
EPA	Environmental Protection Agency
ERC	emergency response coordinator
ERT	emergency response team
ESH&WM	Environment, Safety, Health, and Waste Management
FUSRAP	Formerly Utilized Sites Remedial Action Program
HWP	hazardous work permit
IDLH	immediately dangerous to life or health
IH	industrial hygiene
LSA	low-specific-activity
MSDS	material safety data sheet

ACRONYMS

(continued)

NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PEL	permissible exposure limit
PI	project instruction
PP	project procedure
PPE	personal protective equipment
RSS	radiological support subcontractor
RWA	restricted work area
SCBA	self-contained breathing apparatus
S&H	Safety and Health
SHSP	site-specific health and safety plan
SSHO	site safety and health officer
TLV	threshold limit value
UL	Underwriter's Laboratories

UNITS OF MEASURE

°C	degrees Celsius
cm	centimeter
cpm	counts per minute
dB	decibel
dpm	disintegrations per minute
°F	degrees Fahrenheit
ft	feet
g	gram
gal	gallon
h	hour
in.	inch
L	liter
m	meter
mg	milligram
ml	milliliter
μCi	microcurie
μR	microroentgen
mrad	millirad
mrem	millirem
pCi	picocurie
ppm	parts per million
s	second

1.0 INTRODUCTION

1.1 GENERAL

Bechtel National, Inc. (BNI) is the project management contractor for the Department of Energy's (DOE) Formerly Utilized Sites Remedial Action Program (FUSRAP). FUSRAP was established to identify and decontaminate or otherwise control sites where residual radioactive materials remain from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy.

The purpose of this site-specific health and safety plan (SHSP) is to ensure that all known and expected hazards at the site have been or will be factored into the work planning and emergency planning process and to comply with applicable regulatory codes that require an SHSP. Specific health and safety requirements will be specified in applicable work instructions and/or hazardous work permits (HWPs) based on conditions at the time work is carried out. The information in this document is applicable to all government employees, contractors, subcontractors, and visitors at a FUSRAP site.

The SHSP may be routinely revised during the annual review process or whenever a significant change occurs in site conditions or scope of work. The SHSP will be revised immediately if it does not adequately protect FUSRAP personnel, the general public, or the environment. It is the responsibility of the health and safety supervisor, or designee, to revise the SHSP as needed. Before they are implemented, the revised sections of the SHSP will undergo internal review in accordance with FUSRAP Project Instruction (PI) 5.1.1, "Inter-Department Project Document Review."

The SHSP is a controlled document that will be maintained in accordance with FUSRAP Project Procedure (PP) 2.1, "Communications," and PI 13.2.2, "Revision Orders for Project Instructions and Controlled Documents," and will be issued in three-ring binders so that revised sections can be easily replaced. There will be at least one document holder per site, but usually the SSHO and site superintendent will both be document holders. SHSPs and approved revisions will be issued to document holders via a document issue memorandum in accordance with PI 5.5.3, "Document Issue Memorandum."

This plan was developed to support compliance with (1) DOE orders; (2) safety standards defined by the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), and the National Institute for Occupational Safety and Health (NIOSH); (3) health standards for known contaminants; and (4) procedures designed to prevent exposure to unknown substances. The following reference sources and guidance were used to develop this comprehensive SHSP:

- OSHA 29 Code of Federal Regulations (CFR) 1910.120 and EPA 40 CFR 311;
- EPA Office of Emergency and Remedial Response Environmental Response Team Standard Operating Safety Guides;
- NIOSH Pocket Guide to Chemical Hazards;
- NIOSH/OSHA/U.S. Coast Guard/EPA Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities;
- American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLVs); and
- DOE Orders 5000.3B, 5400.1, 5400.3, 5400.4, 5400.5, 5480.3, 5480.4, 5480.10, 5480.11, 5482.1B, 5483.1A, 4584.1, 5500.2, 5700.6C, and 5820.2A.

1.2 PROJECT ORGANIZATION

Project health and safety organization protocols are detailed in FUSRAP PI 24.001, "Project Safety and Health Program." The Safety and Health (S&H) group of the Environment, Safety, Health, and Waste Management (ESH&WM) Department of BNI in Oak Ridge, Tennessee, is responsible for developing and implementing all health and safety procedures, work instructions, and instruction guides. Before starting a major task, the S&H supervisor or designee will assign individuals to fill site safety and health positions, including the position of site safety and health officer (SSHO). The primary duties of the SSHO include

- conducting site surveillance;
- issuing and posting HWPs;
- conducting site-specific orientation sessions for workers and visitors;
- overseeing all health and safety matters that may adversely affect site personnel;
- specifying engineering controls, administrative protocols, and requirements for personal protective equipment (PPE) and monitoring their effectiveness; and
- issuing stop-work orders as necessary to protect workers, nearby residents, the environment, and property.

The responsibilities of the SSHO are further defined in PI 24.001, "Project Safety and Health Program," a copy of which will be available onsite.

A list of personnel assigned to the site will be maintained onsite by the SSHO and S&H supervisor or designee.

1.3 SITE DESCRIPTION AND HISTORY

A description of the site and its history is presented in Appendix A of this SHSP.

2.0 HAZARD ANALYSIS

2.1 GENERAL

Safety hazards onsite result from industrial operations associated with DOE-contracted work activities and potential exposure to radionuclides and organic and inorganic chemicals. Sections 2.2 through 2.5 describe the general radiological, chemical, electrical, and other hazards anticipated at FUSRAP sites. Appendix B contains characterization data delineating site-specific radiological, chemical, and physical hazards. Work onsite may require the operation of heavy equipment, drilling rigs, support vehicles, power and hand tools, pressurized equipment, and welding and cutting equipment. Work areas may or may not be within areas that are controlled because of radioactive or chemical contamination or a significant safety hazard. Additionally, personnel may be required to work with or around mechanically, pneumatically, hydraulically, or electrically energized equipment and/or installations. Table 2-1 provides a general task-by-task hazard analysis for work at FUSRAP sites. In addition to the controls specified for each hazard in Table 2-1, administrative controls such as worker training and elements of the hazard communication program such as posting, monitoring, and access controls will be used to mitigate potentially hazardous conditions. A list of the site-specific tasks anticipated is provided in Appendix B. Safe operation and appropriate behavior around such equipment and work areas will be a key requirement of personnel working onsite. The requirements in this SHSP will be strictly enforced by site management.

2.2 RADIOLOGICAL HAZARDS

Radiation doses could result from internal and/or external exposure to alpha, gamma, and beta radiation. The pathways for internal exposure are inhalation, inadvertent ingestion,

and infiltration through skin following contamination of skin or clothing. Operations that could introduce radioactive contamination into exposure pathways are

- excavating, trenching, and grading contaminated soil;
- drilling in contaminated soil;
- dismantling and/or demolishing contaminated structures;
- remedial action activities such as mechanically removing or washing off contamination; and
- handling contaminated waste produced by these operations.

Execution of these activities may require engineering controls and will necessitate administrative controls and issuance of an HWP specifying PPE and special operating instructions.

In addition to scheduled activities, emergency situations such as building collapse or fire could disperse contamination in excess of DOE criteria (Table 2-2). The emergency response plan in Section 8.0 provides guidelines for conducting emergency response operations.

Anticipated exposure to radiation will be maintained at levels that are as low as reasonably achievable (ALARA) throughout work onsite and must not exceed the guidelines set forth in DOE Order 5480.11 and the *FUSRAP Radiological Control Manual* (BNI 1993a). ALARA processes are established in the FUSRAP ALARA plan (BNI 1992a). To ensure that the received dose equivalent remains below DOE's protection standards, BNI's administrative external exposure limits will be 10 percent of the limits specified in DOE Order 5480.11.

Areas where surface contamination exceeds DOE release guidelines or where airborne radioactivity exceeds 10 percent of the allowed derived air concentration (DAC) will be designated as restricted work areas (RWAs). Before authorizing work in an RWA, the SSHO or designee will perform radiological monitoring and establish PPE requirements in accordance with FUSRAP implementing procedures via an HWP. In addition, controls will be established to prevent the migration of contamination out of the RWA; these measures will include using portable radiological survey equipment to monitor personnel and equipment leaving the RWA and taking steps to prevent or control contaminated dust.

A site-specific radiological hazard assessment is provided in Appendix B.

2.3 CHEMICAL HAZARDS

Because of their toxic and/or combustible properties, chemical contaminants may pose a hazard to FUSRAP personnel. The primary exposure hazards from contaminants onsite are skin contact with contaminated soil and inhalation of airborne contaminants. However, risks posed by industrial hazards associated with cleaning, remedial action, and decontamination are typically greater than those posed by chemical contaminants in the soil. The chemical to which workers will most likely be exposed at the sites is nitric acid, which may be used to decontaminate equipment and tools.

Onsite nonadministrative services workers will be trained to respond to chemical spills and will have access to material safety data sheets (MSDSs) provided by the chemical manufacturer, which describe the health risks, exposure symptoms, recommended protective equipment, and cleanup and disposal procedures for each chemical. In addition to training, administrative and engineering controls will be used to reduce chemical exposure hazards; the controls could include modifying the industrial process that creates the hazard, discontinuing use of problematic cleaning agents, and installing localized ventilation. Areas where

operations involving drummed wastes (such as opening or filling drums) are being conducted or where hazardous gases are present will be restricted.

For worker protection, an air monitoring/air sampling program will be performed in accordance with Section 5.0 and Appendix D of this SHSP and PI 24.086, "Air Surveillance for Chemical and Biological Exposures." The individual responsible for ensuring that air monitoring is performed is the SSHO. The SSHO or designee may also prescribe temporary containments and/or the use of respirators with appropriate filtration cartridges and chemical-specific PPE to ensure the safety of workers.

The requirements of 29 CFR 1910.1200, "Hazard Communication," must be fully implemented.

To mitigate hazards such as those listed in Table 2-1, engineering controls may be implemented. Additionally, the S&H group will also identify administrative protocols and PPE to be used when engineering controls alone cannot reduce hazards to acceptable levels.

Appendix B contains characterization data delineating site-specific chemical hazards and lists toxicological data. Exposure limits for hazardous chemicals onsite can be found in the OSHA standard and the ACGIH TLV booklets, and appropriate monitoring instrumentation information can be found in the NIOSH guide on analytical sampling methods.

2.4 ELECTRICAL HAZARDS

All electrical connections or repairs at FUSRAP sites will be made by qualified electricians, in accordance with 29 CFR 1926/1910. FUSRAP operations will comply with the National Electric Code and the National Electrical Safety Code. Additionally, DOE/ID-10600 (Electrical Safety Guidelines) will be followed as a best management practice.

All electrical appliances and equipment used during work activities onsite will be appropriately inspected and connected to a ground-fault circuit interrupter or will have double insulation that is properly labeled and has been approved by Underwriter's Laboratories, Inc. (UL). Any tools that are damaged or not properly labeled will be removed from service and, if possible, repaired and reissued. If extension cords are used, they must be double-insulated and elevated or covered to reduce electrical and safety hazards.

No work will be performed close to energized circuits unless proper safety measures are taken by the site superintendent, project engineer, or SSHO. Where applicable, lockout/tagout measures will be performed in accordance with PI 24.121, "Tagging and Lockout." Any areas containing electrical hazards will be barricaded, and appropriate warning signs will be posted.

2.5 OTHER HAZARDS

Physical hazards and hazards associated with industrial and construction activities present the greatest potential risks to workers on FUSRAP sites. This section identifies the anticipated conditions or activities onsite for which engineering and administrative controls and use of appropriate PPE may be required. Table 2-1 identifies the specific tasks in which these conditions or activities are likely to occur and the minimum levels of controls required. Appendix B contains a site-specific, task-by-task hazard analysis for physical and construction-related safety hazards.

2.5.1 Confined Space Entry

If an apparent need to enter a confined space is identified, the S&H supervisor will be consulted, and an alternative procedure will be sought. If entry into the confined space is necessary to achieve remedial investigation and action objectives, authorization to proceed

will be granted if strict adherence with the provisions of PI 24.108, "Confined Space Entry Program," can be maintained. At a minimum, these provisions include the following:

- A confined-space entry permit is prepared and approved.
- The appropriate supervisor is on hand during the entry.
- An HWP covering the task is prepared and approved.
- Pre-entry industrial hygiene (IH) measurements are made, and appropriate PPE is used if a hazardous atmosphere is detected.
- Appropriate emergency response equipment and personnel are on hand, and the "buddy system" is employed.
- Training and prejob briefings covering hazards and safety and health requirements are conducted.

2.5.2 Open Excavations and Trenches

Soil excavation performed during remedial investigation, remedial action, and emergency response activities may require opening excavations and digging trenches to depths greater than 1.2 m (4 ft). To eliminate the hazards associated with these activities, the SSHO will monitor the task to ensure that excavating and trenching are performed in accordance with the requirements of PI 24.103, "Excavations and Trenches." The following conditions must be adhered to:

- All trenching and excavation work will meet the requirements of 29 CFR 1926, Subpart P.

- Trench and excavation faces are to be sloped, benched, shored, or shielded to prevent cave-in if personnel must enter them.

- The provisions of PI 24.108, "Confined Space Entry Program," are to be implemented as needed for work in confined spaces.
- Excavations and trenches are to be inspected daily for infiltration of water, and water will be removed when necessary.

- To prevent objects from falling on workers, spoils are to be kept a minimum of 0.6 m (2 ft) from the edges of excavations and trenches, and loose rocks and debris are to be prevented from rolling back into them. Working above workers in excavations and trenches, especially with heavy equipment, is prohibited.

- Excavations and trenches left open at the end of a shift will be appropriately barricaded to prevent people from falling in.

2.5.3 Traffic

Remedial investigation and action activities may be performed along public roads or onsite areas where vehicular traffic can present a hazard to FUSRAP personnel and equipment. The SSHO will evaluate and monitor the activity to ensure that adequate measures are taken to alleviate traffic hazards for all workers. These measures include mandatory use of orange traffic-safety vests, the use of orange cones and/or barricades for guiding traffic, posting of appropriate warnings along the road before the work site, and use of flagmen when needed.

2.5.4 Heat and Cold Stress

Procedures for addressing potential heat and cold stress are contained in PI 24.024, "Identification of Chemical, Biological, and Physical Hazards."

Work in Tyvek™ or other protective coveralls during hot weather will significantly increase the threat of heat stress to workers. The SSHO will ensure that physiological monitoring consisting of heart-beat measurements and oral body temperature readings is performed when the ACGIH-corrected, wet bulb globe temperature TLVs are reached. In addition, the SSHO will ensure that workers have adequate access to fluids and follow the work and rest regimen prescribed by ACGIH. During periods of hot weather, the SSHO will also ensure that workers are given weekly reminders of the symptoms of heat stress.

During outdoor work when temperatures are below 4.4°C (40°F), the SSHO will ensure that workers wear dry, preferably insulated clothing. In addition, the ACGIH TLVs and work/warmup schedule will be used to protect workers from cold-weather injuries such as frostbite and hypothermia.

2.5.5 Energized Utilities

Remedial investigation and remedial action activities such as drilling, excavation, and demolition may result in contact with overhead, underground, and in-structure energized utilities. Contact with energized utilities could result in electrocution, explosion, or other serious accident. The site superintendent will ensure that before any work is performed in areas where utilities may exist, the "one call" service (i.e., a centralized service that provides information on all utilities present) will be used to identify utility locations. This information will be supplemented with information obtained from the property owner and utility companies. In addition, the proposed work site will be inspected, and if underground utilities could be affected, a walk-over survey with a metal detector will be performed to locate underground pipes, wires, and conduits. The SSHO will prohibit the entry of drill rigs or other equipment with booms into areas with overhead utilities until it is established that a safe distance from overhead power lines can be maintained. Where applicable, lockout/tagout procedures will be performed in accordance with PI 24.121, "Tagging and Lockout."

2.5.6 Heavy Equipment

Operation of heavy equipment may be required during remedial investigation, remedial action, and site maintenance activities. Use of heavy equipment presents potential hazards to the operator and nearby workers. Heavy equipment onsite will be operated, inspected, and maintained in accordance with the requirements of PI 24.106, "Cranes, Heavy Equipment and Motor Vehicles." The SSHO will ensure that equipment operators have documented training and experience on the equipment operated and that the equipment is inspected before it is used. Movable equipment will have a back-up alarm. If other workers must remain in the area or if hoisting and rigging are performed, a spotter (i.e., an individual who aids the driver by directing the movement of the equipment) will also be present. Lifting, hoisting, and rigging will be performed in accordance with PI 24.123, "Hoisting and Rigging." The DOE hoisting and rigging manual will be followed as a best management practice during hoisting and rigging operations. A written site- or job-specific hazard analysis and lift plan are required for all high-hazard and critical lifts. Workers will receive prejob briefings covering how to identify and avoid pinch points (tight places where one could be crushed between two items and/or structures).

2.5.7 Work at Elevation

Radiological and chemical sampling and surveying, as well as demolition and decontamination activities, may involve work at elevation. A written site- or job-specific hazard analysis is required for all work at elevations greater than 1.8 m (6 ft). Work at elevations greater than 1.8 m (6 ft) will be performed in accordance with PIs 24.104, "Ladders," and 24.105, "Scaffolds." All scaffold work will meet the requirements of 29 CFR 1926, Subpart L. Where practicable, engineering controls such as scaffolding and/or manlifts will be used. If engineering controls are not available, safety belts and/or motion-stopping safety systems will be used. The SSHO will specify administrative controls

such as barriers and safety monitors to prevent unprotected workers from approaching elevated openings, ledges, or unsafe locations and to prevent personnel from walking beneath overhead work.

2.5.8 Hazards Requiring Head and/or Eye Protection

In addition to the eye and head hazards of construction activities, more severe hazards could result from flying objects generated during mechanical decontamination techniques such as abrasive blasting, chipping, and scabbling. Severe hazards could also be caused by splashing of hazardous liquids and use of pressurized water and steam systems during equipment decontamination. Requirements for head and eye protection are outlined in PI 24.063, "Protective Apparel and Equipment." The HWP for these activities will designate the use of face shields meeting American National Standards Institute (ANSI) Z87.1 standards and the requirements of PI 24.063. When abrasive blasting is being performed, head protection must meet the requirements of 29 CFR 1910.94.

2.5.9 Pressurized Water and/or Steam

Decontamination procedures may require the use of high-pressure water or steam equipment at the decontamination pads. Operation of this equipment may present a head/eye risk from the pressure blast or burn hazard to the operator. The SSHO will specify appropriate PPE and ensure that operators are adequately trained in the use of the equipment and are aware of its dangers.

2.5.10 Noise

Noise levels in excess of 85 dB(A) may be produced during operation of heavy equipment, pneumatic equipment, and powered hand tools. Impact noise may also be

produced during normal construction activities. Hearing conservation requirements, including workplace monitoring, are specified in PI 24.085, "FUSRAP Noise Control and Hearing Conservation." The SSHO is responsible for identifying potential noise exposures in excess of 85 dB(A) and for specifying or approving the type of hearing protection to be used.

2.5.11 Unilluminated Work Areas

Illumination of work areas, corridors, offices, and storage areas will not be less than the minimum intensities specified below.

Foot-Candles	Area of Operation
5	General site areas
3	Excavation and waste areas, active storage areas, loading platforms, refueling and field maintenance areas
5	Indoors: warehouses, corridors, and exits
10	Active storerooms, locker or dressing rooms, toilets, and workrooms
30	First aid stations, offices

2.5.12 Construction Hazards

General construction hazards that may be present during site activities are addressed in the following PIs: PI 24.111, "Hand and Portable Power Tools"; PI 24.107, "Welding and Oxygen-Acetylene Cutting"; PI 24.110, "Housekeeping and Sanitation" (includes tripping hazards); PI 24.110, "Asbestos Abatement Program"; and PI 24.123, "Hoisting and Rigging."

2.5.13 Unanticipated Hazards

All chemical and radioactive contaminants known or suspected to be onsite have been discussed in Sections 2.2 through 2.5. If other hazards (including those associated with industrial operations, chemicals, radiation, or materials listed in the Resource Conservation and Recovery Act) are discovered during work activities, the hazards will be assessed; procedures to ensure worker safety will be implemented onsite and incorporated, through revision orders into applicable work-controlling documents.

2.1.14 The Buddy System

In the buddy system, each worker is given responsibility for the safety and health of fellow workers. The buddy system will be implemented during all onsite activities and incorporated whenever workers are isolated. Two-way radio communication should be established whenever possible, depending on the immediate environmental circumstances.

2.6 HAZARDOUS WORK PERMITS

HWPs are required for site tasks that present an unusual health and safety problem (e.g., entry into confined spaces, work in airborne contamination, and work in a flammable atmosphere). Requirements for the use and implementation of the HWP are found in PI 24.061, "Hazardous Work Permits." The SSHO will carefully review the potential hazard. Normally, the HWP will address

- medical surveillance,
- personnel exposure monitoring program,
- adherence to ALARA guidelines,
- respiratory protection,

- PPE,
- compliance with rules regarding prohibited activities,
- hygiene facilities and practices, and
- employee information and training.

TABLES FOR SECTION 2.0

Table 2-1

Task-By-Task Hazard Assessment

Page 1 of 8

TASK	HAZARD	CONTROL	REF. PIs
Excavation Drilling Demolition Dismantling	Energized utilities	Perform work under an HWP Use "one-call" service to identify utility locations Contact utility companies to aid in locating underground utilities Confer with property owner and review available blueprints and plans Use metal detector to identify underground utilities Before allowing drill rigs, cranes, etc., on the site, walk over the work area and ensure booms will be clear of overhead power lines (minimum 10 ft) Adhere to applicable lockout/ tagout procedures	24.103 24.121
Potentially all tasks	Noise	Use engineering controls such as mufflers and enclosures when available Use hearing protectors approved by the S&H supervisor	24.085

Table 2-1

(continued)

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TASK	HAZARD	CONTROL	REF. PIs
Potentially all tasks	Eye and head hazards	Use head protection meeting ANSI Z89.1 Use eye protection meeting ANSI Z87.1 Use double eye protection, face shield plus safety glasses, when splash hazard is present or when performing tasks that generate flying fragments (e.g., grinding, chipping, scabbling) Use helmet and hood approved by S&H supervisor when performing abrasive blasting Use shaded eye protection and helmet specified by SSHO during welding and torch cutting procedures	24.063
Excavation and trenching (greater than 5 ft)	Cave-in	Perform work under an HWP Use shoring or slope to an angle not steeper than one and one-half horizontal to one vertical Soil classification Keep excavation spoils a minimum of 2 ft from edge of trench	24.103 24.121

Table 2-1

(continued)

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TASK	HAZARD	CONTROL	REF. PIs
Excavation and trenching (greater than 5 ft) (cont'd)		Secure or remove large rocks to prevent them from falling back into excavation Prohibit heavy equipment from operating above workers in trenches Check trenches daily for groundwater infiltration and remove water as necessary Provide required number of egresses (e.g., ladders, ramps) Inspect condition of trench by qualified individual before entry	
Drilling Excavation Demolition Site maintenance	Heavy equipment operation	Limit equipment use to operators with documented training and experience Inspect equipment before use; lockout/tagout energized systems or equipment Use backup alarm when traveling in reverse Assign spotter	24.106

Table 2-1

(continued)

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TASK	HAZARD	CONTROL	REF. PIs
Site maintenance (cont'd)		Prohibit operation of equipment on steep slopes, soft/wet ground, or other hazardous terrain until the SSHO has inspected the area and specified safety requirements Train workers to recognize and avoid pinch points and other dangerous conditions resulting from heavy equipment use	
Potentially all tasks	Tripping, falling	Perform documented site safety inspections a minimum of once per week Identify and remove tripping hazards or post warning Enforce strict housekeeping requirements to ensure debris does not accumulate Barricade locations with severe tripping hazards	24.110

Table 2-1

(continued)

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TASK	HAZARD	CONTROL	REF. PIs
Surveying Demolition Dismantling Site maintenance	Work at elevation	Perform work under an HWP Use scaffolding or manlifts where practical Ensure that scaffolds and other raised platforms have handrails, midrails, toe boards, and cleats meeting FUSRAP requirements Ensure that ladders are positioned, secured, and used in accordance with FUSRAP requirements When engineering controls are unavailable, use safety harnesses and life lines tied off to a secure, nearby structure that will not allow a fall greater than 6 ft Inspect elevated work areas by a qualified engineer for unsafe conditions such as weak flooring or supports, elevated openings, tripping hazards, etc. Barricade unsafe areas	24.104 24.105

Table 2-1

(continued)

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TASK	HAZARD	CONTROL	REF. PIs
Demolition Dismantling Surveying Decontamination Site maintenance	Asbestos exposure	Perform work under an HWP Use PPE specified by SSHO Work may only be performed by certified asbestos handlers Use negative air pressure enclosures or glove bags during the removal of asbestos-containing material Establish RWAs around the work locations	24.119
Potentially all tasks within radiologically or chemically controlled areas	Exposure to chemical or radioactive contaminants	Perform work under an HWP Establish RWAs around locations with contaminant levels above action limits Use PPE as specified by SHSO in the HWP Frisk personnel and equipment before releasing from an RWA (for radioactive contamination) Perform bioassay specified in SHSP	24.021 24.023 24.024 24.025 24.026 24.065 24.081 24.082

Table 2-1

(continued)

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TASK	HAZARD	CONTROL	REF. PIs
(cont'd)		Perform air monitoring specified in SHSP Issue thermoluminescent dosimeters as specified by SSHO Inspect/survey material to be welded or torch-cut for radioactive contamination or hazardous coatings	
Site maintenance	Electrical shock	Limit electrical work to qualified electricians Perform lockout/tagout as required Use ground-fault circuit interrupters Use UL-approved, double insulated extension cords (when an extension cord is necessary) Ensure that cords are protected against damage and do not present a tripping hazard	24.102 24.121

Table 2-1
(continued)

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TASK	HAZARD	CONTROL	REF. PIs
Welding	Burns and fires	Assign fire watch during welding and torch cutting	24.107
Oxy-acetylene torch cutting Site maintenance (refueling)		Locate appropriate type of fire extinguisher in the work area Forbid smoking within 20 ft during handling of combustible or flammable fuels Inspect welding and torch-cutting equipment before use; store compressed gas cylinders 20 ft apart or separated by fire retardant barrier when not in use Remove all combustible items to beyond 35 ft from torch-cutting or welding operations	
Potentially all tasks	Power tools	Limit use of power tools to operators with adequate training and experience Inspect power tools before each use Ensure all guards, shields, and other safety features are in place and operational before using the power tool Ensure approved extension cords and ground-fault circuit interrupters are used	24.111
Hoisting and Rigging	Dropping lifted equipment; personnel injury	Inspect lift equipment before each use	24.123

Table 2-2

DOE Radiological Release Limits

Mode of Exposure	Exposure Conditions	Guideline Value
Gamma radiation	Indoor gamma radiation level (above background)	20 μR/h
Surface contamination	Uranium-238, natural uranium	
	Fixed on surfaces	5,000 dpm/100 cm^2
	Removable	1,000 dpm/100 cm^2
	Thorium-232, natural thorium	
	Fixed on surfaces	1,000 dpm/100 cm^2
	Removable	200 dpm/100 cm^2
	Radium-226	
	Fixed on surfaces	100 dpm/100 cm^2
	Removable	20 dpm/100 cm^2
Beta-gamma dose rates	Surface dose rate averaged over not more than 1 m^2	0.20 mrad/h
	Maximum dose rate in any 100-cm^2 area	1.0 mrad/h
Radionuclide concentrations in soil	Maximum concentration above background levels allowed in soil when averaged over a 100-m^2 area	5 pCi/g when averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over 15-cm-thick soil layers more than 15 cm below the surface
thorium-232		
thorium-230		
radium-228		
radium-226		
uranium-238		Derived (site-specific)

Source: DOE 1990.

3.0 MEDICAL SURVEILLANCE

General requirements for the FUSRAP medical surveillance program are in PI 24.083, "Medical Surveillance," and related requirements are in PIs 24.012, "Hazardous Incident Investigations," and 24.013, "Safety, Injury and Occupational Illness Reporting." Appendix C contains site-specific medical surveillance requirements.

3.1 PARTICIPANTS

Employees must participate in the medical surveillance program if they

- work in RWAs,
- are required to use respiratory protection or other equipment that can cause physical stress,
- could have received an overexposure during an incident involving hazardous substances or show symptoms of an exposure to a hazardous material, or
- have sustained a traumatic injury.

BNI developed the medical surveillance program in compliance with 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response," and DOE Order 5480.8A, "Contractor Occupational Medical Program."

3.2 BASELINE HEALTH ASSESSMENT AND RETURN TO WORK

Before beginning work onsite, each participating worker must have a BNI-approved physical examination from which a baseline health assessment will be formed. Baseline health assessments of all participants will include

- a complete medical and occupational history;
- a physical examination;
- laboratory studies, including a complete blood count;
- urinalysis;
- a chemistry panel;
- pulmonary-function testing;
- audiometry and visual screening;
- chest X ray or electrocardiogram;
- a qualitative or quantitative fit-test for respiratory equipment (see Section 5.0); and
- special urine or blood tests as necessitated by anticipated hazards onsite (see Appendix C).

Participants in the medical surveillance program may not begin work onsite until the FUSRAP medical provider has reviewed the results of the baseline health assessment and indicated on the FUSRAP physician's statement that the worker is medically qualified to work at a hazardous waste site and use respiratory protection equipment. Additionally, until the provider gives written approval (using a "Return to Work Slip"), workers will not be allowed to return to work following an occupational illness or injury that requires offsite medical treatment or any nonoccupational injury or illness that may sensitize the employee to onsite contaminants and/or affect the employee's ability to perform the assigned job. The site superintendent, SHSO, or radiological support subcontractor (RSS) will verify with the Oak Ridge FUSRAP S&H supervisor or coordinator that a physician's statement has been submitted before authorizing a worker to enter an RWA.

3.3 ANNUAL MEDICAL EXAMINATIONS

A follow-up medical exam must be performed at least once every 12 months.

3.4 CLOSE-OUT MEDICAL EXAMINATION

Upon termination of employment, any participant who has worked continuously at a FUSRAP site(s) for more than six months will receive an exit physical equivalent to the entrance baseline physical. Personnel who terminate employment within six months will be examined on the basis of their exposures to chemicals and radioactive materials at the site; the BNI-approved examining physician, with guidance from the S&H supervisor, will determine which additional tests are to be conducted, if any.

3.5 VISITORS

A site visitor may be granted access to a controlled area without participation in the medical surveillance program provided that

- the use of respiratory protection equipment or other stress-producing PPE is not required,
- the visitor does not spend more than 30 days per year at a FUSRAP site,
- the visitor is not exposed to contaminants of concern in excess of applicable exposure criteria, and
- the visitor is escorted at all times by the site superintendent or qualified designee.

Visitor access to a controlled area requires the approval of the S&H supervisor on a case-by-case basis.

4.0 BIOASSAY PROGRAM

General requirements for the FUSRAP bioassay program are in PI 24.084, "Bioassay Monitoring"; site-specific bioassay requirements are provided in Appendix C.

Bioassay analysis will be performed to determine whether contaminants of concern are being taken into the body through any of the applicable exposure pathways. The S&H supervisor will identify contaminants of concern using site survey and characterization data. Additional guidance may be obtained from the FUSRAP medical provider.

4.1 BIOASSAYS FOR RADIOACTIVE MATERIALS

For full-time site workers, an entrance bioassay analysis, or a 24-h urine collection for bioassay analysis, will be performed to establish a baseline before an individual is allowed to enter an RWA. The bioassay will include analysis for thorium-230, thorium-232, uranium-238, radium-226, and the site-specific radionuclides listed in Appendix C. A baseline bioassay for an employee with prior FUSRAP experience may be compiled from his or her exit bioassay from another FUSRAP site, provided that the RSS and SSHO are satisfied that the individual was not occupationally or otherwise exposed to radioactive material while off the project.

Each participant in the bioassay program must submit a urine sample during each quarter of work onsite.

The SSHO may require additional bioassays for employees who are particularly at risk of inhaling or ingesting radioactive contaminants. The S&H supervisor will direct that urine samples be collected immediately from any individual suspected to have ingested or inhaled radioactive contaminants.

An exit bioassay analysis will be performed for each participant whose assignment onsite is terminated.

4.2 BIOASSAYS FOR NONRADIOACTIVE MATERIALS

The FUSRAP medical provider will approve the bioassay method(s) for nonradioactive contaminants of concern. Appendix C lists site-specific nonradioactive contaminants of concern for which bioassay analyses are required, the bioassay methods, and the routine sampling schedules.

A baseline bioassay will be performed as part of the baseline medical assessment for new FUSRAP employees or for FUSRAP employees without previous bioassay analyses for the contaminants of concern. Baselines for employees with prior FUSRAP experience may be compiled from those employees' exit bioassays for the same contaminants from other FUSRAP sites, provided that the RSS and SSHO are satisfied that the individual was not occupationally or otherwise significantly exposed to the contaminants while off the project.

The SSHO may require additional bioassays for employees who are at particular risk of inhaling or ingesting any of the contaminants of concern listed in Appendix B or who encounter unexpected contaminants at levels near applicable exposure limits. The S&H supervisor will require that a bioassay be performed immediately if it is suspected that an employee has been exposed to a contaminant in excess of an applicable exposure limit.

An exit bioassay will be performed for each participating worker whose assignment onsite is terminated.

4.3 VISITORS

A site visitor may be granted access to an RWA or otherwise controlled area without participation in the bioassay program provided that

- he or she has been offered the opportunity to participate in the bioassay program (in accordance with PI 24.084, "Bioassay Monitoring");
- the condition(s) for which the area is controlled can be adequately regulated so that the visitor will not be exposed to a contaminant of concern at or above applicable exposure criteria;
- the use of respiratory protection equipment is not required;
- the visitor does not spend more than 30 days a year at a FUSRAP site; and
- the visitor is escorted at all times by the site superintendent or a qualified designee.

Visitor access to a controlled area requires the approval of the S&H supervisor on a case-by-case basis.

5.0 PERSONAL PROTECTIVE EQUIPMENT AND APPAREL AND AIR MONITORING

The FUSRAP PPE program specified in PI 24.063, "Protective Apparel and Equipment Program," and respiratory protection program specified in PI 24.062, "Respiratory Protection Program," will be implemented for all applicable site work. Additional site-specific PPE and air monitoring requirements are specified in Appendix D. The ALARA philosophy will be practiced onsite with respect to worker exposure to hazardous substances and will be the basis for PPE selection.

The following administrative controls will be implemented to limit worker exposure and mitigate the need for PPE when containers of hazardous substances are handled:

- All drums and containers used during cleanup activities must meet appropriate Department of Transportation, OSHA, and EPA regulations.
- Drums and containers must be inspected and their integrity ensured before they are used.
- Operations onsite will be organized to minimize handling and transport of drums and containers.
- Employees who conduct operations involving drums or containers will be warned of associated hazards.

- Quantities of spill-containment materials (such as absorbents and pillows) sufficient to contain and isolate the entire volume of the drum of hazardous liquid being transferred will be maintained near any area where spills, leaks, or ruptures could occur, or a berm will be constructed.

- Fire-extinguishing equipment that meets criteria in 29 CFR Part 1910, Subpart I, will be available to control incipient fires.

5.1 PPE SELECTION

Where engineering controls are not feasible or not sufficient to protect workers, PPE will be selected and used to protect individuals against

- inhalation and respiratory tract hazards,
- dermal contact hazards,
- mechanical injury and hazards,
- construction safety hazards,
- physical agent hazards, and
- environmental hazards.

The SSHO is responsible for prescribing the level of protection for all work activities at the site, selecting the equipment required for that level, and upgrading or downgrading the level as necessary. The level of protection will be specified in an HWP. The action levels for upgrading PPE during site activities will be based on the levels listed in Table 5-1.

The level of PPE will be upgraded if dermal hazards are known or suspected to be present, if there is an occurrence or likely occurrence of gas or vapor emission, or if a change in the work task will increase contact or potential contact with hazardous conditions.

The level of PPE will be downgraded if new information (e.g., results of monitoring or surveillance) indicates that the situation is less hazardous than was originally thought, a change in site conditions decreases the hazard, or a change in the work task reduces contact with hazardous materials.

Level A protection affords the highest available level of respiratory, skin, and eye protection. Level B protection affords the highest level of respiratory protection but less skin protection than Level A. The need for these levels of protection is not anticipated during cleanup of low-level contamination. Level C protection affords the same level of skin protection as Level B but a lower level of respiratory protection. A minimum of Level C protection will be required for all personnel working at a decontamination pad. The minimum protective clothing to be used during activities in a controlled area will be modified Level C, which includes Tyvek™ coveralls, shoe covers, inner latex gloves, outer work gloves, ear protection, hard hat, safety glasses, and sturdy work boots.

Level D protection affords minimal skin protection and no respiratory protection. The minimal acceptable clothing for Level D protection includes hard hat, safety glasses, sturdy work boots, pants with long legs, and T-shirt with sleeves. Level D PPE will be required during all mobilization activities and in unrestricted areas during demobilization activities.

Examples of PPE and safety equipment to be used onsite include

- hard hat, safety glasses, and sturdy work boots, all of which must be worn at all times in all work areas;

- ear plugs or other hearing protection, to be worn when noise levels exceed permissible limits;

- full-face, air-purifying respirators;

- polyethylene-coated Tyvek™ coveralls;

- toe caps for work boots, to be worn whenever a hydraulic pavement breaker or similar equipment is being used;

- inner latex gloves, to be worn underneath outer work gloves whenever a hydraulic pavement breaker is being used;

- safety belts with lanyards or body harnesses, with retractable lifelines, to be worn as necessary to provide adequate fall prevention and protection; and

- positive-pressure, pressure-demand, self-contained breathing apparatus (SCBA), for use in emergency or rescue situations where conditions that are immediately dangerous to life or health (IDLH) could exist.

The following PPE will be maintained onsite, ready for use by emergency response team (ERT) personnel in the event of a spill:

- chemical-resistant boots,
- full-face gas masks (the type of canister to be used depends on the nature of the spill),
- chemical-resistant Tyvek™ coveralls with hoods,
- two SCBAs for rescue (if the potential for IDLH conditions exists),

- hard hats and splash-proof face shields and goggles, and
- monitoring instruments.

PPE designated for emergency response activities will be used exclusively for this purpose. The storage location for emergency response PPE will be marked on an Emergency Equipment and Maintenance Site Plan (map) posted in the site office.

Durable protective equipment and apparel (i.e., plastic, rubber) may be reused if a radiological survey indicates no detectable contamination. The SSHO will ensure that nondisposable apparel and equipment are stored to prevent damage or malfunction caused by exposure to dust, moisture, sunlight, damaging chemicals, temperature extremes, or physical damage. All PPE will be visually inspected before it is used and during the cleaning and decontamination process. Damaged or defective equipment will be repaired or replaced immediately.

The SSHO will monitor to ensure that the decontamination of PPE and the disposal of wastes resulting from the decontamination of PPE are performed in accordance with project procedures.

Respiratory Protection Equipment

The SSHO will ensure that an adequate supply of respiratory equipment is maintained onsite and will issue it to workers as necessary. Workers required to wear respirators will be medically qualified and fit-tested in accordance with ANSI Standard Z88.2-1969 before starting work onsite. The worker will be fitted for the type of respiratory equipment in use at the site. Quantitative fit-tests will be conducted as required by 29 CFR 1910.1025. A copy of the physician's statement and respiratory fit-test for each worker will be submitted to the site superintendent and maintained by the S&H group in the BNI Oak Ridge office.

Training in the proper use of respirators and/or other PPE is required to ensure that site personnel (including visitors) are familiar with the use, care, and limitations of the types of PPE they may be required to use. Training will be conducted in accordance with project procedures.

Workers at risk of inhaling radionuclides must wear full-face, air-purifying respirators with high-efficiency particulate air cartridges. Air-purifying respirators must be used if airborne radioactivity could exceed 10 percent of the DAC (Table 5-2). Engineering controls will be initiated if airborne radioactivity exceeds 10 percent of the DAC; however, respirators will be worn until the engineering controls have been implemented and monitoring results confirm their effectiveness.

The SSHO will issue an HWP that specifies PPE requirements, including organic vapor cartridges to be worn if direct-reading IH instruments indicate that concentrations of organic vapors are greater than background but less than 5 ppm. If organic vapor concentrations exceed 5 ppm, access to the affected area will be restricted, the SSHO will upgrade the HWP and PPE requirements, and appropriate engineering controls and administrative protocols will be implemented. If organic vapor concentrations increase to life-threatening levels, or if combustible gases are encountered during work activities, the affected area will be evacuated immediately, and work will stop until hazards are abated to permissible exposure levels.

The SSHO is responsible for ensuring that all respirators are stored in clean plastic bags to protect them from dust, chemical and mechanical damage, sunlight, and excessive moisture. The SSHO or designee will collect, clean, disinfect, and, if necessary, decontaminate all respiratory equipment. Respiratory protection equipment will be inspected by a qualified individual during daily cleaning and disinfecting. Damaged equipment will be removed from service. Minor field repairs (e.g., changing straps, gaskets, valves) may be undertaken at the site by a qualified individual.

5.2 AIR SURVEILLANCE OF RADIOLOGICAL AND HAZARDOUS CHEMICALS

5.2.1 Surveillance Rationale

Policies and procedures for implementing an air surveillance program are contained in PIs 24.023, "Air Monitoring for Particulate Radioactive Materials"; 24.024, "Identification of Chemical, Biological and Physical Hazards"; and 24.086, "Air Surveillance for Chemical and Biological Exposures." Any additional air surveillance requirements are specified in Appendix D. Air surveillance will be conducted by or under the direction of the SSHO and the supervision of the RSS supervisor. When required, additional guidance will be provided by the S&H coordinator and/or the S&H supervisor. This section sets forth the criteria for conducting air monitoring and air sampling onsite as part of a comprehensive radiological health and IH evaluation that

- identifies work areas and activities that require the use of engineering controls, administrative controls, and/or PPE;
- provides data for documentation of employee exposure (or lack of exposure);
- provides data to confirm that protection levels afforded by the assigned engineering and administrative controls and/or PPE are adequate to protect workers;
- provides data to ensure that controls and precautions are adequate to protect the public and the environment; and
- provides data for use in determining the need to implement emergency control measures and contingency plans.

Air monitoring (direct-reading) instruments will be used to screen for the presence of airborne contaminants. If unknown contaminants are encountered, the action levels outlined in Table 5-1 will be used. When unknown contaminants are identified by air sampling and

laboratory analysis (i.e., indirect methods), air sampling results will be compared with applicable exposure standards to determine suitable exposure control measures.

Measurements will be taken in various locations to assess the impact of work operations on personnel and the environment, to establish worker protection levels, and to assess the effectiveness of engineering and administrative controls.

General area samples are obtained in the work area and at the perimeters of controlled access areas to estimate potential worker exposures and environmental exposures, respectively. Work-area samples are taken near generation sources to estimate the most severe potential exposure. Perimeter samples are obtained in upwind and downwind locations to determine background concentrations and the impact of work activity on uncontrolled areas.

Biased air surveillance techniques will be used on the basis of worst-case exposure situations as determined by direct-reading instruments. Where appropriate, full-shift, time-weighted average measurements will be obtained and compared with applicable exposure standards such as permissible exposure limits (PELs), TLVs, and DACs.

5.2.2 Air Monitoring (Direct Methods)

Direct-reading instrumentation (i.e., flame-ionization and/or photoionization detectors, which provide onsite readings) will be available during drilling, excavation, confined space entry, dust generation, and other intrusive activities onsite. The primary sources of information concerning specific instruments are the manufacturers' reference documents, which are consulted for operation, maintenance, and calibration specifications. Trained personnel use the provided instrumentation to conduct air monitoring for work activities. The monitoring frequency in areas suspected of containing radioactive or chemical

contaminants is established in PI 24.086, "Air Surveillance for Chemical and Biological Exposures."

Minimum air surveillance measurements for intrusive work activities in known and/or suspected contaminated areas and for confined space entry include percent oxygen, lower explosion limits for combustible gas, total volatile organic compounds, and airborne radioactive materials. Air sampling for specific potentially toxic compounds may also be conducted to aid in further assessing the adequacy of specified PPE levels.

The guidelines presented in Table 5-1 are action levels for vapor, combustible gas, oxygen, particulates, and airborne radioactivity of unidentified types. These levels should be used in conjunction with all other available information such as historical radiological or chemical use and disposal information. Data from vapor, gas, particulate, or radiological measurements, as determined by direct-reading instruments, are used as a supplement to other information and not as the sole selection criterion for PPE.

5.2.3 Air Sampling (Indirect Methods)

Contaminant identification and accurate quantification usually require sample collection followed by laboratory analysis (i.e., indirect methods). Air sampling pumps with filters, sorbent tubes, or other collection devices are commonly used. Indirect air samples will be collected and analyzed using recognized protocols such as OSHA and NIOSH reference procedures and methods.

Air sampling methods for radioactive materials have many similarities with conventional particulate contaminant sampling methods. However, significant differences exist because of radioactive decay, which is an important consideration when sampling for

short-lived isotopes such as radon progeny. General recommendations for air sampling for chemical contaminants are included in PI 24.086, "Air Surveillance for Chemical and Biological Exposures," and air sampling recommendations for radioactive contaminants are included in PI 24.023, "Air Monitoring for Particulate Radioactive Materials."

5.2.4 Air Sampling for Chemical Contaminants

Sampling for chemical contaminants may involve a variety of methods, including the use of impingers, impactors, cyclones, filters, and solid sorbents (e.g., carbon, silica gel, Tenax™). The selection of collection devices depends on the physical and chemical properties of the contaminants. Sampling protocols developed by OSHA and/or NIOSH are used for onsite chemical sampling efforts. Table 5-3 provides guidance for conducting air sampling for a wide variety of chemical compounds. The chemical analysis subcontractor must be contacted for specialized sampling and analytical methods for which standard protocols do not exist.

Sample Duration and Selection of Exposure Standard

Chemical exposure standards such as PELs define sampling periods in relation to specific physiological responses. The SSHO and the S&H coordinator select appropriate sampling times based on the nature of the expected contaminant. For example, with an acutely toxic or irritating material such as chromic acid, the ceiling PEL is the most important parameter. For cumulatively toxic compounds such as inorganic lead or mercury, an estimate of daily average exposure is appropriate. The corresponding standard would be the time-weighted average of the PEL. Sampling times are also based on the nature of the work operation and exposure (e.g., continuous, intermittent).

Gas and Vapor Collection

Adsorption tubes (carbon, silica gel, Tenax™) are commonly used for gas and vapor collection. Other methods such as sampling flasks or bags may be used if deemed appropriate by the SSHO and the S&H coordinator. Typically, at least two adsorption tube sections are used to collect samples. Backup sections of the adsorption tubes are analyzed separately. Sampling results are suspected of underestimating exposure if the second adsorption stage contains more than 25 percent of the mass collected in the front section. The SSHO should ensure that a notation is made on the sampling sheet that contaminant breakthrough with subsequent underestimation of exposure occurred. Sample volume should be adjusted to prevent breakthrough in subsequent samples.

Particulate Sampling

Particulate samples are commonly collected for analysis of the total mass of chemical contaminants or the fraction of mass considered to be respirable. Other sampling devices such as impingers and impactors may be used if deemed appropriate by the SSHO and S&H coordinator.

Unknown Contaminants

Atmospheres that contain unknown organic or inorganic contaminants as detected by direct-reading instruments are sampled with solid sorbents that collect a variety of substances. Tenax™, carbon, or other sample sorbents recommended by the chemical analysis subcontractor are used to sample unknown atmospheres. To determine the nature of unknown contaminants, gas chromatography/mass spectrometry systems are used to separate and identify unknown compounds. Chemicals identified in this manner are then analyzed

with methods outlined in the "NIOSH Manual of Analytical Methods" (NIOSH latest version).

5.2.5 Air Sampling for Radioactive Contaminants

Sampling Strategy

Task-specific air sampling for radioactive contaminants is conducted on the basis of the potential presence of radioactive materials. Priority is given to activities that cause aerosols to be generated (e.g., drilling, excavation, sampling of dry soils, decontamination activities).

When work operations necessitate the use of respiratory protection, breathing-zone (lapel) air sampling must be conducted. Filters for sampling should prevent subsurface deposition of particulates. Filters suitable for this purpose include Millipore™ and Nucleopore™ polycarbonate membrane.

Air sample filters are analyzed for alpha and/or beta-gamma radiation, and analytical results are compared with applicable DACs for radionuclides known to be in the work area. If contaminants have not been identified in the work area, conservative DACs are used to determine action levels.

Exposure Standards

DOE Order 5480.11 (DOE 1989) provides DACs for each radionuclide; these DACs are used to control internal exposures to radioactive materials. DACs for radionuclides of concern are included in Table 5-2. Under extreme conditions, limitations on occupancy may be governed by both external and internal exposure limits. A sign warning of airborne radioactivity is posted if airborne radioactivity in the area exceeds or has the potential to

exceed 10 percent of the DAC. Posting requirements are outlined in PI 24.023, "Air Monitoring Requirements for Particulate Radioactive Materials."

Personal Breathing-Zone Air Samples

Personal breathing-zone (lapel) air samples are required for workers who enter areas that exceed 10 percent of the DAC as measured by area sampling techniques. The biased sampling protocol outlined in Section 5.2.1 is used to select workers for personal samples. PI 24.086, "Air Surveillance for Chemical and Biological Exposures," contains an example of a sheet that is used to record relevant sampling information.

Perimeter Workplace Air Samples

Air samples are collected at the boundaries of radiologically controlled-access areas to verify compliance with DOE Order 5400.5 (DOE 1990), which specifies maximum allowable airborne radioactivity in unrestricted areas.

5.2.6 Air Surveillance Data Records and Instrument Calibration

Instruments are calibrated and maintained in accordance with manufacturers' specifications. Calibration checks are required before and after each field monitoring or sampling event. Table 5-3 describes uses, calibration, and maintenance of monitoring and sampling equipment that may be used onsite. Calibration checks are performed in accordance with the "NIOSH Manual of Analytical Methods" (NIOSH latest revision). Calibration, monitoring, and sampling data are recorded and maintained on air monitoring data sheets and IH monitoring data sheets, which are included in PI 24.086, "Air Surveillance for Chemical and Biological Exposures."

TABLES FOR SECTION 5.0

Table 5-1

Action Levels for Direct-Reading Measurements in Uncharacterized Atmospheres

Page 1 of 2

Hazard	Measurement	Action	Level of Protection
Gases and Vapors	ppm[a] Above Background		
Volatile organics	Background to ≤5 above background level	Monitor contaminant in or near breathing	Level C or modified Level C protection
	>5 to 500	Obtain further information; use GC/MS[b] to analyze sorbent samples	Upgrade protection to Level B
	>500 to 1,000	Obtain further information; use GC/MS to analyze sorbent samples	Upgrade protection to Level A
	>1,000	Stop work	N/A[c]
Combustible Gases[d,e]	Percentage of Lower Explosive Limit		
	<10	Requires continuous monitoring, as practical	N/A
	≥10 to 20	Limit activities in area to those that do not generate sparks; use non-sparking tools and gear; investigate source of combustible gas	N/A
	≥20	Stop work	N/A
Oxygen Level	Percent		
	<19.5	Monitor while wearing self-contained breathing apparatus	N/A

Table 5-1

(continued)

Hazard	Measurement	Action	Level of Protection
Oxygen Level (cont'd)	≥19.5 to <25	Continue measurements and use of respiratory protection equipment based on other factors such as the presence of toxic air contaminants	N/A
	≥25	If potential for fire exists, stop work	N/A
Particulates and Respirable Dust	Airborne Concentrations (mg/m^3)		
	≤2	Air-purifying respirator should be equipped with high-efficiency, organic-vapor, acid-gas combination cartridges. Basic dust control techniques will be used for all intrusive activities	Level C or modified Level C protection
	>2 to ≤10	Continue work and upgrade respirator protection; collect air sample information	Upgrade protection to Level B
	>10 to <20	Continue work and upgrade level of respirator protection; collect air sample information	Upgrade protection to Level A
	≥20	Stop work	N/A

[a]ppm = parts per million.
[b]GC/MS = gas chromatography/mass spectrometry.
[c]N/A = Not applicable.
[d]Readings in the immediate vicinity of work activities.
[e]Low oxygen concentrations may affect the validity of combustible gas measurements.

Table 5-2

Derived Air Concentrations for Radionuclides Onsite

Radionuclide	Inhaled-Air Lung-Retention Class		
	Clearance Class D[a] (μCi/ml)	Clearance Class W[b] (μCi/ml)	Clearance Class Y[c] (μCi/ml)
Thorium	---	5.0E-13	1.0E-12
Uranium-238	6.0E-10	3.0E-10	6.0E-07
Radium-226	---	3.0E-10	---

[a]The length of retention in the pulmonary region is approximately 10 days.

[b]The length of retention in the pulmonary region is approximately 10 to 100 days.

[c]The length of retention in the pulmonary region is greater than 100 days.

Table 5-3

Use, Calibration, and Maintenance Data for Monitoring and Sampling Equipment

Instrument	Use	Calibration	Maintenance
High-volume air pump	Monitoring of airborne particulates in work area	Daily, immediately before and after use	Shipped to the instrument calibration department of the RSS every 6 months
Low-volume air pump	Monitoring of airborne particulates in workers' breathing-zone areas	Daily, immediately before and after use	Shipped to the instrument calibration department of the RSS every 6 months
Drager tubes (direct-reading instrument)	Screening for airborne chemical contaminants (may be used in conjunction with a low-volume pump)	Precalibrated by the manufacturer (if a low-volume pump is used, the calibration requirements for it should be followed)	Marked with expiration dates (if a low-volume pump is used, its maintenance requirements also apply)
Flame-ionization detector	Monitoring of organic vapors	Daily, immediately before and after use	Should be serviced by manufacturer once every 6 months
Photoionization detector	Monitoring of organic and inorganic vapors	Daily, immediately before and after use	Should be serviced by manufacturer once every 6 months
Direct-reading alpha analyzer	Detection of alpha radiation	Source-checked daily before use (must be within 6-month calibration schedule frequency)	Shipped to the RSS every 6 months for calibration
Direct-reading beta/gamma analyzer	Detection of beta/gamma radiation	Source-checked daily before use (must be within 6-month calibration schedule frequency)	Shipped to the RSS every 6 months for calibration
Combustible gas/oxygen analyzer	Detection of flammable vapor and oxygen content	Daily, before and after use	Should be serviced by manufacturer once every 6 months

6.0 RESTRICTED WORK AREAS

Areas where exposure to contaminant levels above administrative action limits (see Table 6-1) could occur or where there are significant safety hazards will be designated as RWAs. Figure 6-1 depicts a typical RWA. Requirements for establishing and maintaining access to RWAs are specified in PI 24.021, "Restricted Work Areas"; site-specific information is provided in Appendix E. Boundaries of RWAs will be clearly marked with ropes and appropriate warning signs and will remain restricted until surveys indicate there is no need to restrict access and the RSS formally documents that levels of radioactive and/or chemical contaminants do not exceed administrative limits.

Site maps indicating the locations of RWAs and detailing requirements for posting signs will be displayed at the administrative office onsite and will be updated throughout the project by the SSHO or site superintendent. Posting requirements are established by DOE Order 5480.11 (DOE 1989), the *FUSRAP Radiological Control Manual* (BNI 1993a), OSHA (1984), and PI 24.023, "Air Monitoring for Particulate Radioactive Material."

6.1 FEATURES AND REQUIREMENTS

Features will be incorporated into the design of each RWA to control access and exit, minimize equipment traffic, and prevent the spreading of contamination. RWAs should incorporate the following features (see Figure 6-1):

- An **access control point** must be established near areas of scheduled onsite work activities. At the control point, an HWP listing contaminants of concern, PPE, and special health and safety requirements will be posted; a register must be signed by each worker entering or leaving the area; dosimeter badges (thermoluminescent dosimeters) will be issued, as required, to personnel and collected daily; and

external surface surveys for radiation (called "frisks") must be conducted on personnel and equipment leaving the RWA.

The health physics technician will observe the frisking to ensure that established frisking procedures are followed. If contamination is detected, decontamination procedures will be performed at the direction of the health physics technician, as necessary.

- **Exclusion zones** encompass the areas where contamination above applicable criteria (see Tables 2-2 and 6-1) is present. Areas where remedial action and field sampling activities are conducted will be designated as exclusion zones. Smoking, chewing, eating, and drinking are prohibited in these zones.

- A **contamination reduction zone** (CRZ) acts as a buffer zone to prevent the migration of contaminants from the exclusion zone to uncontaminated areas.

- A **contamination reduction corridor** is an area within the CRZ where decontamination of personnel and/or equipment will be performed. A decontamination pad will be established in each RWA and will include a mobile eyewash station, a fire extinguisher, two-way radios, towels, and Alconox™ cleaning detergent. Before work begins in an RWA, decontamination instructions will be communicated to the workers and implemented at the site. Instructions will include measures to reduce employee contact with hazardous substances and contaminated equipment; procedures for decontaminating apparel and equipment; description of the decontamination pad and its location; and procedures for decontaminating vehicles, respirators, and tools.

After determining the hazards and required PPE for an activity, the SSHO will issue an HWP in accordance with PI 24.061, "Hazardous Work Permits"; an example of an HWP is provided as Figure 6-2. The HWP will include the following information, as required by NIOSH (NIOSH, latest revision):

- the site identification number,
- radiological conditions onsite,
- IH and safety conditions onsite,
- measures to ensure that ALARA practices are employed,
- radiological and IH survey information gathered during the preliminary walkover,
- any special instructions for IH safety,
- required PPE,
- expiration date of the HWP, and
- potential IH and industrial safety risks.

The SSHO must revise the HWP or terminate it and reissue another one to change action levels if hazards in the RWA change. After the HWP has been completed, the site superintendent will review the form, sign it, and return it to the SSHO, who will also sign it. The SSHO or site superintendent will then review the contents and requirements of the HWP in detail with the workers. When the HWP expires or is completed, a copy of it will be placed in an HWP logbook, and a copy will be transmitted to the BNI ESH&WM Department.

Site personnel will perform radiological surveys of all vehicles that have entered RWAs to ensure that radioactive contamination is not transported offsite. All personnel exiting an RWA will be scanned with appropriate radiation-monitoring instruments.

To determine the boundaries of the RWAs, the SSHO will use direct-reading instruments and the action levels listed in Table 6-2. Action limits may be increased if volatile organic vapors are identified and quantified. The SSHO will use a portable gas chromatograph to identify the contaminants and determine concentrations. After an air sample is collected and analyzed, all compounds will be identified and quantified before the action level is determined. If any contaminants are identified, the action level will be determined on the basis of (1) the PEL for each contaminant, specified in 29 CFR 1910.1000, "Air Contaminants"; (2) the threshold limits for mixtures, per 1992-1993 values stated by ACGIH (issued annually); (3) a protection factor of 50 for a full-face respirator; and (4) a maximum-use limit of 1,000 ppm for each respirator cartridge.

Visitors who have not been trained in safety procedures, fitted for respirators (if so required by the SSHO), and medically approved are prohibited from entering RWAs. These visitors may observe site operations from an area that the SSHO has determined to be safe. Visitors who meet the requirements for entering an RWA may do so only after appropriate documentation has been submitted to and approved by the ESH&WM Department.

The SSHO will establish other work practices as necessary to eliminate exposure hazards. Such work practices may include substitution of chemicals used, use of local exhaust ventilation, and establishment of work/rest regimens.

6.2 DECONTAMINATION

Decontamination will be performed in accordance with the provisions of PI 24.065, "Decontamination of Personnel, Vehicles, and Equipment." Section 8.3 provides decontamination guidance for responding to an occupational injury.

6.2.1 Apparel Decontamination

A decontamination pad may be established in each RWA; additionally, the SSHO may establish a decontamination pad for site-wide use. Appendix E provides site-specific information about the locations of decontamination pads. The need for and the precise design and location of a pad will be established during mobilization; the pad may be moved if work locations change. Alconox™ detergent, rinse water, towels, plastic basins, and brushes for scrubbing boots will be available at the pad designated for site-wide use. Rinseate resulting from decontamination will be collected for processing and disposal.

As part of the BNI waste minimization program, all PPE must be scanned for radioactivity before being removed from the access control points. If small areas of the PPE are contaminated above release criteria, the contaminated portions will be removed and disposed of as radioactive waste; the remaining portions will be disposed of as industrial waste. If most or all of the PPE is contaminated, the survey technician will

- brush lightly any dry areas of contamination while holding the PPE over a waste container,
- wipe with a dry cloth or towel any wet areas of contamination, and
- dispose of the PPE as radioactive waste if it is still contaminated above DOE guidelines for release after several attempts have been made to clean it.

Any waste generated during the decontamination process will be collected and disposed of at the direction of the SSHO using guidance established by the ESH&WM Department. Disposable PPE that is radioactively contaminated will be disposed of as radioactively contaminated waste. Nondisposable PPE such as respirators and boots will be left at the access control point; they will be scanned and decontaminated if necessary. The SSHO will assess PPE used during chemical decontamination processes to determine whether it must be

disposed of as contaminated waste. Disposable PPE that is neither radioactively nor chemically contaminated will be disposed of as industrial waste.

6.2.2 Personnel Decontamination and Personal Hygiene

Site personnel could experience skin or eye irritation from contact with chemicals onsite. An eyewash station capable of delivering 15 minutes of flow and inspected in accordance with ANSI standards, as well as a facility for decontaminating skin, will be available at each location where corrosive or toxic chemicals have been identified.

Toilet and hand-washing facilities with potable water will also be available onsite for sanitary and hygienic purposes. Workers leaving RWAs must wash their hands before eating, drinking, smoking, or chewing gum (activities permitted only in designated areas).

Protocols for Surveying Personnel

Each person leaving an RWA will be frisked in accordance with PI 24.025, "Personnel Radiological Contamination Surveys." A health physics technician will conduct the survey or at least will observe as employees frisk themselves. If the technician is in an RWA or has handled contaminated material, he or she should survey both hands by holding them in front of the probe before picking it up and frisking someone. Frisking is conducted by

- verifying that the beta/gamma probe or alpha probe is turned on and set on the lowest possible scale;

- picking up the probe, placing it about 1.3 cm (0.5 in.) from the surface being surveyed, and moving it slowly [approximately 1.3 cm/s (0.5 in./s)] across the surface;

- initiating decontamination procedures if levels equal or exceed 100 cpm above background (see Table 6-1 for the maximum release guidelines to be used for personnel); and

- carefully returning the probe to its holder [with the active window (Mylar™) facing up], replacing the protective cover, and turning the meter off.

The person is frisked in the following sequence:

- Hands: survey each hand for approximately 5 seconds.
- Head: pause 5 seconds at the nose and again at the mouth.
- Neck and shoulders: pause 5 seconds at the throat.
- Stomach: pause 5 seconds.
- Back, hips, and arms: carefully check visibly dirty or moist areas.
- Legs and shoe-tips: pause at the knees.
- Shoe bottoms: pause 5 seconds at each foot.

Frisking typically can be completed in 3 minutes; however, survey technicians may prolong the process if necessary to ensure that personnel are not contaminated and that PPE is properly scanned. Feet and hands should be checked frequently so that contamination is not spread to nonrestricted areas. (Table 6-2 lists surface radioactivity guidelines for skin, personal clothing, and shoes of personnel.)

Instructions for Decontaminating Personnel

Requirements for personal decontamination are contained in PI 24.065, "Decontamination of Personnel, Vehicles and Equipment." Unless an emergency condition exists, personnel who are radioactively or chemically contaminated above the guidelines listed

in Table 6-2 should submit to the decontamination procedures described below until they are decontaminated to background or ALARA levels. After each step of the procedure, the technician should check the contaminated areas with appropriate instrumentation. The area where the decontamination procedures are conducted must also be checked with an appropriate survey instrument. The survey technician should perform the following steps for decontaminating personnel who are radioactively contaminated:

- Remove visible dirt or grease.
- Remove all contaminated clothing and equipment.
- Thoroughly wash the contaminated area with a mixture of liquid laundry detergent and water (use a soft-bristle brush on hands and feet if necessary).
- Wrap a plastic bag, lightly sealed with tape, around the contaminated area until the skin perspires; then remove the bag and rewash the area.
- Notify the SSHO immediately if irritation develops.

Body-wash supplies will be available near the decontamination pad. Any water used in the decontamination process must be contained until its radionuclide content is analyzed. Personnel who assist in the decontamination process must wear Tyvek™ coveralls and gloves. The SSHO will immediately be notified of any incident involving personal contamination. The SSHO is responsible for advising the emergency response coordinator (ERC) at the BNI Oak Ridge office so that a determination can be made about whether a DOE occurrence report is required.

If a worker becomes chemically contaminated, the survey technician should follow the decontamination guidelines found in the MSDSs. If the worker demonstrates symptoms of allergic reaction, the site superintendent, SSHO, or designee will notify the emergency room at a designated hospital near the site and will instruct a health physics or technician to be

present during transport of the worker from the site to the designated hospital. Emergency medical service personnel should be apprised of the contents of the MSDSs.

More detailed instructions for chemical and radiological decontamination are contained in PI 24.065, a copy of which will be maintained onsite. A contamination/exposure report (see Figure 6-3) will be completed after any exposure incident and forwarded to the BNI Oak Ridge office.

6.2.3 Equipment Decontamination

Requirements for equipment decontamination are specified in PI 24.065. A gross decontamination should be performed first to remove dry contaminated material, which will minimize the amount of liquid waste generated. Sampling tools and miscellaneous hardware used onsite will be decontaminated, surveyed, and released (if appropriate) at the decontamination pad. The release guidelines to be followed for unrestricted use of materials are provided in Table 2-2. If items are contaminated with hazardous chemicals, the items will be decontaminated in accordance with MSDSs for those chemicals and then released in accordance with the guidelines in Table 2-2.

6.3 COLLECTION OF GENERATED WASTE

Waste streams that could be generated include

- solid waste,
- organic liquids,
- aqueous liquids,
- asbestos-containing waste,

- mixed waste, and
- radioactive waste.

Wastes generated during onsite work will be packaged and disposed of in accordance with the waste management program plan (BNI 1993b) and at the direction of the ESH&WM Department. ESH&WM personnel will provide the following guidance to field personnel:

- regulatory reporting requirements of appropriate government agencies;
- waste management policies, including packaging and storage requirements;
- waste minimization procedures; and
- transportation and disposal requirements.

Solid and radioactive waste generated during remediation may be collected in low-specific-activity (LSA) boxes, in bags, in drums, and/or in bulk; composite samples will be gathered from each box and analyzed by gamma spectroscopy. Organic waste will be collected in drums and analyzed for hydrocarbons and radioactive constituents.

Water used in decontamination processes and liquids pooled in floor drains will be collected and sampled for radionuclides and chemical constituents. Uncontaminated aqueous liquids will be disposed of as industrial waste; contaminated aqueous liquids will be disposed of on the basis of sampling results.

Asbestos-containing waste will be collected, double-bagged, labeled as asbestos-containing material, placed in LSA boxes labeled "asbestos/radioactive material," and shipped to an approved site without further sampling.

Other chemical waste identified will be packaged and disposed of in accordance with the FUSRAP waste management program plan (BNI 1993b).

FIGURES FOR SECTION 6.0

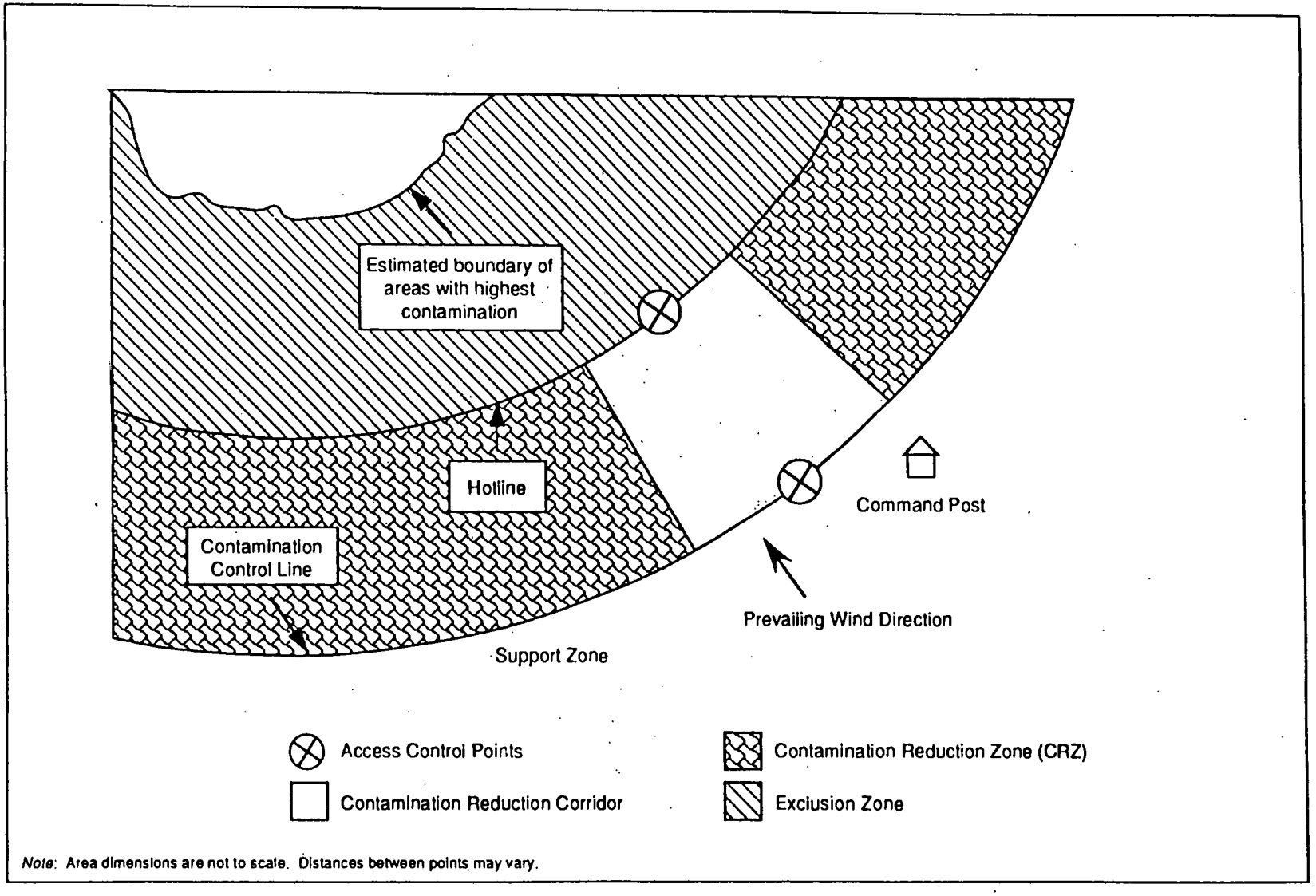

Figure 6-1
Typical Restricted Work Area

FUSRAP PI: 24.061
Attachment: 1
Rev: 4
Page: 1 Of 2

HAZARDOUS WORK PERMIT (HWP)

No ____ - ____ (WBS Number - HWP Number)

Technical Work Document Number: Work Description:	Work Location Est. Start Date/Time Requested By Request Date

Hazardous Conditions

Is a Radiological/ALARA Review Required? No ☐ Yes ☐ (See Rad Con 312)

Chemicals/Substances Present	Radiation Levels	Other (Specify)
	Surface Alpha:	
	Surface Beta-Gamma:	
	% DAC:	

Site Surveys

Type	Number	Date	By

Required Personnel Protective Clothing And Equipment

Head/Eyes		Feet/Legs		Body	
Hard Hat	☐	Sturdy Work Shoes	☐	Cotton Coveralls	☐
Safety Glasses	☐	Disposable Shoe Covers	☐	Tyvek Coveralls (Regular)	☐
Monogoggles	☐	Other (Specify):	☐	Tyvek Coveralls (Coated)	☐
Face Shield	☐			Other (Specify):	☐
Other (Specify):	☐				
Respiratory		**Hands**		**Miscellaneous**	
Full-face (Negative Pressure)*	☐	Cotton Gloves	☐	Tape Gloves & Boots To Coveralls	☐
Powered Air Purifying*	☐	Latex Gloves	☐	Safety Belt With Lanyard	☐
*Specify Cartridge Or Canister Type Below		Rubber Gloves	☐	Hearing Protection	☐
Other (Specify):	☐	Other (Specify):	☐	Other (Specify):	☐

Special Instructions/Requirements And Limiting Radiological Conditions

- ☐ Firewatch
- ☐ Portable Fire Extinguisher
- ☐ Tagging and Lockout
- ☐ Confined Space Entry Permit
- ☐ Pre-Entry Monitoring
- ☐ Emergency Response Equipment
- ☐ Hand-Held Radio Communication
- ☐ Portable Eyewash Station
- ☐ "Buddy System" in Effect
- ☐ Job Coverage by Safety and Health Personnel
- ☐ Special Training or Pre-job Briefing Required
- ☐ Excavation Permit
- ☐ Fire Retardant Clothing
- ☐ Special Personnel Frisking Considerations
- ☐ Special Dose or Contamination Reduction Considerations
- ☐ Stay Time Controls
- ☐ Other (Specify)

Dosimetry	Indiv.	Group
TLD Badge		
Extremity TLD		
Other (Specify)		

IH Monitoring	Indiv.	Group
Lapel Sampler		
Other (Specify):		

Expiration Date/Time

Approvals	Date	Termination	Date
Site RSS Supervisor		Site RSS Supv. or SSHO	
Site S&H Officer		Reason:	
Site Superintendent			

4.79-5485.1

Figure 6-2
Example of a Hazardous Work Permit

FUSRAP PI: 24.025
ATTACHMENT: 2
REV: 0
PAGE: 1 of 2

CONTAMINATION/EXPOSURE REPORT

_____ LOSS OF PERSONAL DOSIMETRY _____ PERSONNEL CONTAMINATION

Name _____ Company _____

SS No. _____ Date_____ Time _____

Address _____

_____

A. LOSS OF PERSONAL DOSIMETRY

Section 1 - TLD Badge

1. Date Issued _____ Date Lost _____
2. Dosimeter reading covering last TLD Badge period _____ mrem
3. Reading entered on Individual's Exposure Record: Yes _____ No _____
4. Individual restricted from controlled area: Yes _____ No _____

Section 2 - Self-Reading Dosimeter

1. Dosimeter Lost _____ Dosimeter Off Scale _____ Date _____
2. TLD Badge Evaluated _____ mrem
3. TLD Badge Reissued: Yes _____ No _____
4. Individual restricted from controlled areas: Yes _____ No _____

B. PERSONNEL CONTAMINATION

Instrument used: Model No. _____ Serial No. _____

1. _____

Contaminated Body Areas Survey Results Highest DPM

_____

_____

_____

_____

_____

PI_0054

Figure 6-3
Example of a Contamination Exposure Report

2. Sample for Urin Bio Collected: Yes _____ No _____

3. Individual sent for Whole Body Count: Yes _____ No _____

C. INVESTIGATION REPORT: (Include Hazard Work Permit No.)

_____

_____

Form

Completed By:

_____

_____

D. RESULTS OF INVESTIGATION (Completed by S&H supervisor)

_____

_____

_____

Approved by S&H supervisor:

_____

Original: Individual's Exposure History file
cc: Oak Ridge FUSRAP Project Office

Figure 6-3
(continued)

TABLES FOR SECTION 6.0

Table 6-1

Administrative Action Limits

Type of Exposure	Radionuclide	Administrative Action Limit
Airborne radioactivity	Uranium-238	3.0×10^{-11} μCi/ml
	Uranium-235	3.0×10^{-11} μCi/ml
	Thorium-230	3.0×10^{-13} μCi/ml
	Thorium-232	1.0×10^{-13} μCi/ml
	Radium-226	3.0×10^{-11} μCi/ml
	All other radionuclides	10% of the concentration given in Attachment 1 of DOE Order 5411.80.
External radiation dose rate	All	5 rem in 1 h at a distance 30 cm from the nearest radiation source
All exposure modes	All	10% of the dose limit specified in Table 2.1 of the DOE *Radiological Control Manual*

Table 6-2

Surface Radioactivity Guidelines for Skin, Personal Clothing, and Shoes of Site Personnel[a]

Radionuclide[b]	Total Radioactive Contamination[c] (Fixed Plus Removable) (dpm/100cm^2)[d]
Natural uranium, uranium-235, uranium-238, associated decay products	1,000
Transuranics, radium-226, radium-228, thorium-230, thorium-228, protactinium-231, actinium-227, iodine-125, iodine-129	300
Natural thorium, thorium-232, strontium-90, radium-223, radium-224, uranium-232, iodine-126, iodine-131, iodine-133	1,000
Beta/gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except strontium-90 and others noted above	5,000

Source: DOE 1991.

[a]Guidelines apply to the maximum direct-reading contamination levels. The specific guidelines to be used at each site will be determined after samples have been analyzed for isotopic distribution.

[b]Limits should be applied to alpha-emitting and beta/gamma-emitting nuclides independently if surface contamination by both exists.

[c]Does not include released items.

[d]As used in this table, dpm means the rate of emission by radioactive material as determined by correcting the cpm observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

7.0 TRAINING REQUIREMENTS

7.1 GENERAL

Training requirements and records retention will follow the criteria established in 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response"; 29 CFR 1910.1200, "Hazard Communication"; *FUSRAP Radiological Control Manual* (BNI 1993a); and PIs 24.041, "Hazard Communications"; 24.042, "Site Worker Orientation"; 24.043, "Respiratory Protection Training"; and 24.044, "Protective Apparel and Equipment Training." The matrix provided in Table 7-1 will be used as standard training criteria for workers entering and performing work onsite. Site-specific training information is contained in Appendix F.

7.2 SITE EMERGENCY RESPONSE TEAM AND DRILLS

The site superintendent will establish an ERT at the beginning of the work activity, and the SSHO will conduct emergency response training for the team, including

- the effects of hazardous substances onsite,
- how to handle occupational injuries,
- what to do if personal contamination occurs,
- how to respond to spills, and
- what to do in case of storms.

The site superintendent and SSHO will conduct site emergency response drills at least annually. All emergency response sessions and simulated drills will be documented, and copies of the documentation will be filed at the site and in the BNI Project Document Control Center.

7.3 SITE ORIENTATION AND SITE-SPECIFIC TRAINING

Site training will include site history, explanation of site controls that are in place, identification of known site hazardous materials, emergency response procedures, hazard communication program elements, congregation points in case of emergency, types of PPE required for entry to the site, and any other information needed by personnel entering the site. Job briefings and HWPs will cover additional PPE or other requirements for the specific task.

7.4 VISITOR TRAINING

In accordance with PI 24.042, "Site Worker Orientation," site visitors (such as subcontractors who do nonintrusive maintenance, elected or appointed officials, media representatives, members of the general public, and senior management) will receive a briefing on the site-specific safety and health program. The topics covered, at a minimum, will include

- a description of the hazards onsite,
- locations of controlled areas, and
- emergency response procedures for visitors.

The SSHO or designee and possibly another BNI representative will escort site visitors at all times when the visitors are in an RWA.

7.5 WEEKLY TRAINING

The SSHO will hold a safety meeting for 15 minutes or longer at least once a week. Items discussed will include

- changes in site conditions,
- upcoming work and the contents of HWPs controlling the work,
- a review of selected topics contained in the initial site-specific orientation, and
- workers' safety concerns.

TABLE FOR SECTION 7.0

Table 7-1

Site Training Requirements

REQUIRED TRAINING	TRAINING FREQUENCY	REGULATION
40-hour HAZWOPER (hazardous waste operator)	One-time requirement	CFR 1910.120
8-hour supervisor	One-time requirement	CFR 1910.120
8-hour refresher	Annually	CFR 1910.120
Site-specific	Before work begins	CFR 1910.120 and *FUSRAP Radiological Control Manual*
Radiation worker	Biannually	
3-day on-the-job	At the beginning of the job	CFR 1910.120
Hazard communications	Initially, annually, and when a new hazardous material is brought onsite	Biannually
Hearing conservation	Annually and when PPE requirements change	CFR 1910.1200
Fire extinguisher	Annually	CFR 1910.95
Respirator	Annually	CFR 1910.157
Self-contained breathing apparatus	Semiannually	CFR 1910.134
Powered industrial lift trucks	Annually	CFR 1910.134
OSHA standards at 1910.1001 and above	Annually	CFR 1910.178 CFR 1910.1001 and above

Table 7-1

Site Training Requirements

REQUIRED TRAINING	TRAINING FREQUENCY	REGULATION
40-hour HAZWOPER (hazardous waste operator)	One-time requirement	CFR 1910.120
8-hour supervisor	One-time requirement	CFR 1910.120
8-hour refresher	Annually	CFR 1910.120
Site-specific	Before work begins	CFR 1910.120 and *FUSRAP Radiological Control Manual*
Radiation worker	Biannually	
3-day on-the-job	At the beginning of the job	CFR 1910.120
Hazard communications	Initially, annually, and when a new hazardous material is brought onsite	Biannually
Hearing conservation	Annually and when PPE requirements change	CFR 1910.1200
Fire extinguisher	Annually	CFR 1910.95
Respirator	Annually	CFR 1910.157
Self-contained breathing apparatus	Semiannually	CFR 1910.134
Powered industrial lift trucks	Annually	CFR 1910.134
OSHA standards at 1910.1001 and above	Annually	CFR 1910.178 CFR 1910.1001 and above

8.0 EMERGENCY RESPONSE AND NOTIFICATION

8.1 GENERAL

Emergency response and notification procedures will comply with guidelines established for FUSRAP, which are listed in detail in FUSRAP PP 1.4, "FUSRAP Occurrence Reporting Handbook," and in PIs 24.064, "Emergency Response and Notification Planning," and 23.103, "Project Instruction for Field Exchange Log Management." Site-specific emergency response guidance is contained in Appendix G.

Where applicable, the site superintendent will coordinate all emergency response activities with the property owner. If the property owner has an emergency response plan, details of the plan will be included in Appendix G.

8.2 RESPONSIBILITIES

The site superintendent or designee must supervise emergency response activities by FUSRAP personnel and will have decision-making authority. Other responsibilities of the site superintendent include

- specifying a designee;
- contacting local emergency assistance personnel;
- acting as a FUSRAP contact for offsite responders;
- obtaining equipment and supplies as needed;
- resolving safety and health problems, with assistance from the SSHO or RSS;
- requesting assistance from the BNI office in Oak Ridge when necessary;
- immediately determining the character, source, amount, and extent of any release of radioactive or hazardous substances;

- assessing the possible hazards to people and the environment; and
- enacting procedures to limit damage.

The SSHO must be trained in emergency response procedures and must ensure that all personnel are prepared to respond appropriately if an accident occurs. The SSHO is also responsible for maintaining contact with offsite responders and providing them with information about site hazards. Emergency response duties of the SSHO include:

- preparing for and overseeing any emergency evacuation of the site;
- ensuring that all emergency response equipment and materials (see Appendix G) are maintained onsite;
- working with the RSS to assign qualified personnel to an ERT, which will respond to any onsite emergencies (the S&H supervisor will provide technical direction to the ERT as needed);
- ensuring that all personnel are familiar with procedures for communicating with local emergency services and project administrators;
- maintaining a logbook of all onsite emergency incidents and transmitting appropriate documentation of each to the BNI office in Oak Ridge;
- investigating all onsite emergency incidents and aiding in subsequent investigations by BNI S&H staff;

- informing all local emergency assistance personnel of major activities scheduled for the site and sending them copies of this SHSP, site emergency response procedures, and decontamination procedures; and

- giving tours of the site to local emergency assistance personnel.

The RSS must be trained in emergency response procedures and in the hazards associated with onsite radioactive and hazardous materials. Emergency response duties of the RSS include:

- assessing any potential hazard to employees or to offsite responders, and
- providing information about site-specific hazards to offsite responders.

8.3 OCCUPATIONAL INJURIES

In accordance with 29 CFR 1926.50, "Medical Services and First Aid," at least one person onsite must have either a valid certificate in first-aid training from the American Red Cross or documented evidence of equivalent training. First-aid kits and an accompanying first-aid log will be maintained at the BNI onsite office. Personnel with Red Cross certification may use the kits to administer first aid. The SSHO will write an entry in the site first-aid log whenever an injured employee is treated onsite.

When responding to emergencies at the site, the ERC will contact appropriate authorities (e.g., fire department, doctor, paramedics, police). Information about local emergency assistance services is listed on page iii of this SHSP.

Adherence to entrance and exit procedures is not required for emergency response personnel; medical needs take precedence over contamination-control requirements. Any spread of contamination will be surveyed for and contained after the incident.

Severely injured personnel will be transported to the hospital by ambulance (see page iii for the authorized hospital and ambulance service for the site). Site personnel will transport such persons to the hospital only if an ambulance service is not available to do so. A map showing the most direct route to the hospital is provided in Appendix G.

All injuries must be reported to the SSHO and each injured employee's supervisor. The SSHO will be responsible for recording all injuries in the first-aid log maintained at the site. Whenever offsite assistance is requested, the site superintendent or designee will notify FUSRAP management in Oak Ridge. In case of an injury, the following steps should be taken:

- The first responsibility of anyone who witnesses a personnel injury is to call for help.

- If the injury can be treated onsite, an individual who has training in cardiopulmonary resuscitation (CPR)/first aid should provide assistance.

- If the injury requires offsite help, the site superintendent or designee will call for an ambulance and notify responders of the victim's potential contamination.

- Employees should be sent to meet the ambulance and direct responders to the victim's location.

- If transport to the hospital is expected, the site superintendent or designee will call the hospital and inform them of the victim's injuries and potential contamination; if chemical contamination is present, the MSDSs for the chemicals should accompany the victim to the hospital.

- If the person trained in CPR/first aid determines that the victim is ambulatory, the victim may be removed from a contaminated area; adherence to exit survey procedures is not required.

- If the victim is not ambulatory and time permits, a clean path to the victim should be created for offsite responders by surveying the area or by placing clean materials for them to walk on; adherence to entrance and exit procedures is not required for emergency response personnel.

- If time permits, a survey of the victim should be made to ascertain contamination levels. Contaminated clothing not associated with any wounds or injuries should be removed as directed by the individual trained in CPR/first aid.

- The SSHO will inform responders of contamination types, contamination levels, and any other hazards present; in no case will rescuers be denied access.

- When an employee is transported to the hospital and there is a potential for radioactive contamination, a health physics technician will accompany the employee with appropriate survey instrumentation. The technician will provide assistance to the responders and the hospital by implementing contamination control procedures and surveying the victim, the transport vehicle, and the hospital emergency room. Any contaminated materials will be held by the hospital until arrangements for its disposal can be made.

8.4 FIRE

Supervisors must maintain constant awareness of potential fire hazards. During general training, all personnel will be trained to use portable fire extinguishers to quench any small, incipient fires. The locations of fire fighting equipment will be indicated in the Emergency Equipment and Maintenance Plan (map) posted in the site office. If personnel cannot extinguish a fire, however, they must evacuate the area immediately and notify the fire department (see page iii). Appendix G specifies the site-specific fire alarm signals to be used.

The senior onsite BNI representative or designee will act as liaison with fire department personnel when they arrive and will provide them with all pertinent information, including potential hazards, names of missing personnel and their last known locations, and the location and description of the fire. The senior onsite BNI representative or designee will also provide personnel assistance and resources within his command.

The first responsibility of anyone who discovers a fire is to call for help and activate the fire alarm.

If the fire is still small enough to control with a portable fire extinguisher,

- locate the nearest exit for a potential escape;
- get the nearest portable fire extinguisher;
- determine that the type of extinguisher is appropriate for the type of fire;
- using a sweeping motion, empty the extinguisher toward the base of the fire; and
- notify site management.

Evacuate the area if the fire continues to grow and cannot be put out with one portable extinguisher.

Site-specific guidance for fire safety and emergency response is provided in Appendix G.

8.5 SPILLS OF HAZARDOUS SUBSTANCES

Radionuclides and chemicals could be spilled during site tasks as a result of

- transportation accidents;
- improper packaging practices;
- failure of packaging; and
- handling accidents during storage, use, or waste disposal.

A hazardous materials inventory listing will be posted at the site office.

Appendix G provides a list of spill equipment that will be maintained onsite. The storage location(s) for emergency spill equipment will be indicated on the Emergency Equipment and Maintenance Plan posted in the site office.

In the event of a spill, the responsibilities and required actions are as follows:

- Whoever first witnesses a spill must immediately notify the site superintendent, who will proceed to the spill location with the SSHO and RSS.

- The site superintendent is responsible for notifying the ERC at the BNI Oak Ridge office (see page v for telephone number).

- If there is any indication that a member of the public may be exposed to radioactive or chemical contaminants as a result of the spill, the site superintendent or designee will notify local emergency response authorities. If the spill is not onsite, the nearest fire department will be called.

- The site superintendent or designee will determine the extent of the spill and methods to be used to contain and clean up the spill.

- The site superintendent or designee will direct all nonessential workers to evacuate the immediate area to reduce the likelihood that contamination will be spread or that workers will be exposed to contamination.

- The RSS will assign personnel to monitor for exposure to radioactive, chemical, or biological contamination.

- The SSHO will determine the appropriate PPE required and the extent of the spill area to be restricted.

- The SSHO and RSS will provide technical guidance to the site superintendent as needed.

- The site superintendent or designee will direct containment and cleanup activities and will remain at the area until it has been cleaned, surveyed, and approved for release.

- ıe site superintendent will issue the approval for release and will document and report the incident in accordance with PP 1.4 and Section 8.7 of this SHSP.

8.6 PERSONNEL EVACUATION AND ACCOUNTABILITY

Site-specific evacuation procedures are contained in Appendix G.

8.6.1 Need for Evacuation

Any condition that may require evacuation of the work area will be reported immediately to the SSHO, site superintendent, or their designee(s), who will initiate all emergency evacuations. Personnel will follow the same evacuation procedures as for a fire alarm. The evacuation order will remain in effect until normal working conditions are restored and permission to return to work is granted by the SSHO.

Site-specific evacuation signals, escape routes, and assembly points are described in Appendix G. If time permits, when the evacuation signal is issued, all equipment in use will be shut down. All personnel will remain calm and follow prescribed routes to the predetermined assembly point; they will remain at the assembly point until all personnel are accounted for.

Maps depicting emergency exits, evacuation routes from different areas of the site, and locations of fire extinguishers will be posted in a conspicuous location in the administrative office. These maps will be brought to the attention of all personnel. Personnel who cannot reach the assembly point must report their individual locations to the site superintendent or SSHO as soon as possible.

If there is an airborne hazard when the site is being evacuated, evacuation routes will ›e upwind of any hazard. A windsock will be maintained onsite at all times to indicate wind rection.

8.6.2 Personnel Accountability

The site superintendent or designee will verify that all supervisors are present at the assembly point. Supervisors will determine whether any of their personnel are missing. If any are missing, the site superintendent or SSHO will immediately notify emergency rescue personnel. Access logs will be used to determine whether any visitors are onsite and whether any are missing.

8.6.3 Evacuation from an Outdoor Location

Specific evacuation routes from the site will be established before work begins and will be clearly marked on the site map posted inside the BNI onsite office; evacuation routes will be communicated to all employees. All personnel will meet at the assembly point unless otherwise directed by the SSHO or site superintendent. The SSHO will determine when workers may safely reenter the evacuated area and will inform the site superintendent.

8.6.4 Evacuation from a Building

Before work begins in a building, escape routes from the building will be established, indicated on site maps, and communicated to affected personnel. If a building must be evacuated, affected personnel will gather at a predetermined assembly point (see Appendix G). The SSHO will determine when workers may safely reenter evacuated buildings and will inform the site superintendent.

8.7 NOTIFICATION

Any employee who discovers a situation that is not within normal operations should immediately notify his or her supervisor. The supervisor should, in turn, notify the site

superintendent or designee, who then will notify the project manager at the BNI Oak Ridge office. If the project manager cannot be contacted, the site superintendent will attempt to contact the deputy program managers, other project managers, the ERC, the occurrence reporting coordinator, or the program manager. If none of these people can be contacted, the site superintendent will contact the Director of the DOE Former Sites Restoration Division. Telephone numbers (including home and beeper numbers) for the project managers, senior FUSRAP staff, and DOE personnel will be updated quarterly by the S&H group and posted at the site.

The project manager or designee will determine whether an incident is an occurrence that should be reported to DOE, EPA, and/or OSHA.

The specific types of reportable occurrences are detailed in PP 1.4 as required by DOE 5000.3B. These types of events or conditions are to be consistently reported. The seriousness of the event or condition is reflected in the selection of the occurrence category. The three occurrence categories are emergency, unusual, and off-normal.

Occurrences are arranged into nine groups: facility condition, environmental, personnel safety, personnel radiation protection, safeguards and security, transportation, value basis reporting, facility status, and cross-category items. Within each grouping is a list of events and/or conditions derived from previous DOE orders and actual operation occurrences. The list is not intended to be all-inclusive; it presents a minimum set of standards necessary to allow personnel at each site and facility to identify the reportable types of occurrences applicable to their operations.

Occurrences that require notification include, but are not limited to,

- any request for assistance issued to an offsite emergency service;

- any onsite injury or illness that causes a DOE contractor or subcontractor employee to lose one or more days of work;
- discovery of measurable contamination on the skin or personal clothing of an employee;
- any internal intake of radioactive material by an onsite employee or member of the local community;
- any accidental release of radioactive or hazardous materials offsite;
- any spill of a hazardous material onsite that may exceed a reportable quantity;
- apparent loss or theft of radioactive or nonradioactive material;
- any occurrence that garners attention by the public or press;
- any traffic accident that results in a loss of radioactive or hazardous material or violation of regulatory requirements;
- discovery of contamination on the exterior of a container during transport;
- damage to any container of radioactive material during shipping and handling that may result in leakage;
- any aviation-related occurrence involving a fatality, lost workday of the crew, personal injury to a member of the public, or damage to DOE property; and
- estimated loss or damage to DOE property amounting to more than $100.

A detailed investigation of emergencies will be conducted jointly by the site superintendent and the SSHO. As soon as the emergency condition is under control, the site superintendent or designee will notify FUSRAP project management at the Oak Ridge office.

8.8 SITE SECURITY

During onsite operations, the site will be secured in accordance with procedures that will be established and agreed to by DOE and BNI before work begins and with procedures detailed in the *FUSRAP Field Construction Manual* (BNI 1992b).

8.9 EMERGENCY ASSISTANCE SERVICES

Emergency assistance organizations nearest the site are listed on page iii of this document; DOE and BNI administrative personnel are listed on pages iv and v.

At the beginning of site activity and annually thereafter, tours will be provided to offsite emergency response organizations (hospital, police, firefighters, and ambulance service). The SSHO will use the annual tours to ascertain whether the responders are capable and willing to respond to emergencies at the site.

The SSHO will document annual contacts in a thank-you letter to each emergency assistance organization; the site superintendent, project manager, and S&H supervisor will receive copies of the letter. This letter will document that a copy of this SHSP has been forwarded to local emergency assistance personnel and state any agreements or understandings with the organizations. The letter will specifically state that the organization is able to respond to emergencies at the site and ask for a reply from the organization if any part of the letter is incorrect.

REFERENCES

Bechtel National, Inc. (BNI), 1992a. *Formerly Utilized Sites Remedial Action Program ALARA Plan*, Oak Ridge, Tenn. (March).

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Occupational Safety and Health Administration (OSHA), 1984. "Industrial Hygiene Technical Manual," OSHA Instruction CPL 2-2.20A (March).

APPENDIXES FOR THE HEALTH AND SAFETY PLAN FOR THE ST. LOUIS SITE

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(continued)

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(continued)

FIGURES

TABLES

ATTACHMENTS

ACRONYMS FOR APPENDIXES A-G

AEC	Atomic Energy Commission
ALARA	as low as reasonably achievable
BNI	Bechtel National, Inc.
CPR	cardiopulmonary resuscitation
DAC	derived air concentration
DOE	Department of Energy
EMS	emergency medical service
EPA	Environmental Protection Agency
FUSRAP	Formerly Utilized Sites Remedial Action Program
HISS	Hazelwood Interim Storage Site
HWP	hazardous work permit
LSA	low specific activity
MED	Manhattan Engineer District
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
ORNL	Oak Ridge National Laboratory
PPE	personal protective equipment
RWA	restricted work area
S&H	safety and health

ACRONYMS FOR APPENDIXES A-G

(continued)

SLAPS	St. Louis Airport Site
SLDS	St. Louis Downtown Site
SHSO	site safety and health officer

APPENDIX A

St. Louis Site Description and History

A1.0 ST. LOUIS SITE, GENERAL INFORMATION

The Department of Energy (DOE) is implementing a cleanup program for four groups of properties in the St. Louis area that are contaminated with low levels of thorium, uranium, and radium. Collectively named the St. Louis Site, the properties are the St. Louis Airport Site (SLAPS), the Latty Avenue and Hazelwood Interim Storage Site (HISS), the St. Louis Downtown Site (SLDS), and several nearby or "vicinity" properties associated with SLAPS and Latty Avenue (Figure A-1). Contamination on the St. Louis site properties resulted from uranium processing at Mallinckrodt Chemical Works (at SLDS) and subsequent movement of waste materials to SLAPS and the Latty Avenue and HISS properties.

A2.0 ST. LOUIS AIRPORT SITE

A2.1 LOCATION AND DESCRIPTION

SLAPS is located approximately 24 km (15 mi) northwest of downtown St. Louis, immediately north of Lambert-St. Louis International Airport (Figure A-2). The 21.7-acre site is bordered by the Norfolk and Western Railroad and Banshee Road on the south, Coldwater Creek on the west, and McDonnell Boulevard and adjacent recreational fields on the north and east (Figure A-3).

SLAPS is completely surrounded by security fencing and contains no permanent structures. The site includes a small storage pile [765 to 1,148 m^3 (1,000 to 1,500 yd^3)].

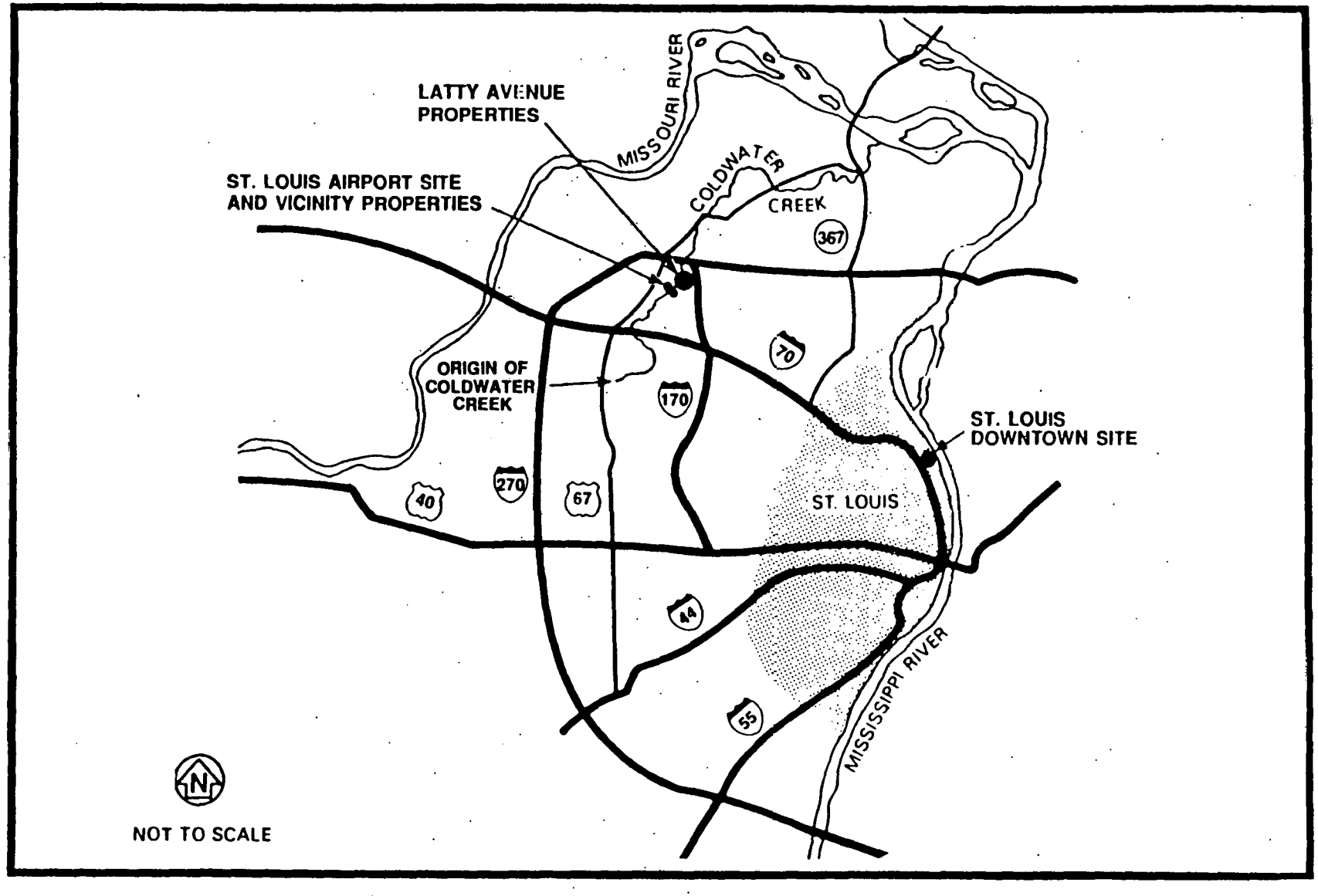

FIGURE A-1 LOCATIONS OF FUSRAP PROPERTIES IN THE ST. LOUIS, MISSOURI, AREA

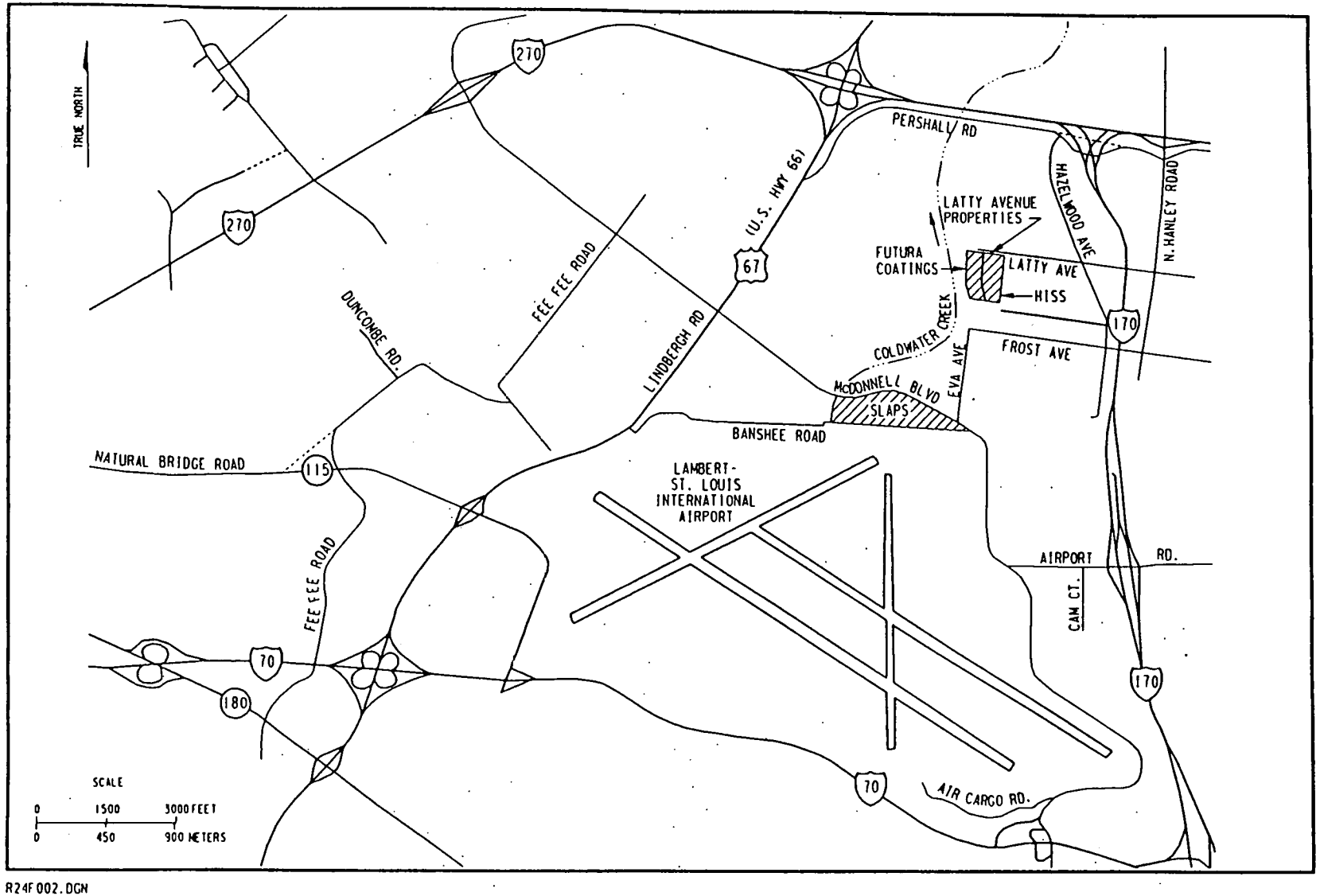

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Figure A-2
Location of SLAPS and Latty Avenue Properties

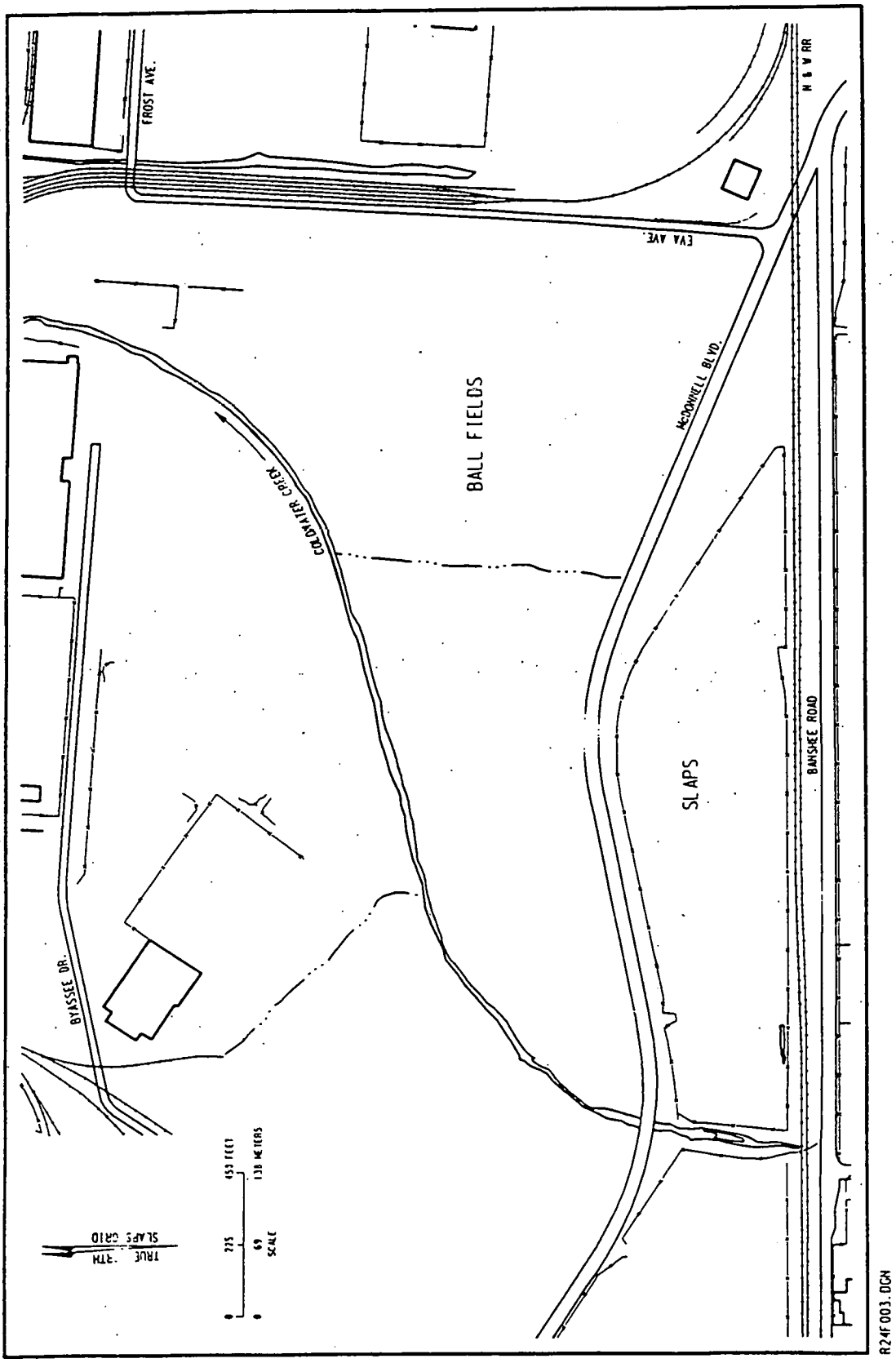

Figure A-3
St. Louis Airport Site

A water main crosses the northwest corner and runs parallel to the property on the north; a small onsite line connected to the water main provides service to the site. Electric and telephone lines may be extended to the site when these services are required. The site may also include a trailer for temporary office facilities when needed.

Site access is through a gate on the north border, from McDonnell Boulevard. Crushed stone has been used to cover surface contamination to allow access from the site gate. The balance of the site is designated as a radiologically controlled area and is barricaded with yellow and magenta rope or by the site fence.

A2.2 SITE HISTORY

SLAPS was acquired by the Manhattan Engineer District (MED) in 1946 for storage of residues from uranium ore processing conducted at SLDS. The residues included barium sulfate cake, pitchblende raffinate residues, radium-bearing residues, Colorado raffinate residues, and contaminated scrap. Most residues were stored in bulk and in 55-gal drums until 1948, when they were transferred to the Lake Ontario Storage Area in Model City, New York.

In 1950 a covered concrete storage pad was constructed for storing approximately 50,000 empty drums. In addition, approximately 3,000 tons of contaminated steel and alloy scrap were stored onsite. Until 1953 the site was operated by MED and its successor, the Atomic Energy Commission (AEC), and received shipments of slag containing up to 2% uranium. Most of these residues were later removed; the last offsite shipment was made by 1969. Empty drums were sold for reconditioning and scrap, building facilities were demolished and buried onsite, and the site was covered with 0.3 to 0.9 m (1 to 3 ft) of clean

backfill. Title was transferred from AEC to the City of St. Louis in 1973. In September 1989, SLAPS was placed on the Environmental Protection Agency's (EPA) National Priority List (NPL).

A3.0 LATTY AVENUE AND THE HAZELWOOD INTERIM STORAGE SITE

A3.1 LOCATION AND DESCRIPTION

The Latty Avenue and HISS properties cover 4.5 ha (11 acres) in Hazelwood, Missouri (Figures A-2 and A-4). The western portion of the tract includes Futura Coatings, Inc., and the eastern portion includes HISS; a chain link fence separates the two facilities. The site is bordered on the north by Latty Avenue, on the west and south by the Norfolk and Western Railroad, and on the east by property owned by the General Investment Fund Real Estate Holding Company.

The HISS property includes several office trailers, a decontamination pad, a storage building, and interim storage piles containing radiologically contaminated soils from vicinity properties. The site is entirely fenced, and the public has access only to the DOE Public Information Office. Crushed stone is used to cover contaminated soil and to facilitate access to office and laboratory trailers and other HISS locations. The balance of the site is designated as a radiologically controlled area and is barricaded with yellow and magenta rope or by the site fence. There are no areas within the Futura facility that are radiologically controlled.

A3.2 SITE HISTORY

SLAPS residues purchased by the Continental Mining and Milling Company of Chicago, Illinois, were moved to temporary storage at the Latty Avenue properties between

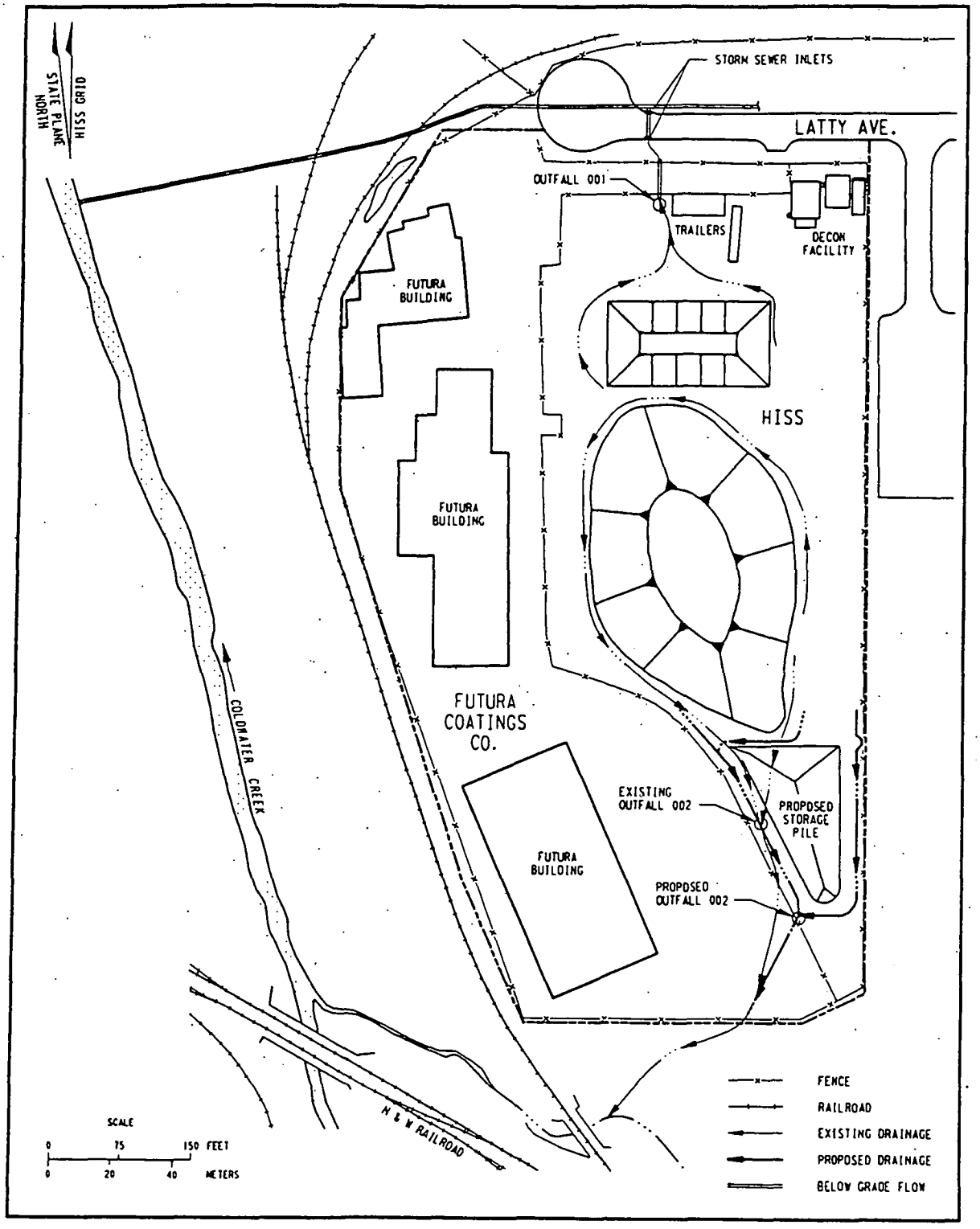

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Figure A-4
Hazelwood Interim Storage Site and Latty Avenue Properties

1966 and 1969. These residues, which included 13 tons of uranium and 32,500 tons of leached barium sulfate containing 7 tons of uranium, were placed directly on the ground. The residues were purchased and shipped offsite by 1973.

In 1976 NRC measurements of radionuclide concentrations at the Latty Avenue property indicated that uranium and thorium concentrations and resulting exposure levels exceeded DOE guidelines for release for unrestricted use (Table A-1). A radiological characterization of the site performed by the Oak Ridge National Laboratory (ORNL) in 1977 revealed that radium and thorium concentrations in excess of DOE guidelines were present in and around buildings and in soil to a depth of 46 cm (18 in.). Consequently, in preparing the western portion of the Latty Avenue property for commercial use, the owner demolished one building, excavated several areas, paved several others areas, and erected a number of new buildings. The excavation spoils [9,945 m^3 (13,000 yd^3)] were piled on the eastern half of the property, which later became HISS.

In 1981 Oak Ridge Associated Universities characterized the storage pile at HISS and performed radiological surveys of the northern and eastern boundaries of the site for the Nuclear Regulatory Commission (NRC). In 1984 and 1985, cleanup of the northern end of HISS and surrounding areas generated 10,710 m^3 (14,000 yd^3) of contaminated soil, which was added to the pile. In 1986 DOE directed Bechtel National, Inc. (BNI) to provide radiological support for improvements along Latty Avenue. During this operation, 3,519 m^3 (4,600 yd^3) of contaminated soil were removed and deposited as a second storage pile at HISS.

Table A-1

Department of Energy Release Limits

Mode of Exposure	Exposure Conditions	Guideline Value
Gamma radiation	Indoor gamma radiation level (above background)	20 μR/h
Surface contamination	Uranium-238, Uranium-natural	
	Fixed on surfaces	5,000 dpm/100 cm^2
	Removable	1,000 dpm/100 cm^2
	Thorium-232, Thorium-natural	
	Fixed on surfaces	1,000 dpm/100 cm^2
	Removable	200 dpm/100 cm^2
	Radium-226, Thorium-230	
	Fixed on surfaces	100 dpm/100 cm^2
	Removable	20 dpm/100 cm^2
Beta-gamma dose rates	Surface dose rate averaged over not more than 1 m^2	0.20 mrad/h
	Maximum dose rate in any 100-cm^2 area	1.0 mrad/h
Radionuclide concentrations in soil	Maximum concentration above background levels allowed in soil when averaged over a 100-m^2 area	5 pCi/g when averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over 15-cm thick soil layers more than 15 cm below the surface
Thorium-232 Thorium-230 Radium-228 Radium-226		
Uranium-238		Derived (site-specific)

Source: DOE Order 5400.4.

A4.0 ST. LOUIS DOWNTOWN SITE

A4.1 LOCATION AND DESCRIPTION

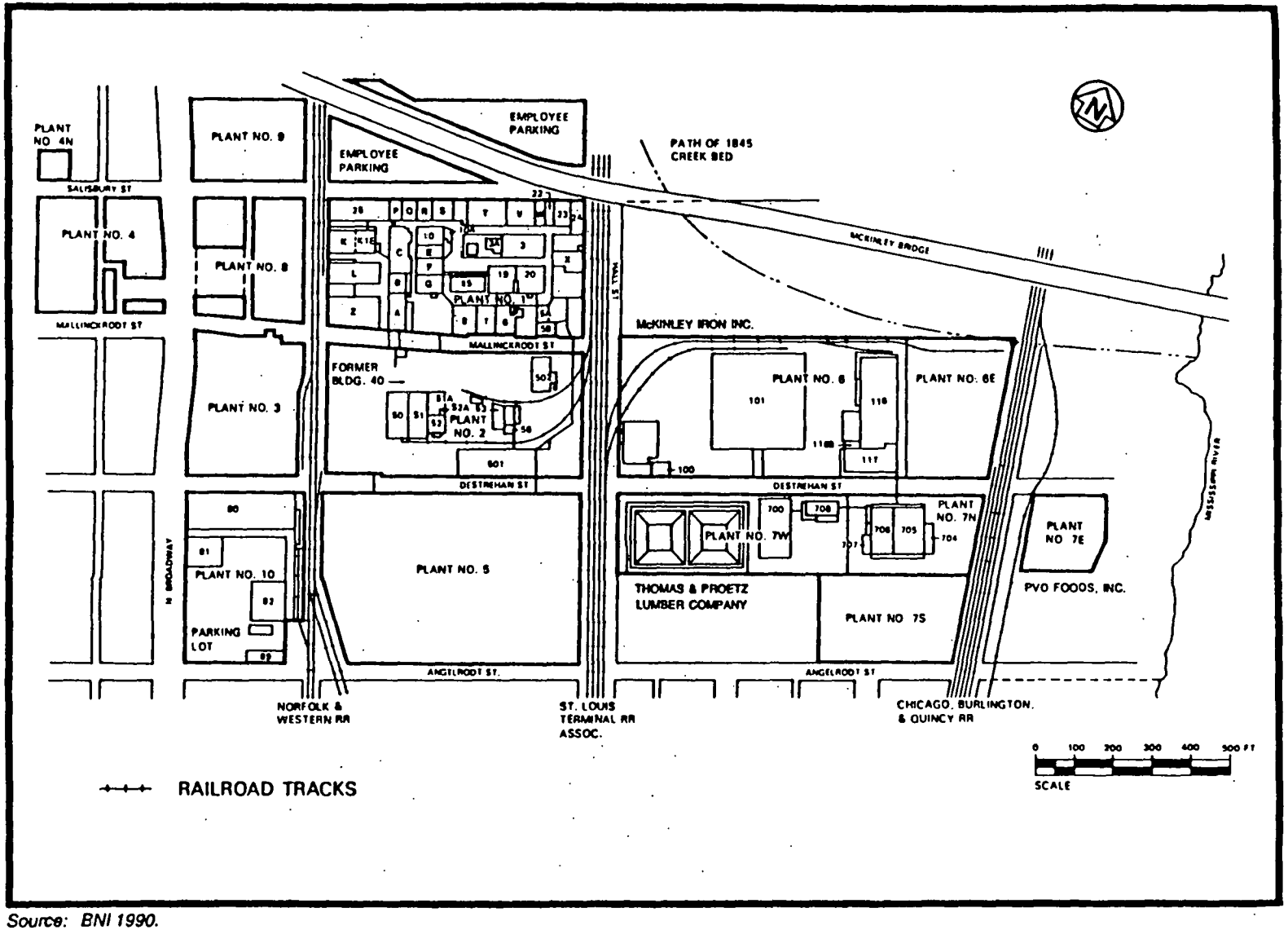
SLDS covers approximately 18.2 ha (45 acres) in an industrial area on the eastern border of St. Louis, Missouri, approximately 90 m (300 ft) west of the Mississippi River (Figure A-1). The owner of the property, Mallinckrodt, Inc. (formerly the Mallinckrodt Chemical Works) produces a variety of chemical products.

The climate of the St. Louis area is classified as modified continental. The average daily temperature ranges from 7.4 to 18.6°C (45.4 to 65.5°F). The highest monthly average is 31.6°C (89°F) in July, and the minimum average is -6.7°C (19.9°F) in January. Prevailing winds are from the south in summer and fall at average speeds of 13.9 km/h (8.7 mph) and from the west and northwest during winter at average speeds of 17.7 km/h (11 mph). Normal annual precipitation is 87.5 cm (35 in.), and annual snowfall averages 65.8 cm (26.3 in.).

A4.2 SITE HISTORY

From 1942 to 1962, uranium compounds were produced and processed and uranium was recovered at the site under contracts to MED and AEC.

From 1942 to 1945, MED/AEC activities were conducted in Plants 1, 2, and the original Plant 4, now Plant 10. (Figure A-5 shows the locations of the plants at the Mallinckrodt facility.) In 1946 the manufacture of uranium dioxide from pitchblende ore began a newly constructed Plant 6. From 1948 through 1950, Mallinckrodt decontaminated Plants 1 and 2; the plants were released in 1951 for unrestricted use pursuant to then existing AEC criteria.



Source: BNI 1990.

FIGURE A-5 ST. LOUIS DOWNTOWN SITE

Plants 6E and 7 began operating in 1950 and 1951. Plant 4 was modified and used as a metallurgical pilot plant for development of uranium metal until it was closed in 1956. In 1957 operations in Plant 6E were terminated, and the AEC guided decontamination efforts in Plants 4 and 6E, returning them to Mallinckrodt for unrestricted use in 1962. Some buildings in existence in 1962 have since been demolished, and some new buildings have been constructed.

In 77 ORNL conducted a radiological survey of portions of SLDS at the request of DOE. Results of this survey indicate that alpha and beta contamination inside and outside some buildings exceed DOE guidelines for release for unrestricted use (Table 2-2). Elevated external exposure rates were found at some outdoor locations and in some buildings. Concentrations of uranium up to 20,000 pCi/g and radium-226 up to 2,700 pCi/g were found in subsurface soil, and elevated gamma radiation levels were detected in some indoor drains. Radon and radon daughter concentrations were in excess of federal guidelines for nonoccupational exposure.

In 1978 DOE revised AEC's contamination guidelines; the new guidelines were more restrictive, and sites that had been restored under AEC guidelines were relisted as possibly contaminated. Characterization was performed at SLDS to identify and delineate areas of radiological contamination and to determine the magnitude of chemical contamination associated with those areas.

In 1981 remedial action was initiated under the DOE Formerly Utilized Sites Remedial Action Program (FUSRAP) with BNI named as the project management contractor for DOE. BNI conducted radiological, chemical, and hydrogeological characterization sampling and measurements at SLDS from December 1981 through April 1989 (BNI 1990).

A5.0 ST. LOUIS AIRPORT SITE AND LATTY AVENUE VICINITY PROPERTIES

A5.1 LOCATION AND DESCRIPTION

The SLAPS vicinity properties (Figure A-6) consist of Coldwater Creek and its vicinity properties to the west; adjacent ball fields to the north and east; Norfolk and Western Railroad properties perpendicular to Coldwater Creek to the south; Banshee Road to the south and ditches to the north and south; and the St. Louis Airport Authority to the south. The transportation routes (or haul roads) on the site—Latty Avenue, McDonnell Boulevard, Pershall Road, Hazelwood Avenue, Eva Avenue, Frost Avenue, and adjoining properties—are believed to have been used during waste transfer among the St. Louis sites. The Latty Avenue vicinity properties consist of six properties along Latty Avenue, mostly within the corporate limits of Berkeley, Missouri.

A5.2 SITE HISTORY

Radioactive contamination of SLAPS and the Latty Avenue vicinity properties may be the result of contaminated soil movement from SLAPS by surface runoff or spillage from transport vehicles. Road and underground utility improvements may have caused migration of contamination onto adjacent land, and materials from railroad cars that transported materials to and from SLAPS may have spilled onto the railroad property and then migrated onto adjacent properties.

In 1982 DOE directed BNI to perform a radiological characterization of the ditches to the north and south of SLAPS and portions of Coldwater Creek. These measurements and later soil analysis indicated exposure levels and concentrations of thorium-230 in excess of DOE guidelines. In 1984 ORNL performed a mobile gamma scanning survey of potential haul routes from SLAPS to the Latty Avenue properties that revealed exposure rates on

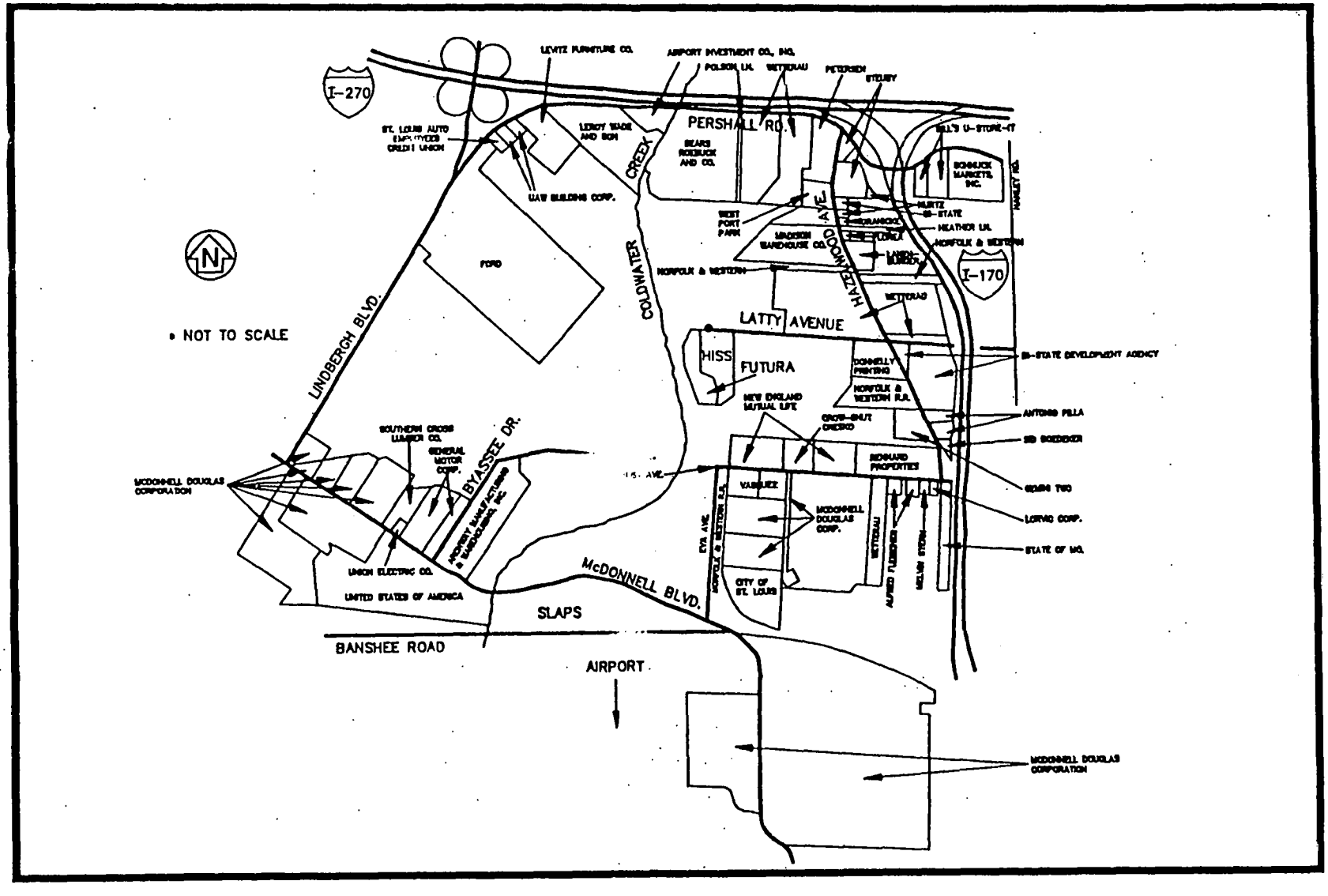


Figure A-6
Locations of the SLAPS and Latty Avenue Vicinity Properties

McDonnell Boulevard, Hazelwood Avenue, and Pershall Road in excess of background levels; subsequent soil sampling identified thorium-230 as the major contaminant. BNI conducted a radiological characterization of the SLAPS vicinity properties from 1986 to 1991 to define the extent and boundaries of contamination and evaluate disposal alternatives.

A6.0 REFERENCE

BNI, 1990. *Radiological, Chemical, and Hydrogeological Characterization Report for the St. Louis Downtown Site in St. Louis, Missouri*, DOE/OR/20722-258, Oak Ridge, Tenn. (September).

APPENDIX B

Radiological, Chemical, Physical, and Other Hazards at the St. Louis Site

B1.0 GENERAL INFORMATION

The scope of work to be performed at the St. Louis site includes remedial investigation and remedial action activities; Table B-1 lists the anticipated tasks, and Table 2-1 stipulates generic controls to be used against the hazards listed. Specific hazard mitigation measures will be provided in hazardous work permits (HWPs) prepared for tasks that involve potential exposure to radiological contamination and/or hazardous chemicals or significant safety hazards. Because general construction safety hazards may be present during all nonadministrative site activities, all workers and visitors who enter nonadministrative areas are required to wear head and eye protection, sturdy leather work shoes, and, when applicable, hearing protection.

B2.0 CHEMICAL HAZARDS

Soil sampling for chemical contaminants was performed at numerous St. Louis site locations known to be radiologically contaminated. Table B-2 lists chemicals detected in soil samples in concentrations exceeding expected background levels. Tables B-3 and B-4 list exposure symptoms and exposure pathways for the chemicals specified in Table B-2 and for other hazardous chemicals that are expected to be present onsite.

Based on the results of soil sampling, excavation spoils are not expected to require handling as mixed hazardous waste. (Additional chemical characterizations of the St. Louis site can be found in BNI 1990 and 1992.)

Hazardous chemicals may be used by site personnel during decontamination, pile cover repair, and general site maintenance operations. Table B-5 lists the types of hazardous chemicals expected to be used at the St. Louis site.

Table B-1

St. Louis Site-Specific Tasks

Activity	Related Tasks	Hazardous Conditions/Activities
Data Collection	Direct/transferable radiological contamination measurements and exposure rate measurements Collection of soil, water, air and sediment samples	Energized utilities, combustible gases, heavy (drilling) equipment, power tools, work at elevation, work on or near rivers or creeks[a], traffic, and potential exposure to surface and airborne radiological and/or hazardous chemical contamination
Decontamination	Decontamination of buildings and other structures Decontamination of personnel, vehicles, and equipment Decontamination of chemical sampling equipment	Abrasive blasting equipment, pressurized water or steam equipment, compressed air lines and pneumatic equipment, use of strong solvents and corrosives (nitric acid), work at elevation, power tools, asbestos, potential exposure to surface and airborne radiological and/or hazardous chemical contamination
Demolition	Demolition or dismantling of contaminated structures Packaging of contaminated waste	Work at elevation, power tools, heavy equipment, compressed air lines and pneumatic equipment, torch cutting, falling objects, heavy lifting, rigging/hoisting, partially dismantled roof, wall, floor, and load-supporting structures, asbestos, and potential exposure to surface and airborne radiological and/or hazardous chemical contamination

Table B-1

(continued)

Activity	Related Tasks	Hazardous Conditions/Activities
Soil remediation	Removal of soil from contaminated properties Packaging of contaminated waste	Excavations, heavy equipment, energized utilities, traffic, and potential exposure to surface and airborne radiological and/or chemical contamination
Site maintenance	Construction work and building repair, including carpentry, concrete and masonry work, plumbing, electrical work, digging, and roof work Repair and/or replacement of storage pile covers Refueling equipment Grass mowing Painting General repairs and site improvements, including pile consolidation, erecting fences, and improving roadways and sewer and stormwater runoff lines	Excavations, heavy equipment, power tools, compressed air lines and pneumatic equipment, work at elevation, falling objects, energized utilities, welding/torch cutting, fire hazards, asbestos, potential exposure to surface and airborne radiological contaminants

[a]See Section B4.0 for descriptions of hazards and controls related to work in or near streams and rivers.

Table B-2

Chemicals Detected in Soil Samples at Levels Exceeding Expected Background Levels

Chemical	Latty Avenue	SLAPS	SLDS	SLAPS Vicinity Properties	Latty Avenue Vicinity Properties
Antimony	*	*	*	*	*
Arsenic	*	*	*	*	*
Barium	*	*		*	*
Beryllium			*		
Boron	*	*		*	*
Cadmium		*	*	*	
Cobalt		*	*	*	
Cobalt (trivalent)		*	*	*	
Lead		*	*	*	
Magnesium		*		*	
Molybdenum		*		*	
Nickel		*	*	*	
Selenium	*	*	*	*	*
Silver	*				*
Thallium	*	*	*	*	*
Vanadium	*	*		*	*
Zinc	*	*		*	*
Benzene		*	*		
Toluene	*	*			
Acetone		*			

Table B-2

(continued)

Chemical	Latty Avenue	SLAPS	SLDS	SLAPS Vicinity Properties	Latty Avenue Vicinity Properties
Methyl ethyl ketone		*			
Tetrachloroethene			*		
Trichloroethene		*			
Trichlorofluoromethane		*			
1,2-Dichloroethane		*			
2-Propanol-1,3-dichlorophosphate		*			
Polynuclear aromatic hydrocarbons[a]			*		
Polychlorinated biphenyls (Aroclor-1254)			*		

* = Chemical detected in soil samples at levels exceeding background.

[a]Polynuclear aromatic hydrocarbons include the following compounds:

Fluoranthane	Benzo(a)anthracene	Benzo(a)pyrene
Benzo(a)fluoranthene	Benzo(b,h.i)perylene	Benzo(k)fluoranthene
Pyrene	Phenanthrene	Indeno(1,2,3-cd)perylene
Chrysene	Anthracene	2-Methyl naphthalene
Fluorene	Acenaphthalene	

Table B-3

Toxicological Properties of Chemicals Suspected to be at SLDS

Chemical	Routes of Entry	Acute Exposure Effects/Symptoms	Chronic Exposure Effects/Symptoms
Inorganics			
Antimony	Inhalation, ingestion, eye and skin contact	Eye: Irritation Skin: Itching and skin eruptions Respiratory tract: Irritation of nose and throat; coughing Systemic: G.I. pain	Headache, sleeplessness, weight loss, diarrhea, ulcers
Arsenic	Inhalation of dust; eye and skin contact	Eye: Irritation, conjunctivitis Skin: Brief contact has no effect. Prolonged contact results in irritation, contact dermatitis Respiratory tract: Irritation of mucosa Systemic: Gastric pain, vomiting, diarrhea, blood in vomitus and stool. Shock and possible death at high doses	Weight loss. diarrhea, pigmentation and eruption of skin, loss of hair. Chronic hepatitis and cirrhosis. Suspected human carcinogen
Beryllium	Inhalation, ingestion, eye and skin contact	Eye: Irritation Skin: Irritation Respiratory tract: Irritation of nose and throat Systemic: Abdominal pain, cough, shortness of breath, weight loss	Joint pain, weakness, weight loss, clubbing of fingers, cyomosis, allergic contact dermatitis, ulceration of skin

Table B-3

(continued)

Page 2 of 4

Chemical	Routes of Entry	Acute Exposure Effects/Symptoms	Chronic Exposure Effects/Symptoms
Cadmium	Inhalation of dust; skin or eye contact; inadvertent ingestion	Eye: Irritation Systemic: Irritation of upper respiratory tract, coughing, pain in chest, sweating, chilling, generalized weakness, shortness of breath. Kidney and central nervous system damage can occur	Suspected human carcinogen
Trivalent Chromium	Inhalation of dust; skin contact; inadvertent ingestion	No data; considered to be of low toxicity	Possible dermatitis
Cobalt	Inhalation, ingestion, eye and skin contact	Eye: irritation Respiratory tract: irritation of nose and throat Skin: allergic skin rash	Respiratory disease (coughing, shortness of breath, dyspnea, disabilities, possible death)
Lead	Inhalation of dust	Systematic: Lead poisoning–decreased physical fitness, fatigue, sleep disturbance, headaches, aching bones and muscles, constipation, abdominal pains, decreased appetite, anemia	Anemia, pallor, weaker hand grip, lead colic, nausea, vomiting, central nervous system damage, headaches, coma, delirium, kidney damage, possible death
Nickel	Normally ingested in food; inhalation of dust; eye and skin contact	Eye: Irritation Skin: Sensitization, chronic eczema Respiratory tract: Irritation	Nickel sulfide is confirmed human carcinogen of lung and nasal passages
Selenium	Inhalation of dust; inadvertent ingestion; eye and skin contact	Eye: Irritation Skin: Destruction caused by selenium dioxide and selenium oxychloride Respiratory tract: Irritation Systemic: Gastrointestinal irritation, pulmonary edema, metallic taste, pallor, irritability, indigestion	Possible liver and kidney damage

Table B-3

(continued)

Chemical	Routes of Entry	Acute Exposure Effects/Symptoms	Chronic Exposure Effects/Symptoms
Thallium	Inhalation of dust; ingestion and percutaneous absorption of dust; eye and skin contact	Systemic: Gastrointestinal symptoms, abdominal colic, loss of kidney function, peripheral neuritis, strabismus, disorientation, convulsions, joint pain	Fatigue, limb pain, metallic taste in mouth, loss of hair, peripheral neuritis, proteinuria, slowed response, central nervous system and kidney damage, death
Organics			
Methane	Inhalation	Asphyxia	No data
Halogenated Aliphatic Hydrocarbons Tetrachloroethene	Inhalation of dust and vapor; skin and eye contact	Systemic: Depression of central nervous system, decrease of alertness, headache, sleepiness, loss of consciousness	Kidney effects: Decreased urine flow, swelling (especially around eyes), anemia Liver effects: Fatigue, malaise, dark urine, liver enlargement, jaundice Carcinogens: Vinyl chloride (confirmed), chloroform (suspected), methylene chloride (suspected)
Aromatic Hydrocarbons Benzene	Inhalation of dust and vapor; skin and eye contact	Eye: Irritation Skin: Irritation Respiratory tract: Irritation Systemic: Depression of central nervous system, decreased alertness, headache, sleepiness, loss of consciousness	Benzene is suspected human carcinogen; kidney and liver damage

Table B-3

(continued)

Chemical	Routes of Entry	Acute Exposure Effects/Symptoms	Chronic Exposure Effects/Symptoms
Organics - cont'd			
Polynuclear Aromatic Hydrocarbons Fluoranthane Benzo(a)anthracene Benzo(a)pyrene Benzo(a)fluoranthene Benzo(g,h,i)perylene Benzo(k)fluoranthene Indeno(1,2,3-cd)perylene 2-Methyl naphthalene Anthracene Fluorene Acenaphthalene Chrysene Phenanthrene Pyrene	Inhalation of particulates and vapors	No data	Benzo(a)pyrene is suspected carcinogen
Polychlorinated Biphenyls Aroclor-1254	Skin and eye contact; inhalation	Eye: Irritation Skin: Chloracne Respiratory tract: Irritation of nose and throat Systemic: Liver damage	Embryotoxin; suspected carcinogen
Radionuclides Thorium-230 Thorium-232 & daughters Radium-226 Uranium-238 & daughters	Inhalation and ingestion of dust; external exposure to beta-gamma radiation	Dose dependent; changes in blood-forming, nervous, and reticuloendothelial systems	Changes in blood-forming, nervous, and reticuloendothelial systems; functional and morphological damage to lungs and bone tissue; chronic radiation disease and illness; cancer; depression of immune system

Source: Adapted from ERM-New England, Inc., 1991. *Work Plans for Remedial Investigation and Feasibility Study, Shpack Landfill Site, Norton Massachusetts*, Volume 1, Boston, Massachusetts (April 12).

Table B-4

Toxicological Properties of Chemicals Suspected to be at SLAPS and HISS

Chemical	Routes of Entry	Acute Exposure Effects/Symptoms	Chronic Exposure Effects/Symptoms
SLAPS			
<u>Inorganics</u>			
Antimony	Inhalation, ingestion, eye and skin contact	Eye: Irritation Skin: Itching and skin eruptions Respiratory tract: irritation of nose and throat, cough Systemic: G.I. pain	Headache, sleeplessness, weight loss, diarrhea, ulcers
Arsenic	Inhalation of dust; eye and skin contact	Eye: Irritation, conjunctivitis Skin: Brief contact has no effect. Prolonged contact results in irritation, contact dermatitis Respiratory tract: Irritation of mucosa Systemic: Gastric pain, vomiting, diarrhea, blood in vomitus and stool. Shock and possible death at high doses	Weight loss, diarrhea, pigmentation and eruption of skin, loss of hair. Chronic hepatitis and cirrhosis. Suspected human carcinogen
Barium	Inhalation of dust; skin or eye contact; inadvertent ingestion	Eye: Irritation Skin: Local irritation Systemic: Vomiting, diarrhea, increased pulse, muscle spasms followed by possible paralysis	Benign pneumoconiosis (nodules in lung), "baritosis," high blood pressure
Boron	Inhalation, ingestion, eye and skin contact	Eye: Irritation Skin: Irritation Respiratory tract: Nose and throat irritation	None known
Cadmium	Inhalation of dust; skin or eye contact; inadvertent ingestion	Eye: Irritation Systemic: Irritation of upper respiratory tract, coughing, pain in chest, sweating, chilling, generalized weakness, shortness of breath. Kidney and central nervous system damage can occur	Suspected human carcinogen

Table B-4

(continued)

Chemical	Routes of Entry	Acute Exposure Effects/Symptoms	Chronic Exposure Effects/Symptoms
Trivalent Chromium	Inhalation of dust; skin contact; inadvertent ingestion	No data; considered to be of low toxicity	No data
Cobalt	Inhalation, ingestion, eye and skin contact	Eye: Irritation Respiratory tract: Irritation of nose and throat Skin: Allergic skin rash	Respiratory disease (cough, shortness of breath, dyspnea, disabilities, may be fatal)
Lead	Inhalation of dust	Systemic: Lead poisoning–decreased physical fitness, fatigue, sleep disturbance, headaches, aching bones and muscles, constipation, abdominal pains, decreased appetite, anemia	Anemia, pallor, weaker hand grip, lead colic, nausea, vomiting, central nervous system damage, headaches, coma, delirium, kidney damage, possible death
Magnesium	Inhalation, eye contact	Eye: Irritation Respiratory Tract: Nose irritation Systemic: Metal fume fever (chills, headache, fever, tightness of chest, cough, weakness, nausea)	None known
Molybdenum	Inhalation, ingestion, eye and skin contact	Eye: Irritation Skin: Irritation Respiratory tract: Nose and throat irritation, difficulty in breathing Systemic: Loss of appetite, loss of coordination, anemia, colic	Gout
Nickel	Normally ingested in food; inhalation of dust; eye and skin contact	Eye: Irritation Skin: Sensitization, chronic eczema Respiratory tract: Irritation	Nickel sulfide is confirmed human carcinogen of lung and nasal passages
Selenium	Inhalation of dust; inadvertent ingestion; eye and skin contact	Eye: Irritation Skin: Destruction caused by selenium dioxide and selenium oxychloride Respiratory tract: Irritation Systemic: Gastrointestinal irritation, pulmonary edema, metallic taste, pallor, irritability, indigestion	Possible liver and kidney damage

Table B-4

(continued)

Chemical	Routes of Entry	Acute Exposure Effects/Symptoms	Chronic Exposure Effects/Symptoms
Thallium	Inhalation of dust; ingestion and percutaneous absorption of dust; eye and skin contact	Systemic: Gastrointestinal symptoms, abdominal colic, loss of kidney function, peripheral neuritis, strabismus, disorientation, convulsions, joint pain	Fatigue, limb pain, metallic taste in mouth, loss of hair, peripheral neuritis, proteinuria, slowed response, central nervous system and kidney damage, death
Vanadium	Inhalation, ingestion, eye and skin contact	Eye: Irritation Skin: Irritation Respiratory: Nose and throat irritation, wheezing, chest pain, bronchitis	More severe case of acute symptoms, chronic bronchitis, allergic skin rash
Zinc	Inhalation of dust; inadvertent ingestion; eye and skin contact	Respiratory tract: Irritation Systemic: Acute pulmonary edema	Zinc chromate ($ZnCrO_4$) is confirmed human carcinogen associated with carcinogenicity of chromium
Organics			
Halogenated Aliphatic Hydrocarbons 1,2-Dichloroethene Trichloroethene 2-propanol-1,3-dichlorophosphate Trichlorofluoro-methane	Inhalation of dust and vapor; skin and eye contact	Systemic: Depression of central nervous system, decrease of alertness, headache, sleepiness, loss of consciousness	Kidney effects: Decreased urine flow, swelling (especially around eyes), anemia Liver effects: Fatigue, malaise, dark urine, liver enlargement, jaundice Carcinogens: Vinyl chloride (confirmed), chloroform (suspected), methylene chloride (suspected)
Ketones Acetone Methyl/ethyl ketone	Inhalation; inadvertent ingestion; skin and eye contact	Eye: Irritation Skin: Dermatitis Systemic: Irritation of throat; headache; dizziness; vomiting	No data

Table B-4

(continued)

Chemical	Routes of Entry	Acute Exposure Effects/Symptoms	Chronic Exposure Effects/Symptoms
Organics - cont'd			
Aromatic Hydrocarbons Benzene Toluene	Inhalation of dust and vapor; skin and eye contact	Eye: Irritation Skin: Irritation Respiratory tract: Irritation Systemic: Depression of central nervous system, decreased alertness, headache, sleepiness, loss of consciousness	Benzene is suspected human carcinogen; kidney and liver damage
Radionuclides: Thorium-230 Thorium-232 & daughters Radium-226 Uranium-238 & daughters	Inhalation and ingestion of dust; external exposure to beta-gamma radiation	Dose dependent; changes in blood-forming, nervous, and reticuloendothelial systems	Changes in blood-forming, nervous, and reticuloendothelial systems; functional and morphological damage to lungs and bone tissue; chronic radiation disease and illness; cancer; depression of immune system
HISS			
Inorganics			
Antimony	Inhalation, ingestion, eye and skin contact	Eye: Irritation Skin: Itching and skin eruptions Respiratory tract: irritation of nose and throat, cough Systemic: G.I. pain	Headache, sleeplessness, weight loss, diarrhea, ulcers
Arsenic	Inhalation of dust; eye and skin contact	Eye: Irritation, conjunctivitis Skin: Brief contact has no effect. Prolonged contact results in irritation, contact dermatitis Respiratory tract: Irritation of mucosa Systemic: Gastric pain, vomiting, diarrhea, blood in vomitus and stool. Shock and possible death at high doses	Weight loss, diarrhea, pigmentation and eruption of skin, loss of hair. Chronic hepatitis and cirrhosis. Suspected human carcinogen

Table B-4

(continued)

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Chemical	Routes of Entry	Acute Exposure Effects/Symptoms	Chronic Exposure Effects/Symptoms
Inorganics - cont'd			
Barium	Inhalation of dust; skin or eye contact; inadvertent ingestion	Eye: Irritation Skin: Local irritation Systemic: Vomiting, diarrhea, increased pulse, muscle spasms followed by possible paralysis	Benign pneumoconiosis (nodules in lung), "baritosis," high blood pressure
Boron	Inhalation, ingestion, eye and skin contact	Eye: Irritation Skin: Irritation Respiratory tract: Nose and throat irritation	None known
Selenium	Inhalation of dust; inadvertent ingestion; eye and skin contact	Eye: Irritation Skin: Destruction caused by selenium dioxide and selenium oxychloride Respiratory tract: Irritation Systemic: Gastrointestinal irritation, pulmonary edema, metallic taste, pallor, irritability, indigestion	Possible liver and kidney damage
Silver	Inhalation and ingestion of dust; eye and skin contact	Eye: Corneal lesions Skin: Discoloration of skin at point of contact, irritation	Generalized grey pigmentation of skin
Thallium	Inhalation of dust; ingestion and percutaneous absorption of dust; eye and skin contact	Systemic: Gastrointestinal symptoms, abdominal colic, loss of kidney function, peripheral neuritis, strabismus, disorientation, convulsions, joint pain	Fatigue, limb pain, metallic taste in mouth, loss of hair, peripheral neuritis, proteinuria, slowed response, central nervous system and kidney damage, death
Vanadium	Inhalation, ingestion, eye and skin contact	Eye: Irritation Skin: Irritation Respiratory tract: Nose and throat irritation, wheezing, chest pain, bronchitis	More severe case of acute symptoms, chronic bronchitis, allergic skin rash

Table B-4

(continued)

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Chemical	Routes of Entry	Acute Exposure Effects/Symptoms	Chronic Exposure Effects/Symptoms
Inorganics - cont'd			
Zinc	Inhalation of dust; inadvertent ingestion; eye and skin contact	Respiratory tract: Irritation Systemic: Acute pulmonary edema	Zinc chromate ($ZnCrO_4$) is confirmed human carcinogen associated with carcinogenicity of chromium
Organics			
Aromatic Hydrocarbons Toluene	Inhalation of dust and vapor; skin and eye contact	Eye: Irritation Skin: Irritation Respiratory tract: Irritation Systemic: Depression of central nervous system, decreased alertness, headache, sleepiness, loss of consciousness	Benzene is suspected human carcinogen; kidney and liver damage
Radionuclides: Thorium-230 Thorium-232 and daughters Radium-226 Uranium-238 and daughters	Inhalation and ingestion of dust; external exposure to beta-gamma radiation	Dose dependent; changes in blood-forming, nervous, and reticuloendothelial systems	Changes in blood-forming, nervous, and reticuloendothelial systems; functional and morphological damage to lungs and bone tissue; chronic radiation disease and illness; cancer; depression of immune system

Source: ERM-New England, Inc., 1991. *Work Plans for Remedial Investigation and Feasibility Study, Shpack Landfill Site, Norton, Massachusetts*, Volume 1, Boston, Massachusetts (April 12).

Table B-5

Hazardous Chemicals Used at the St. Louis Site

Hazardous Material	Latty Avenue	SLAPS	SLDS	SLDS Vicinity Properties	Latty Avenue Vicinity Properties
Nitric Acid	X	X	X	X	X
Propanol	X	X	X	X	X
Herbicides	X	X			
Fuels and lubricants (gasoline, kerosene, motor oil, dextran, etc.)	X	X	X	X	X
Cleaners/degreasers (ketones, cyclic and aliphatic hydrocarbons, aromatic hydrocarbons, chlorinated hydrocarbons, caustics, bleaches, ammonia, etc.)	X	X	X		
Paints (organic solvents, potentially hazardous pigments)	X	X	X		
Adhesives (organic solvents, isocyanates, epoxy compounds)	X		X		

X = This chemical is used at the site indicated.

The Mallinckrodt Chemical Company is an operating chemical manufacturing plant that includes SLDS. Thus, FUSRAP personnel at SLDS may be exposed to a variety of inorganic and organic chemicals. The site safety and health officer (SSHO) will notify the Mallinckrodt supervisor in charge of the plant area of the locations where FUSRAP operations are to be performed and will determine what chemicals are present at that location. If special precautions are required, they must be included in the HWP covering the work in the area.

B3.0 RADIOLOGICAL HAZARDS

Radiological contaminants (principally thorium-230, radium-226, and uranium-238) at the Latty Avenue and vicinity property locations originated at SLAPS. SLAPS residues were removed and temporarily stored at the Latty Avenue site by the Continental Mining and Milling Company. This operation led to the contamination of the Latty Avenue site. Movement of contaminated material along haul routes from SLAPS to Latty Avenue may also have led to contamination of affected vicinity properties. HISS is used for interim storage of contaminated soil generated during excavation and remedial activities at Latty Avenue and some vicinity properties. Thus, the radiological exposure hazard is similar for Latty Avenue, SLAPS, and other vicinity properties.

The remedial plans for HISS, Latty Avenue, and other vicinity properties entail removal of contaminated soils. Thorium-230 has the most restrictive exposure criteria (Table 2-2) and is a major constituent of the radiological contamination at SLAPS, Latty Avenue, and the vicinity properties. Therefore, for the purpose of health and safety, thorium-230 surface contamination and airborne concentration limits (listed in Tables 2-2 and 5-2) are used for release and site control criteria (Section 6.0) and selection of appropriate controls and protective equipment (Section 5.0).

Because the types and concentrations of contaminants and the proposed remedial activities are the same for Latty Avenue, SLAPS, and the vicinity properties, the potential exposure and associated risks and the controls for mitigating these risks are also similar. Table B-1 provides a list of the anticipated work activities for these locations; Table B-6 provides information on the levels of radioactive contaminants measured. (Additional radiological characterization of the vicinity properties can be found in BNI 1992.)

SLDS differs from the other St. Louis site locations in that the major radiological contaminant is uranium-238; therefore, uranium surface contamination and airborne contamination limits (see Tables 2-2 and 5-1) are used for establishing release and site control criteria and for establishing appropriate levels of worker protection. Also, the work at SLDS may involve decontamination and demolition or dismantling of buildings and other structures, which will require more elaborate controls than at HISS, SLAPS, and the vicinity properties to ensure adequate containment of airborne radioactivity. Because SLDS is located within the Mallinckrodt Chemical Company manufacturing facilities, work at the site may involve exposure of FUSRAP personnel to process chemicals and mixed hazardous waste. Because of the low levels of radiological (and chemical) contamination at SLDS. most of the potential risks to workers will be from industrial and construction hazards. Work activities will be supervised to ensure worker safety.

Table B-1 provides descriptions of the anticipated work activities to be performed at SLDS; Table 2-1 lists potential hazards and controls for those activities. Table B-7 provides information on the levels of radioactive soil contamination found at SLDS and adjacent city-owned property. (Additional radiological characterization of SLDS is included in BNI 1990.)

Table B-6

Ranges of Radioactive Soil Contamination at Latty Avenue, SLAPS, and Vicinity Properties

Location	Radionuclide	Range (pCi/g)
SLAPS	Thorium-230 Thorium-232 Radium-226 Uranium-238	0.6 to 2,300 Background to 63 Background to 5,620 <3.0 to 1,600
Latty Avenue	Thorium-230 Thorium-232 Radium-226 Uranium-238	Background to 790[a] Background to 5 Background to 700 Background to 800
SLAPS vicinity properties	Thorium-230 Thorium-232 Radium-226 Uranium-238	1.9 to 26,000 2 to 7 1.6 to 1,100 < 23 to 390
Latty Avenue vicinity properties	Thorium-230 Thorium-232 Radium-226 Uranium-238	< 1 to 5,700 < 1 to 7 0.7 to 89 < 39 to 100

[a]Samples with high radium-226 and uranium-238 were not analyzed for thorium-230. The actual value is expected to be in excess of this value.

Table B-7

Ranges of Radioactive Soil Contamination at SLDS and Adjacent City-Owned Property

Location	Radionuclide	Range (pCi/g)	Average (pCi/g)
Plant 1	Thorium-230	0.3 to 330	17
	Thorium-232	0.5 to 14	2.2
	Radium-226	0.7 to 5,400	87
	Uranium-238	3.0 to 310	22
Plant 2	Thorium-230	0.4 to 14,000	270
	Thorium-232	0.5 to 9	2.3
	Radium-226	0.4 to 500	13
	Uranium-238	3.0 to 33,000	1,300
Plant 5	Thorium-230	0.5 to 1,000	57
	Thorium-232	0.7 to 130	7.0
	Radium-226	1.0 to 290	21
	Uranium-238	4.0 to 170	23
Plants 6 and 6E	Thorium-230	0.4 to 3,000	52
	Thorium-232	0.4 to 440	6.6
	Radium-226	0.5 to 2,800	27
	Uranium-238	1.3 to 15,000	140
Plant 7	Thorium-230	0.4 to 670	14
	Thorium-232	0.4 to 210	5.0
	Radium-226	0.4 to 490	13
	Uranium-238	2.0 to 31[illegible]	21
Plant 10	Thorium-230	0.3 to 2,100	48
	Thorium-232	0.5 to 56	3.7
	Radium-226	0.5 to 300	11
	Uranium-238	2.0 to 1,100	44
City-owned property	Thorium-230	0.5 to 590	19
	Thorium-232	0.8 to 46	2.2
	Radium-226	0.6 to 1,300	20
	Uranium-238	1.0 to 20,000	75

B4.0 OTHER HAZARDS

Sampling in Streams and Rivers

Water and sediment sample collection may be performed on the Mississippi River and on Coldwater Creek at its junction with the Missouri River. The hazards associated with this work may include

- drowning,
- cold stress (hypothermia), and
- deep mud or quicksand conditions.

All work on the Mississippi River will be performed in accordance with an HWP and will be conducted from a craft approved by the safety and health (S&H) supervisor. Whenever possible, the work will be performed from the U.S. Army Corps of Engineer launch *Blankenship*, a 65-ft vessel stationed on the Mississippi River expressly for sampling activities. U.S. Coast Guard-approved flotation devices must be worn at all times during work on the water; approved life savers must also be present. Work in the river or on the river bank below the high water line will not be performed unless task-specific authorization is given by the S&H supervisor.

Work on Coldwater Creek will not be performed if storm runoff has created treacherously deep or swift currents. The buddy system will be used during sediment sampling activities along the banks of Coldwater Creek at its junction with the Missouri River. Access to mud flats will not be made if wet and deep mud may be present. The SSHO will specify additional safety controls, such as the use of a safety line, in the HWP for this task.

If there is a likelihood that workers will become wet during cold weather, the SSHO will also require the use of a waterproof rain suit as part of the clothing requirements to prevent cold stress.

B5.0 REFERENCES

BNI, 1990. *Radiological, Chemical, and Hydrogeological Characterization Report for the St. Louis Downtown Site in St. Louis, Missouri*, DOE/OR/20722-258, Oak Ridge, Tenn. (April).

BNI, 1992. *Remedial Investigation Report for the St. Louis Site*, DOE/OR/21949-280, Oak Ridge, Tenn. (January).

APPENDIX C

Medical Surveillance and Bioassay Requirements at the St. Louis Site

C1.0 SITE-SPECIFIC MEDICAL SURVEILLANCE REQUIREMENTS

There are no site-specific elements to the required baseline and return-to-work medical examinations beyond the requirements specified in Section 3.2. There are no site-specific laboratory studies required other than those normally performed as part of the FUSRAP medical surveillance program.

C2.0 SITE-SPECIFIC BIOASSAY REQUIREMENTS

Bioassays for radioactive materials will be performed on individuals who are likely to receive an occupational dose of 100 mrem from internally deposited radionuclides. The equivalent airborne radioactive materials exposures are listed in Table C-1. The SSHO, with the concurrence of the S&H supervisor, will determine on a task-by-task basis which site personnel will be required to participate in the bioassay program. Bioassays for nonradioactive contaminants are not required at the St. Louis site.

Table C-1

Airborne Radioactive Material Exposures Requiring Bioassay Monitoring[a]

Radionuclide	Intake[b]	Derived Air Concentration[c] (hours)	Equivalent Concentration[d]
Uranium-238, uranium-235	0.016 μCi	40	4E-13 μCi/ml
Radium-226	0.0012 μCi	40	6E-12 μCi/ml
Thorium-230	0.00012 μCi	40	1.2E-12 μCi/ml
Thorium-232	0.00002 μCi	40	1.0E-14 μCi/ml

[a]The values presented are guidelines for determining whether a bioassay for radioactive material is required. The most applicable guideline should be used; for example, bioassays may not be required for individuals exposed to levels in excess of the equivalent concentration if it is unlikely that they would exceed 40 derived air concentration hours in one year. In calculating a worker's exposure, the protection factor for respiratory equipment used may be taken into account.

[b]Intake is the total amount of the reference radionuclide taken into the body which is required to produce a dose of 100 mrem.

[c]The derived air concentration (DAC) which would result in a committed effective dose equivalent of 5 rem if breathed for 1 year (2,000 DAC hours occupational exposure). Forty DAC hours represent a committed effective dose equivalent of 100 mrem.

[d]The airborne concentration of the reference radionuclide at or below which an individual will receive a committed effective dose equivalent of 100 mrem or less if breathed for 2,000 hours (one working year).

APPENDIX D

Personal Protective Equipment Requirements at the St. Louis Site

D1.0 PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS AT THE ST. LOUIS SITE

Table D-1 provides recommendations for selecting personal protective equipment (PPE) for different categories of site activities. The SSHO has the authority and responsibility to modify the PPE recommendations in Table D-1 if they do not seem appropriate for the task in question or if monitoring results or other data suggest that the recommended PPE is not adequate to maintain exposures at levels as low as reasonably achievable (ALARA).

In addition to the PPE requirements listed in Table D-1, workers performing sampling activities on the Mississippi River must wear U.S. Coast Guard-approved life jackets.

D2.0 AIR MONITORING REQUIREMENTS AT THE ST. LOUIS SITE

There are no site-specific air monitoring requirements beyond the generic air monitoring program specified in Section 5.0.

Table D-1

Personal Protective Equipment Requirements for the St. Louis Site

Activity	Eye Protection[a]	Protective Clothing	Respiratory Protection
General access to SLDS, HISS, and SLAPS	Safety glasses or goggles	Level D: Hard hat, long pants, sturdy leather work shoes	None
General access to SLAPS or restricted work area at SLDS, HISS, or vicinity property	Safety glasses or goggles	Level C: Tyvek™ coverall, disposable shoe covering or rubber boot, vinyl glove, and outer work glove	None
Wet decontamination at HISS or SLDS decontamination pads	Safety glasses or goggles and face (splash) shield	Level C: Coated Tyvek™ coverall or vinyl rain suit, rubber boots, vinyl glove, and rubber outer work glove	None
Dust-producing activities within a restricted work area (excavation, drilling, decontamination grass cutting, etc.)	None (full-face respirator required)	Level C: Tyvek™ coverall, disposable shoe covering or rubber boot, vinyl glove, and outer work glove	Full-face air-purifying respirator with Type H canister; if other airborne toxic substances are suspected, a combination canister (Type H) and added canister
Confined space entry	None (full-face respirator required)	Level B: Tyvek™ coverall or coated Tyvek™ if toxic substances are present, rubber boots or disposable shoe cover, vinyl gloves, and outer work glove	Self-contained breathing apparatus if toxic substances may be present

[a]Eye protection must meet American National Standards Institute Z87.1 Standards.

APPENDIX E

Restricted Work Area Requirements at the St. Louis Site

E1.0 ACCESS CONTROL POINTS AT HISS

A restricted work area (RWA) has been established within HISS. This area is posted with signs bearing radiation warning symbols and the words "Caution, Contamination Area" and "Soil Contamination Area." Access to the RWA is restricted by the site fence on the western and southern borders. The northern and eastern borders along the access road are delineated by a yellow and magenta rope fence.

The RWA access point has been established at the northern border and is usually the only authorized point of entry into and egress from the area. The access control point also serves as the contamination reduction zone for personnel leaving the RWA. The decontamination pad located inside the fence on the northern border of HISS is the contamination reduction zone for vehicles and equipment. When in use, the decontamination pad will be barricaded with yellow and magenta rope and posted with signs containing the words "Caution, Contamination." The decontamination pad remains an RWA until surveys verify that contamination does not exceed release criteria.

The SSHO may establish other access control points on a task-by-task basis. These will by manned by a health physics technician whenever entry or egress may take place. An additional RWA has been established around the wastewater holding tank at the northeastern corner of the site. The border of this area is delineated with yellow and magenta rope and is posted with signs bearing radiation warning symbols and the words "Caution, Contamination Area."

A controlled area has been established between the rope fence along the northern and eastern borders of the RWA and the site fence along the northern and eastern borders of HISS. The area is posted with signs bearing radiation warning symbols and the words

"Controlled Area." Access to the controlled area is allowed only through the personnel gate located next to the laboratory trailer and the vehicle gates along the site fence on the north.

E2.0 ACCESS CONTROL POINTS AT SLDS

An RWA has been established within the main storage area of Building 116 at SLDS. Access and egress are allowed only through the personnel door at the northeastern corner of the RWA. An additional access control point may be established at the vehicle door located at the southwestern corner of the area. The RWA is posted with signs bearing radiation warning symbols and the words "Caution, Contamination Area" and "Caution, Radioactive Material." The access control points also serve as the contamination reduction zones. Within the RWA, a path running north to south through the center of the storage area has been established as a fixed contamination area and is painted grey. The border between the fixed contamination area and the rest of the RWA is delineated by a rope fence and is posted with signs that read "Caution, Contamination Area." Crossing from the fixed contamination area into other sections of the RWA is permitted only at access points established by the SSHO.

The remainder of Building 116 is a controlled area. Access to the controlled area is allowed only through the personnel door and the vehicle door located at the northwestern corner of the building.

A decontamination pad has been established outside the access ramp to the northwestern entrance of Building 116. The decontamination pad is an RWA delineated with yellow and magenta rope and posted with signs bearing radiation warning symbols and the words "Caution, Contamination Area." An additional RWA has been created around the wastewater

holding tank outside the western wall of Building 116. This area is delineated with rope and posted with signs bearing radiation warning symbols and the words "Caution, Contamination Area."

E3.0 ACCESS CONTROL POINTS FOR TEMPORARY RESTRICTED WORK AREAS

Temporary RWAs may be established at HISS and SLDS. In particular, these may be created at temporary work locations in the Mallinckrodt facilities or at SLAPS or other vicinity properties. The sizes of temporary RWAs will be established by the SSHO and will be large enough to prevent the spread (or release) of contamination into clean areas. A temporary RWA will be delineated with yellow and magenta rope and posted with the signs required by the FUSRAP *Radiation Control Manual* for the anticipated hazard (e.g., "Caution, Airborne Radioactivity Area," "Caution, Contamination Area"). An access control point will be established for each RWA.

APPENDIX F

Training Requirements at the St. Louis Site

F1.0 TRAINING REQUIREMENTS AT THE ST. LOUIS SITE

In addition to the standard training specified in Section 7.0, workers at SLDS are required to attend the Mallinckrodt safety and hazard communication training session. Arrangements to receive this training should be made with the SLDS SSHO.

APPENDIX G

Emergency Response and Notification Requirements at the St. Louis Site

G1.0 GENERAL INFORMATION

Because some St. Louis site locations are on private property, emergency response procedures should incorporate the written emergency response procedures of the property owner, if such procedures exist. Section G1.1 outlines the procedures that control emergency responses at the St. Louis site locations. Attachment G-A-1 provides guidance for emergency responders serving SLDS Building 116. Attachment G-A-2 provides guidance for emergency responders serving SLAPS, Latty Avenue, and the vicinity properties.

G1.1 PROPERTY OWNER EMERGENCY RESPONSE PLANS

G1.1.1 Latty Avenue

Emergency response procedures at HISS are governed exclusively by the requirements of BNI Project Procedure 1.4, Project Instructions 24.064 and 24.103, and the St. Louis site HSP.

Emergency response procedures at the Futura Coatings, Inc., property are governed by FUSRAP requirements and should be coordinated with Futura Coatings, Inc., procedures.

Emergency response procedures at the Latty Avenue vicinity properties are governed by FUSRAP requirements; however, the site superintendent or designee will immediately notify property owners of any emergency situation that can adversely affect the health and safety of the owner, the owner's employees (if any), or the condition of the property.

G1.1.2 SLDS

SLDS is located within the property owned by the Mallinckrodt Specialty Chemical Company. Emergency response procedures at SLDS will be governed by FUSRAP requirements and the instructions contained in Mallinckrodt's "Safety Requirements for Outside Construction Subcontractors." The site superintendent will ensure that site personnel are aware of these requirements. A copy of the Mallinckrodt safety manual will be maintained onsite at all times. The site superintendent or designee will immediately notify the delegated Mallinckrodt representative, Tom Byrd, (314) 539-1459, of any emergency situation that can endanger the plant or personnel.

G1.1.3 SLAPS and Vicinity Properties

Emergency response procedures at SLAPs and the SLAPS vicinity properties are governed by FUSRAP requirements; however, the site superintendent or designee will immediately notify property owners of any emergency situation that can adversely affect the safety and health of the owner, the owner's employees (if any), or the condition of the property.

G2.0 ROUTES TO THE HOSPITAL

The preferred means of transporting an injured worker to the hospital is by ambulance (call 911). Ambulance service for Latty Avenue, HISS, SLAPS, and the vicinity properties is provided by the Christian Hospital Ambulance Service; service for SLDS is provided by the City of St. Louis Emergency Medical Service.

The hospital to be used for personnel at Latty Avenue, HISS, SLAPS, and the vicinity properties is Christian Hospital-Northwest (call 839-3800) located at 1225 Graham Road in Florissant, Missouri. The radiation safety officer for Christian Hospital, Dr. Robert Turco, (call 355-5075), should be notified if a contaminated worker is transported there for medical treatment. The hospital to be used for SLDS personnel is Barnes Hospital located at 1 Barnes Plaza in St. Louis. The director of the emergency department, Mr. Rick Flynn (call 362-9170), should be notified if a contaminated worker is transported there for medical treatment.

If site personnel need to transport an injured worker, Figures G-1 and G-2 should be used to identify the most direct route to Christian Hospital-Northwest and Barnes Hospital, respectively.

G3.0 RESPONSE TO FIRES

G3.1 FIRE ALARMS

Two-way radios will be used to alert work crews to fires at the St. Louis site. When workers are using respiratory protective equipment, the standard evacuation signal will be made between workers to indicate the need to leave the area. This signal entails grabbing the worker by the arm and then pointing to the nearest access control point.

General site fire alarms are as follows:

- at Latty Avenue, SLAPS, and the vicinity properties, a series of three 5-second soundings of an air horn;
- at SLDS, four rounds (electric horn sounding) of the four-number code for a specific sprinkler system or fire alarm box.

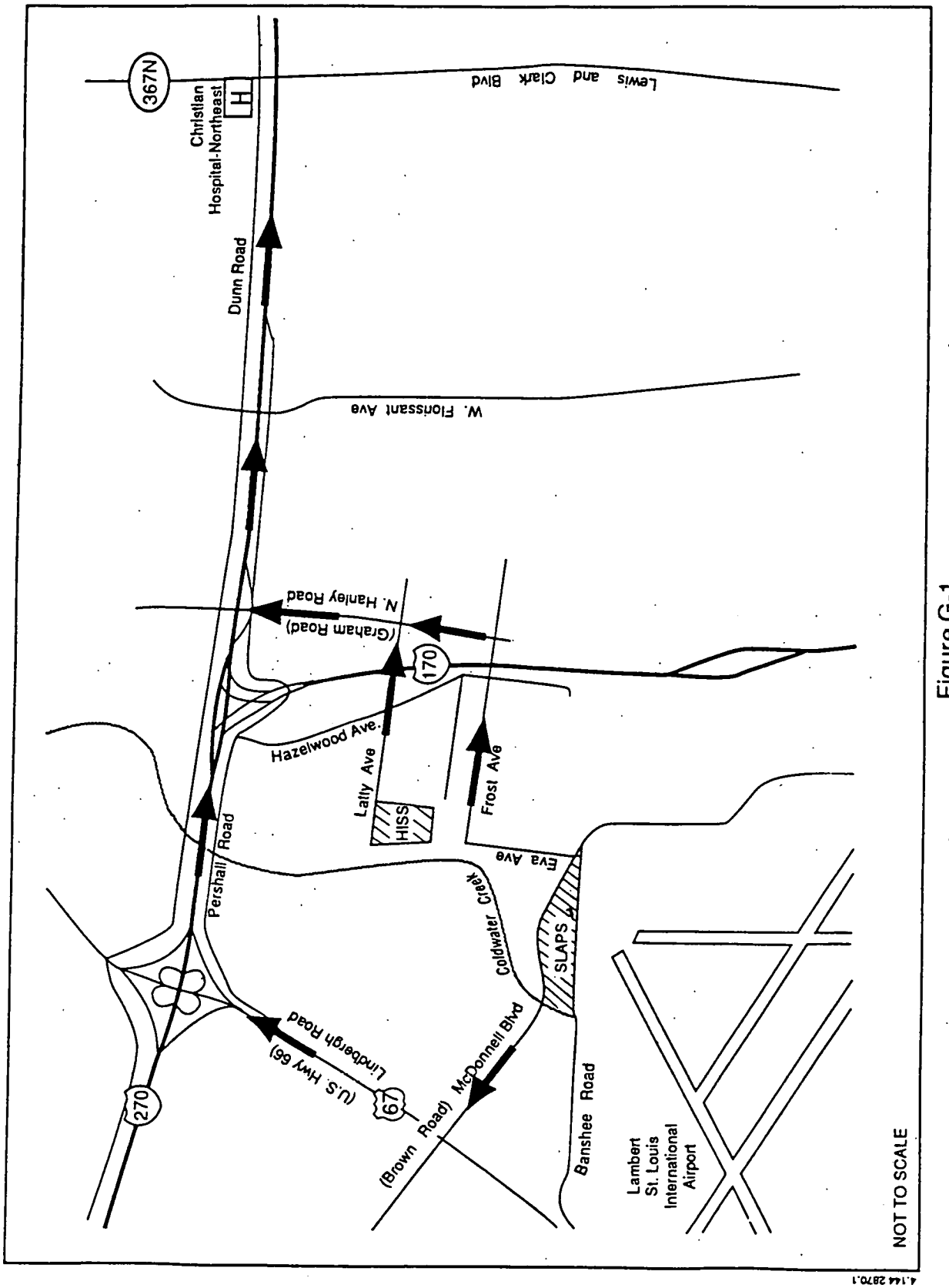

Figure G-1
Routes From SLAPS, Latty Avenue, HISS, and the Vicinity Properties to Christian Hospital-Northeast

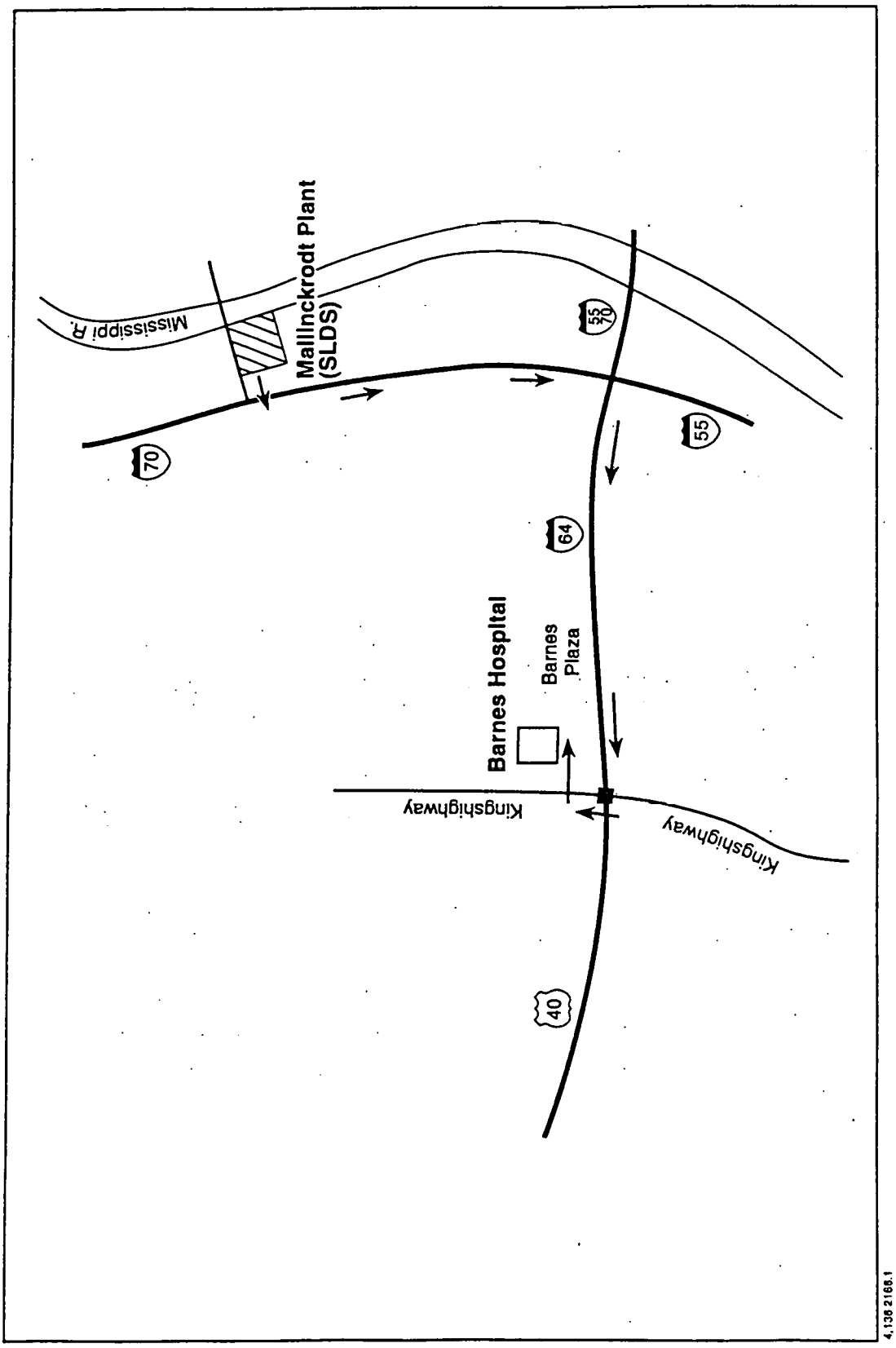

Figure G-2
Route from SLDS to Barnes Hospital

G3.2 RESPONSE PROCEDURES

St. Louis site personnel will be shown the locations of fire extinguishers and trained in their use and in fire alarm and fire response procedures. This instruction will be included in the initial site-specific training and presented at least annually thereafter. SLDS Building 116 has an automatic fire alarm and sprinkler system. If this system is activated, FUSRAP personnel must immediately evacuate the building (see Section G5.0).

At SLDS, the SSHO will contact the Mallinckrodt employee responsible for the building or plant area where FUSRAP work is to be performed and will determine the locations of fire extinguishers and the nearest emergency telephone. This information will be given to the workers before work begins.

Any unplanned fire that must be extinguished, no matter how small, will be reported to the SSHO and investigated in accordance with Project Instruction 24.0.

G3.2.1 Small Fires

An individual who discovers a small fire within a trailer or building must immediately warn all other occupants that there is a fire. If the fire is outdoors, other workers must be alerted to keep clear and be ready to summon the fire department, if needed.

An attempt should be made to extinguish small, controllable fires, but only if there is no immediate danger to the fire fighter and there is a clear evacuation route if the fire grows. Fire fighting should be performed with a fire extinguisher only.

G3.2.2 Large Fires and Explosions

An individual who discovers a large fire must undertake the following steps:

- If in a building, the individual must alert all others to the presence of fire and warn them to evacuate immediately.

- The individual should not attempt to fight the fire but evacuate to a safe area and contact the fire department. If the fire occurs at SLAPS, HISS, or another Latty Avenue or vicinity property, the person who discovers the fire must contact the St. Louis Fire Department (call 911 or 534-2244). If the fire is at SLDS, the individual should use the emergency telephone system to contact Mallinckrodt plant security and then should contact the site superintendent and SSHO.

- If the fire is in a controlled area, the person who discovers it should wait at a safe nearby location for the arrival of fire fighters and other emergency response personnel. The individual should provide guidance concerning the radiological, chemical and/or physical hazards present and should stay at the fire site until the site superintendent or SSHO.

An individual who witnesses an explosion must

- attempt to observe whether anyone is injured and whether a fire has resulted;

- assist any injured persons to evacuate only if it is known that there is no probability of additional explosions and that existing environmental conditions do not present a situation that is immediately dangerous to life or health;

- evacuate and contact the St. Louis police (call 911 or 321-1212) and fire department (call 911 or 534-2244) if the explosion is at HISS or other Latty Avenue, SLAPS, or vicinity property; if the explosion is at Mallinckrodt, use the emergency telephone at the nearest safe location to contact plant security. The individual should contact the site superintendent and SSHO. He or she should remain at a safe nearby location and, if needed, inform emergency response personnel of the location of injured personnel and provide guidance concerning radiological, chemical, and physical hazards at the explosion site. The individual should wait until the site superintendent or SSHO arrives.

G4.0 EMERGENCY RESPONSE AND SPILL EQUIPMENT

Emergency spill supplies and equipment are stored in labeled, red metal rolling boxes in the storage building at HISS and in Building 116 at SLDS. The locations of first aid and other emergency supplies and equipment at HISS and SLDS are shown in the emergency response site drawings posted at each of these locations.

Table G-1 lists the recommended emergency supplies and equipment to be maintained at HISS and SLDS. The SSHO will identify and assemble emergency supplies and equipment for work activities at SLAPS and the vicinity properties on a task-by-task basis.

G5.0 EVACUATION ROUTES AND ASSEMBLY POINTS

G5.1 SLDS

Emergency evacuation of the Mallinckrodt facilities may be required because of an explosion, fire, bomb threat, large-scale chemical release, or other hazardous condition. In

Table G-1

Recommended Emergency Response and Spill Supplies and Equipment to be Maintained at HISS and SLDS

PPE	Medical Equipment	Hazard and Spill Mitigation
Coated Tyvek™ coveralls (4) Full-face negative-pressure respirators (2) Gas mist cartridge-high-efficiency particulate air respirator canisters (4) Plastic shoe cover or rubber boots (4 pairs) Vinyl examination or surgical gloves (4 pairs) Outer rubber work chemical impervious work gloves (4 pairs) Face shields (2) Duct tape (1 roll)	First aid kit and first aid manuals Emergency eyewash apparatus Stretchers Blankets Ice Water in portable containers Mild decontamination solution (premixed soap and water)	Dustpans and dustbrooms (2 each) Street broom (1) Coal shovel (1) 55-gal drums (6) Caution ribbon (2) 10-mil plastic trash bags for radioactive materials (10) Lime marker (1) Lime (2 bags) 12-in. × 12-in. plastic bags (100) 4-mil-thick 12-ft × 100-ft plastic sheeting (3 rolls) Orange traffic cones (5) Absorbent material and oil boom

addition, evacuation to a safe location within the facility may be required because of severe weather conditions or a local emergency.

Electric horns throughout the Mallinckrodt plants will sound for fires and chemical emergencies. A steam whistle will also sound during some emergency conditions. The site superintendent will ensure that all SLDS personnel are aware of the Mallinckrodt alarm codes, evacuation routes, and locations of storm shelters.

Total Plant Evacuation

Three short blasts of the steam whistle indicate that all personnel must evacuate. *FUSRAP and subcontractor personnel must evacuate to the northwestern corner of the 3600 Broadway Reserve Lot and remain there until a head count is performed and further instructions are given.* See Figure G-3 for the evacuation route to the Broadway Reserve Lot.

Go To Designated Storm Shelter

Continuous wailing of the steam whistle for three minutes indicates that personnel must go to a designated storm shelter. If conditions are already too severe to leave, personnel should go to a central area of a building (away from windows) and take shelter under a desk or table.

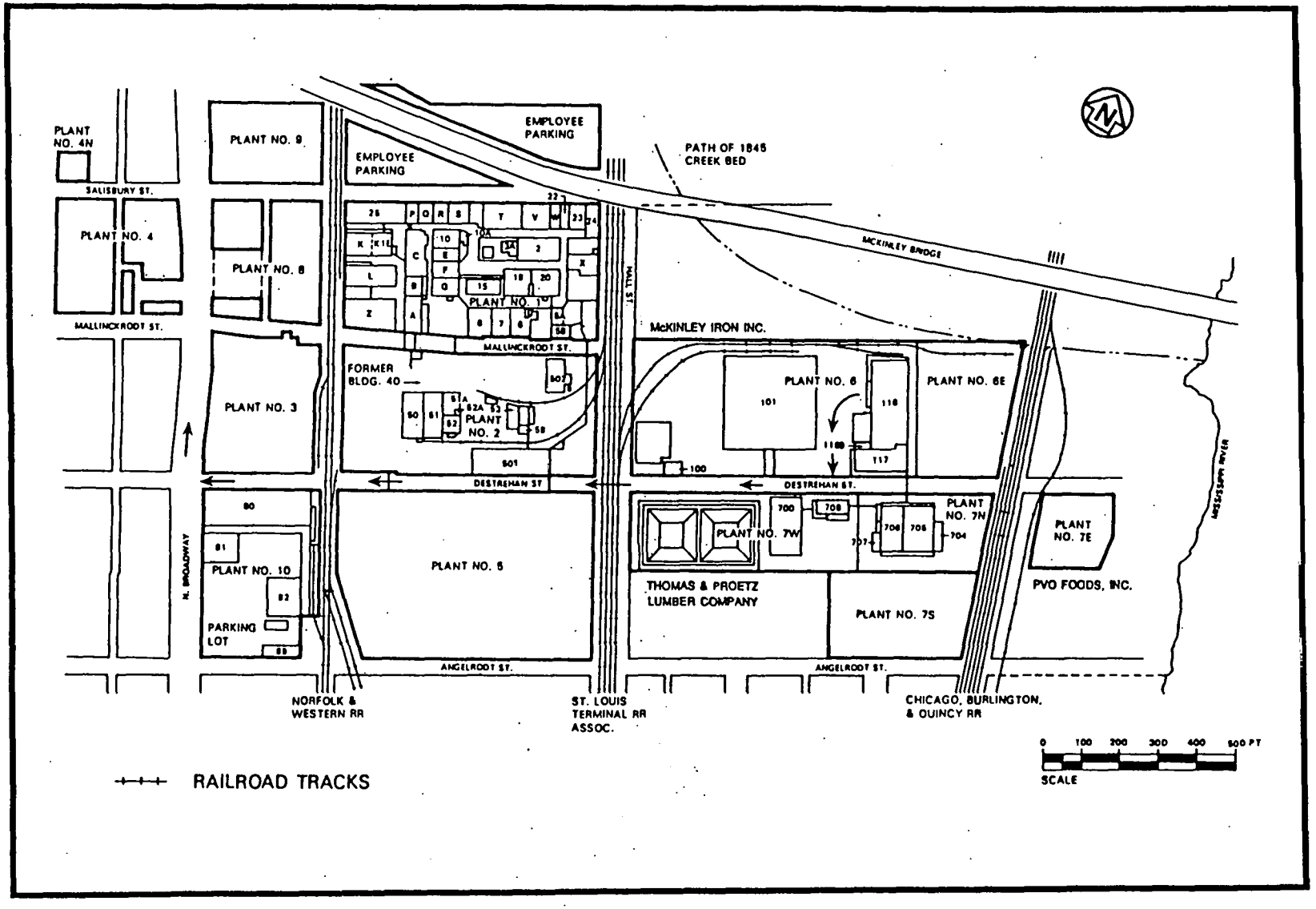

FIGURE G-3 EVACUATION ROUTES FROM MALLINCKRODT PLANT

Fire Alarm

Four rounds of the four-number code will sound for a specific sprinkler system or fire alarm box.

Chemical Emergency

Four rounds of the four-number chemical emergency code will sound.

Local Evacuation Alarms

Some buildings have local evacuation alarms such as air horns and bells. The SSHO will determine whether a specific work location has a local alarm and will instruct personnel in the system before work begins. Mallinckrodt supervisory personnel at each plant location must be contacted concerning local evacuation alarms and escape routes.

When the evacuation notice is issued, all equipment in use will be shut down if time allows. Unless otherwise directed by the SSHO, all personnel will then proceed to the predetermined location(s) specified by the SSHO. Personnel who cannot reach a predetermined location must report their individual locations to the site superintendent or SSHO as soon as possible.

If a building at SLDS must be evacuated, affected personnel will assemble at an upwind location as directed by the SSHO or site superintendent. Before work begins in a building, escape routes from it will be established and communicated to affected personnel.

G5.2 LATTY AVENUE, SLAPS, AND VICINITY PROPERTIES

Personnel at HISS and other Latty Avenue locations should evacuate to the parking lot of the DOE information center located at HISS. The assembly point will be the most upwind location in the parking lot. A series of three soundings of an air horn will be used to signal an evacuation. If workers are in respiratory protection, an evacuation order must be passed between workers: each one will grab another's arm and point to the access control point. A wind sock will be maintained onsite at all times for determining upwind locations. Figure G-4 shows the evacuation route from HISS.

SLAPS personnel must evacuate to the access just outside the main site gate on Banshee Road (see Figure G-5). The assembly point will be the most upwind location along Banshee Road. A wind sock will be used whenever work is performed at SLAPS so that upwind locations can be identified. The evacuation alarm consists of a series of three soundings of an air horn. Workers in respiratory protection must alert each other to an evacuation: each one will grab another's arm and point to the access control point.

Evacuation from dangerous conditions during work at the vicinity properties will be made to a work-site-specific upwind location designated by the SSHO. A windsock must be maintained at the work site and used to identify the upwind direction. The evacuation alarm consists of a series of three soundings of an air horn.

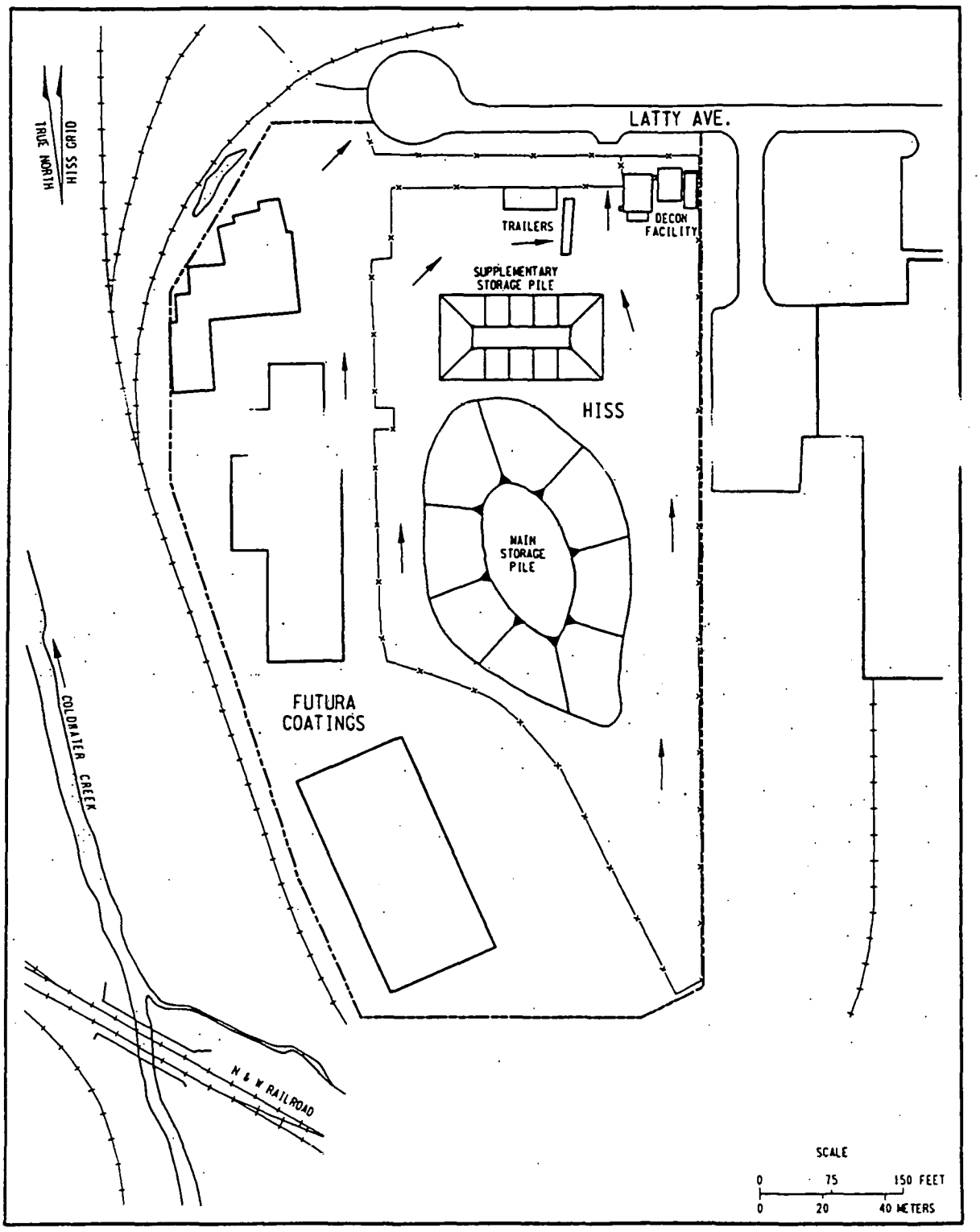

Figure G-4
Evacuation Routes from HISS and Latty Avenue Locations

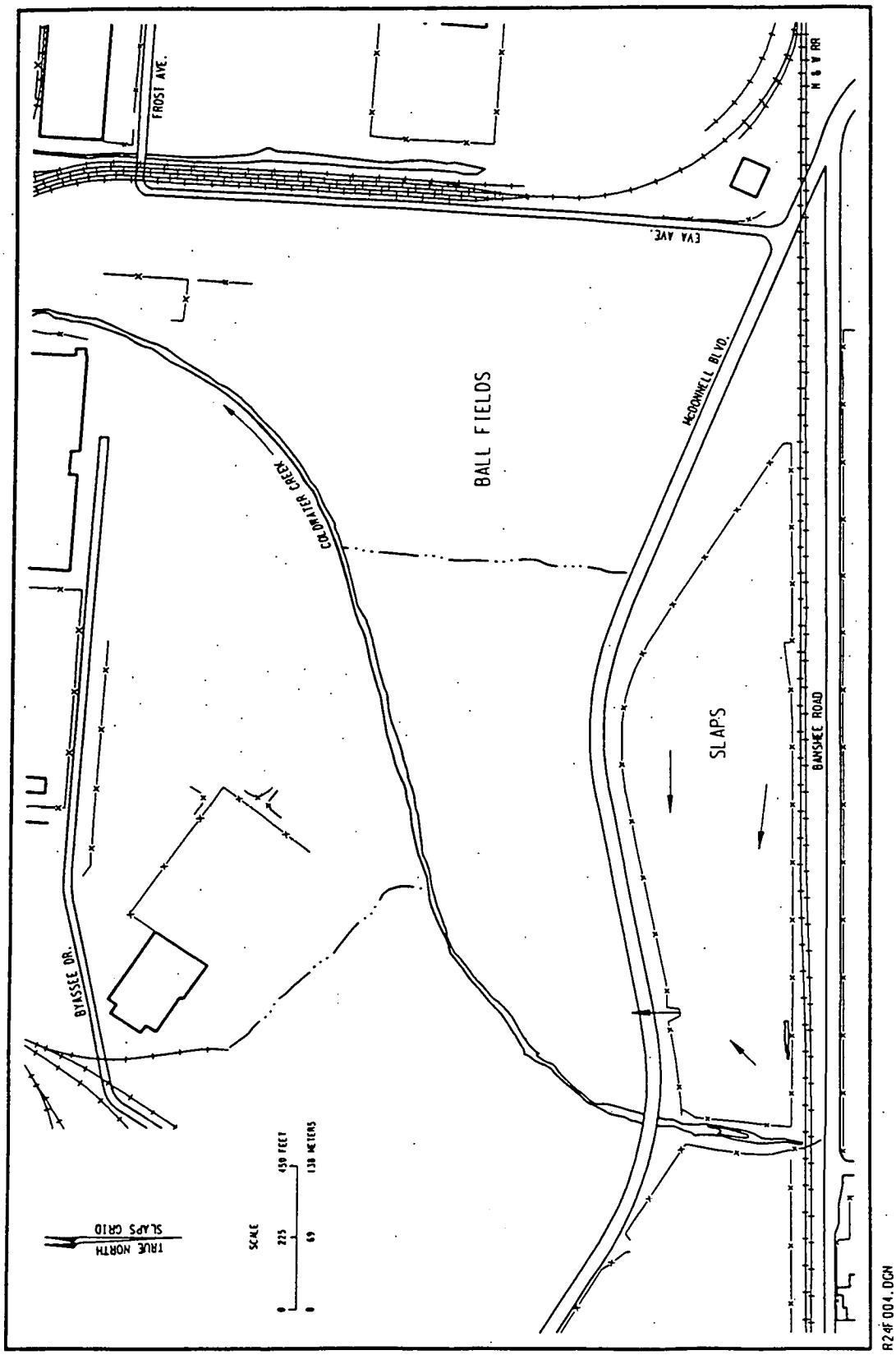

Figure G-5
Evacuation Routes from SLAPS

ATTACHMENT G-A-1
GUIDANCE FOR EMERGENCY RESPONDERS SERVING THE ST. LOUIS DOWNTOWN SITE BUILDING 116

GENERAL INFORMATION

The Department of Energy (DOE) under its Formerly Utilized Sites Remedial Action Program (FUSRAP) is presently using Building 116 at the Mallinckrodt St. Louis plant for administrative and staging facilities and as a temporary storage area for contaminated waste materials. The contamination consists primarily of very low levels of uranium. Although the levels of contamination do not present an immediate health threat, they are in excess of DOE criteria for unrestricted access and require the observance of the precautionary steps outlined in this guidance. Because this facility is under the control of FUSRAP, its personnel will provide radiological safety support during emergency response activities.

In the event of an emergency at Building 116 during normal working hours, FUSRAP personnel will be on hand to provide support. If an emergency occurs during an evening, weekend, or holiday, emergency responders must immediately contact one of the following FUSRAP representatives:

Steve Thieme — FUSRAP Site Superintendent
Work (314) 524-3329
Home (Redacted - Privacy Act)
Mobile Phone: Redacted - Privacy Act
Pager: (314) 538-1235

Gerald Palau — FUSRAP Facility Manager and Project Manager
Work (615) 576-1710
Home (Redacted - Privacy Act)

These two individuals are responsible for providing guidance regarding the seriousness of the situation, for mobilizing the necessary FUSRAP resources to respond accordingly, and for reporting an emergency situation to DOE and appropriate state and federal agencies.

GENERAL CONDITIONS AT BUILDING 116

Radiological Contaminants

The principal contaminant is uranium-238. The contamination is sparsely located and primarily nonremovable and is on floors, walls, and other materials stored in the building. The levels of contamination, although above limits for release of the building, provide no immediate health risks. Although any potential exposures to responders would not exceed a very small fraction of the annual dose limit for a member of the general public, all equipment and personnel that come in contact with contamination must be surveyed before they may be released. Materials and personnel with contamination will be decontaminated, usually by simply washing. Contaminated wash water must also be retained and analyzed before disposal.

Chemical Contaminants

None known.

Unusual Physical Hazards

None known.

Other Hazards

Asbestos-containing building rubble (packaged) and asbestos-containing pipe insulation may be present.

DESCRIPTION OF BUILDING 116

- Emergency telephone numbers are posted outside the entrances.

- The equipment storage and office area has undergone remedial action to fix the contamination in place and may be entered without personal protective equipment (PPE). Note: The floor in this area is painted grey.

- The waste storage area is used for staging containers of contaminated work materials (soil, used protective clothing, building rubble, etc.). These containers, 4- × 4- × 6-ft steel low-specific-activity (LSA) boxes and Type 7A 55-gal drums, meet Department of Transportation requirements for strong, tight containers: LSA boxes have banded lids, and the drums have rims attached. In addition to radioactive waste, some LSA boxes hold asbestos-containing material in the form of transite wall board and roofing material. There are no containers holding liquids. Note: A clean walkway has been established in the waste storage area. This walkway is painted the same color grey as the floor in the equipment storage/ office area and is bordered by a yellow and magenta "rad" rope.

- Outside the western wall of Building 116 is a 15,000-gal storage tank for liquids containing low concentrations of radioactive contaminants.

SPECIAL INSTRUCTIONS FOR EMERGENCY MEDICAL SERVICE PERSONNEL

- The onsite FUSRAP staff includes at least one member who possesses Red Cross certification in first aid and cardiopulmonary resuscitation (CPR).

- Emergency medical service (EMS) personnel may respond without restrictions to medical emergencies occurring outside a radiologically controlled area.

- If an individual is injured within a controlled area, FUSRAP personnel have been instructed to survey the victim and, if time permits, perform any needed decontamination.

- Because of the low levels of radiation involved, medical care must always take precedence over decontamination. When decontamination has not been performed, a trained FUSRAP representative will accompany the victim to the hospital to provide information regarding the type and extent of contamination and perform surveys (and decontamination, when required) on exposed personnel, equipment, and facilities.

- If EMS personnel respond during an evening or holiday (e.g., in support of fire fighters), the following steps should be followed until FUSRAP personnel arrive:

  — EMS personnel should contact FUSRAP personnel.

  — EMS personnel should don protective coveralls and gloves to prevent personal contamination.

— If the building or stored materials are on fire, respiratory protection is recommended for personnel entering the building.

— First aid and emergency medical actions should be provided without further consideration for radioactive contamination. However, items and equipment used during treatment of potentially contaminated victims must be held for survey and decontamination by FUSRAP personnel before they may be released for future use.

— If hospital services are required, the ambulance crew must inform emergency room personnel of the possible presence of very low-level uranium contamination.

  Emergency response personnel at Christian Hospital - Northwest have been alerted to the activities at SLDS and have established procedures for dealing with contaminated victims. Emergency response personnel should be advised to contact Dr. Robert Turco (355-5075), Christian Hospital Radiation Safety Officer, for additional guidance.

— FUSRAP personnel must report to the hospital as soon as possible to survey EMS personnel and equipment. All items that come in contact with the victim must be isolated until surveyed and, if required, decontaminated.

SPECIAL INSTRUCTIONS FOR FIRE AND RESCUE PERSONNEL

During normal working hours, FUSRAP personnel must be available to provide information about conditions in the building, make recommendations regarding PPE, and perform surveys and decontamination when required.

If an emergency occurs during an evening or holiday, the following guidelines should be followed until FUSRAP personnel arrive:

- FUSRAP personnel must be contacted.

- The senior responder should establish a staging area outside the building for holding potentially contaminated personnel and equipment.

- Immediate life-saving actions should be undertaken without regard for contamination.

  After emergency actions are taken, the responders who entered the waste storage area should wait at the staging area, provided there is no medical problem or additional emergency response duties, for arrival of FUSRAP personnel who will perform surveys and decontamination.

- If an alarm sounds at Building 116 but there is no apparent fire or sprinkler discharge, then unrestricted entry may be made for inspection in the equipment storage/office area. Entry to the waste storage area should be undertaken by the minimum number of personnel necessary (preferably 1 or 2 persons). These individuals should stay on the clean, grey walkway to avoid contact with potential contamination. If a responder leaves the walkway, then he/she must wait at the assembly area for survey and, if necessary, decontamination by FUSRAP personnel.

- If the sprinkler system is discharging but there is no apparent fire, then the system must be turned off. Because wet conditions can enhance the possibility of contamination, entry should be limited to the equipment storage/office area. If

entry to the waste storage area must be undertaken, only the minimum number of persons necessary should be allowed, and they must be held at the assembly area until FUSRAP personnel arrive.

- If a fire occurs in the equipment storage/office area, or if a small, localized fire occurs in the waste storage area, fire fighters may enter the building using self-contained breathing apparatus. Normal fire fighters' turnout gear will provide adequate protection against skin contamination. Because wet conditions can increase the risk of personal and equipment contamination, the fire should be fought with dry chemical extinguishers rather than water. At the end of emergency actions, responders who entered the building should wait at the assembly area for FUSRAP personnel to arrive.

- If a large fire occurs in the waste storage area, fire fighters should not enter. The fire may be managed using water streams outside the building. Responders should avoid contact with building debris or water running from the building. After emergency actions are completed, responders should wait at the assembly area for FUSRAP personnel to arrive.

ATTACHMENT G-A-2
GUIDANCE FOR EMERGENCY RESPONDERS SERVING LATTY AVENUE, ST. LOUIS AIRPORT SITE, AND THE VICINITY PROPERTIES

GENERAL INFORMATION

The Department of Energy (DOE) under its Formerly Utilized Sites Remedial Action Program (FUSRAP) is presently performing remedial investigation and remedial action operations at the following locations (see Figure G-A-2-1):

- Latty Avenue, which includes the Hazelwood Interim Storage Site (HISS) on Latty Avenue;
- St. Louis Airport Site (SLAPS) on Banshee Road; and
- vicinity properties located between SLAPS and HISS.

These sites contain low levels of radioactive contamination, principally thorium-230. Although the levels of contamination do not present an immediate health threat, they exceed DOE criteria for unrestricted release of the properties. Thus, certain emergency response activities may require the observance of the precautionary steps outlined in this guidance. HISS is under the control of DOE, and FUSRAP personnel will provide radiological safety support during emergency response activities at this site. FUSRAP personnel will also provide radiological safety support during emergencies at the other locations listed above when work is in progress. If work is not in progress, FUSRAP will provide guidance regarding radiological safety during emergency response at these sites.

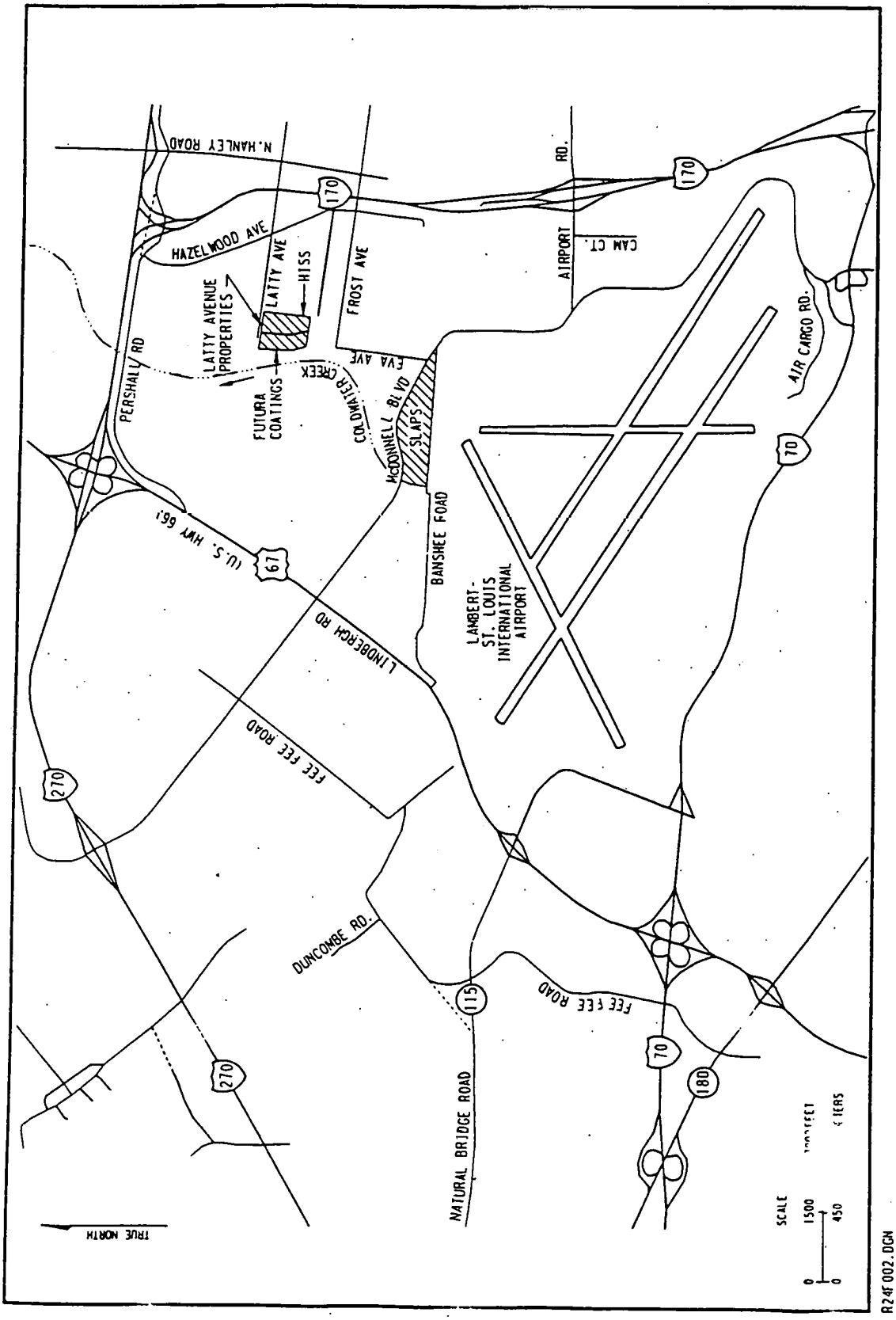

Figure G-A-2-1
Location of SLAPS and Latty Avenue Properties

If an emergency occurs at these sites during normal working hours, FUSRAP personnel will be on hand to provide support and guidance. If an emergency occurs during an evening, weekend, or holiday, emergency responders should immediately contact one of the following FUSRAP representatives:

Steve Thieme — FUSRAP Site Superintendent
Work (314) 524-3329
Home Redacted - Privacy Act
Mobile Phone: Redacted - Privacy Act
Pager: (314) 538-1235

Gerald Palau — FUSRAP Facility Manager and Project Manager
Work (615) 576-1710
Home Redacted - Privacy Act

These two individuals are responsible for providing guidance concerning the seriousness of the situation and for mobilizing the necessary FUSRAP resources to respond accordingly. If the emergency occurs at HISS, these individuals are responsible for reporting the emergency situation to DOE and appropriate state and federal agencies.

GENERAL SITE CONDITIONS

Radiological Contaminants

Low-level thorium-230 and lower levels of radium-226 and uranium are present in soil onsite. Persons and equipment in areas controlled for radiological safety can also become contaminated. Although levels of contamination are above limits for free release of the building, they present no immediate health risks. Any potential exposures to responders would not exceed a very small fraction of annual dose limits for members of the general public; however, all equipment and personnel that come in contact with contamination must

be surveyed before they may be released. Materials and personnel with contamination will be decontaminated, usually by simply washing. Contaminated wash water must be retained for analysis before disposal.

Chemical Contaminants

None are known to be present. However, the storage building contains acids and flammable materials, and diesel fuel and gasoline are stored onsite.

Other Hazards

None known.

SITE DESCRIPTIONS

HISS

(See Figure G-A-2-1.) The DOE information trailer located on Latty Avenue is outside the boundary of the radiologically controlled area at HISS. The remainder of the site is enclosed in a chainlink fence and includes a storage building, a laboratory trailer, storage piles, and a 5,000 gallon storage tank for potentially radioactively contaminated liquids. Areas controlled for radiological safety are marked with yellow and magenta "rad" rope and are posted with signs reading "Caution, Contaminated Area" and/or "Caution, Contaminated Soil." The storage piles containing contaminated soil from SLAPS and other vicinity properties are covered with a reinforced tarpaulin and grid cover and are posted with signs reading "Caution, Radioactive Material." Other areas at HISS may be controlled (and posted) for radiological safety on a task-by-task basis. Diesel fuel and gasoline are stored at

the access point to the controlled area around the storage piles. The storage building contains an acid cabinet used for storing nitric acid and a flammable materials cabinet where solvents are kept (typically alcohols).

SLAPS and Vicinity Properties

(See Figures G-A-2-2 and G-A-2-3.) SLAPS contains soil contaminated with wastes from uranium processing and buried debris from demolition of contaminated buildings. The site is enclosed by a chainlink fence. Areas within the site that are controlled for radiological protection are marked with yellow and magenta "rad" rope and are posted with signs reading "Caution, Contaminated Area." The vicinity properties are located along haul routes between SLAPS and HISS and were most likely contaminated during transport of processing wastes from SLAPS to HISS. The levels of contamination are very low, and none of the vicinity properties are controlled or posted as contaminated areas. However, if work such as excavation changes the level of hazard, posting and radiological controls will be implemented.

SPECIAL INSTRUCTIONS FOR MEDICAL EMERGENCIES

The onsite FUSRAP staff includes at least one member with Red Cross certification in first aid and cardiopulmonary resuscitation.

Emergency medical service (EMS) personnel may respond, without restrictions, to medical emergencies occurring outside radiologically controlled areas.

If an individual is injured within a controlled area, FUSRAP personnel have been instructed to survey the victim and, if time permits, perform any needed decontamination.

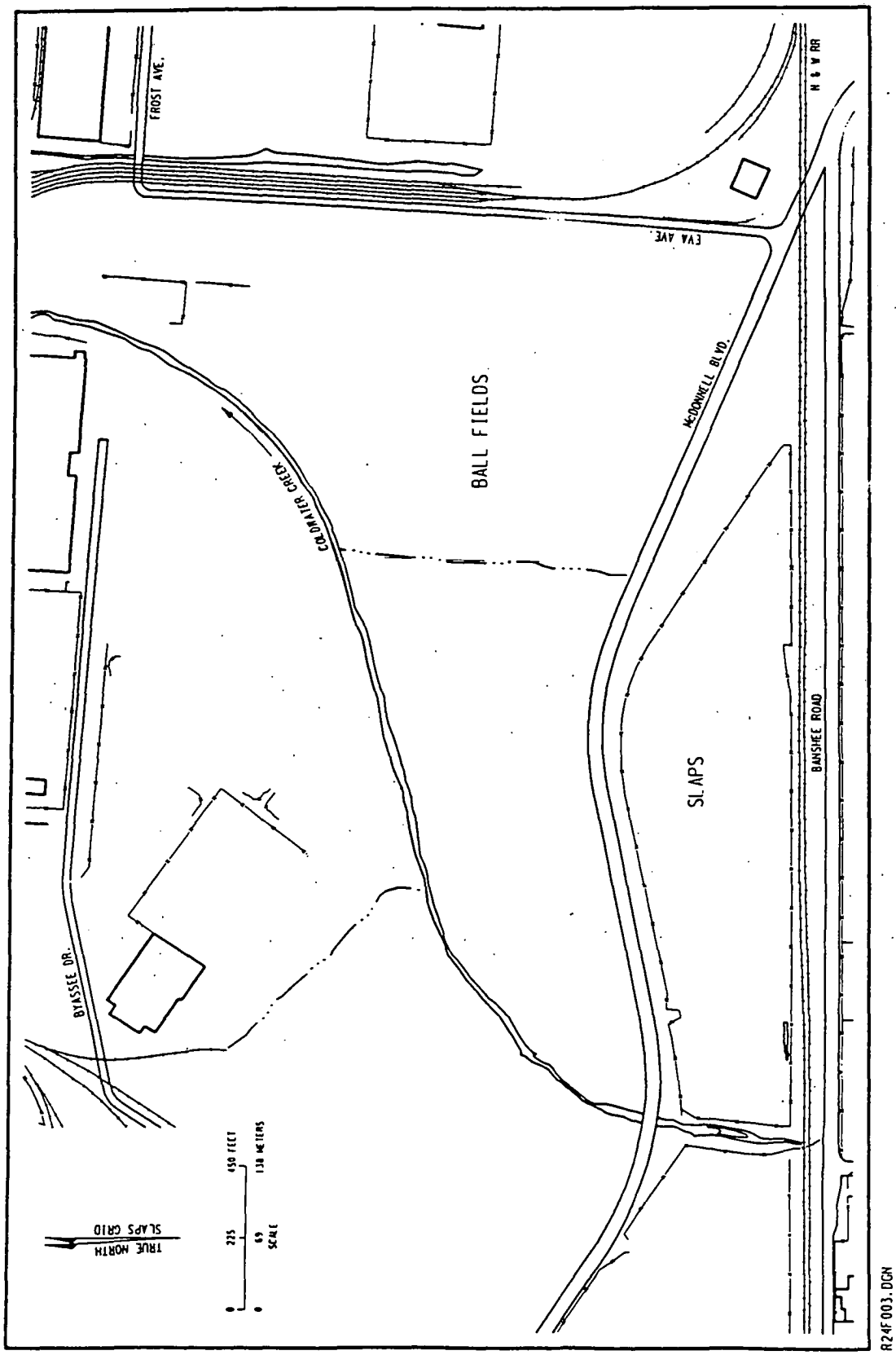

Figure G-A-2-2
St. Louis Airport Site

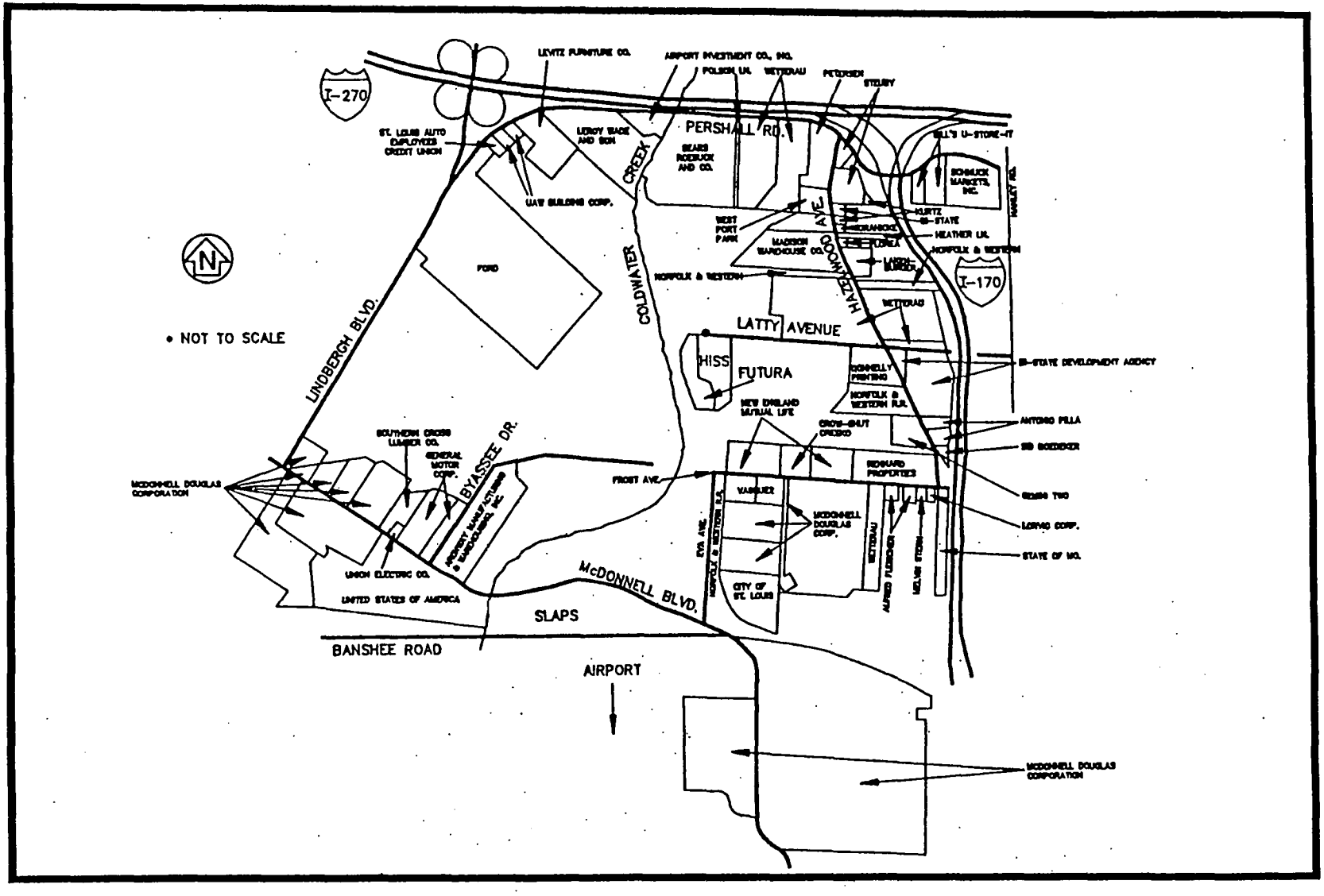

Figure G-A-2-3
Locations of the SLAPS and Latty Avenue Vicinity Properties

Because of the low levels of radiation involved, medical care must always take precedence over decontamination. When decontamination has not been performed, a trained FUSRAP representative will accompany the victim to the hospital to provide information regarding the type and extent of contamination and perform surveys (and decontamination, when required) on exposed personnel, equipment, and facilities.

If EMS personnel respond to an emergency at HISS during an evening or holiday (e.g., in support of fire fighters) the following steps should be followed until FUSRAP personnel arrive:

- Contact FUSRAP personnel.
- EMS personnel who enter a radiologically controlled area should don protective coveralls and gloves to prevent personal contamination.
- Respiratory protection is recommended for personnel aiding an injured person during a fire in the storage building, the lab trailer, or a radiologically controlled area.
- First aid and emergency medical actions should be provided without further consideration for radioactive contamination. However, items and equipment used during treatment of potentially contaminated victims must be held for survey/decontamination by FUSRAP personnel before they may be released for future use.
- If hospital services are required, the ambulance crew must inform emergency room personnel of the possible presence of very low-level thorium contamination.

Emergency response personnel at Christian Hospital-Northwest have been informed of the activities at SLDS and have procedures for dealing with contaminated victims. Emergency response personnel should be advised to contact Dr. David Keys (355-5075), Christian Hospital Radiation Safety Officer, for additional guidance.

- FUSRAP personnel must report to the hospital as soon as possible to survey EMS personnel and equipment. All items that come in contact with the victim must be isolated until surveyed and, if required, decontaminated.

SPECIAL INSTRUCTIONS FOR FIRE AND OTHER EMERGENCIES

Site emergencies can include fire, rescues, releases of contaminated material, and flooding. During normal working hours, FUSRAP personnel will be available to provide information about conditions in radiologically controlled areas and in buildings and trailers at HISS, to make recommendations regarding personal protective equipment, and to perform surveys and decontamination when required.

If an emergency occurs at HISS during an evening or holiday, the following guidelines should be followed until FUSRAP personnel arrive:

- FUSRAP personnel must be contacted.

- The senior responder should establish a control point outside and upwind of the site for holding potentially contaminated personnel and equipment.

- Immediate life-saving actions should be undertaken without regard for contamination.

After emergency actions are taken, the responders who entered a radiologically controlled area should wait at the control point (provided there are no medical problems or additional emergency response duties) for arrival of FUSRAP personnel who will perform surveys and decontamination.

- If a small fire occurs in the storage building, laboratory trailer, or radiologically controlled area, entry may be made using self-contained breathing apparatus. Normal fire fighters' turnout gear will provide adequate protection against skin contamination. Because wet conditions can increase the risk of personnel and equipment contamination, the fire should be fought with dry chemical extinguishers rather than water. After emergency actions are completed, responders who entered the building should wait at the assembly area for the arrival of FUSRAP personnel.

- If a large fire occurs in the storage building, laboratory trailer, or a controlled area, fire fighters should not make entry. The fire may be managed using water streams outside the building. Responders should avoid contact with debris from contaminated areas or water running from radiologically controlled areas. After emergency actions are completed, responders should wait at the assembly area for FUSRAP personnel to arrive.

Formerly Utilized Sites Remedial Action Program (FUSRAP)

ADMINISTRATIVE RECORD

for the St. Louis Site, Missouri

U.S. Department of Energy