Department of Energy
Brookhaven Area Office
P.O. Box 5000
Upton, New York 11973

W.C. Lieneck

JUL 1 8 2001

July 17, 2001

Mr. Leslie M. Hill
Brookhaven Science Associates, LLC
Brookhaven National Laboratory
Upton, New York 11973

Dear Mr. Hill:

SUBJECT: APPROVAL OF UNREVIEWED SAFETY ISSUE DETERMINATION / SAFETY EVALUATION (USID) FOR THE BROOKHAVEN GRAPHITE RESEARCH REACTOR (BGRR) LOWER CANAL AND WATER TREATMENT HOUSE, EQUIPMENT, AND ASSOCIATED SOILS REMOVAL (BGRR-SE-01-02)

The Brookhaven Area Office (BAO) has reviewed your request to begin work on the Lower Canal and Water Treatment House, Equipment and Associated Soils. BAO has determined that the actions referenced in USID/SE BGRR-SE-01-02 (Rev. 0) comply with the requirements of DOE-EM-STD-5502-94; Hazard Baseline Documentation and DOE-EM-STD-5503-94; EM Health and Safety Plan Guidelines. Therefore, Lower Canal and Water Treatment House, Equipment, and Associated Soils work is authorized.

If you have any questions regarding this matter, please contact Mark Parsons of my staff at extension 7978.

Sincerely,

R. L. Desmarais, Director
Project Management Division
Brookhaven Area Office

cc: C. Adey, BNL
M. Dikeakos, BAO
W. Lieneck, BNL
M. Parsons, BAO
G. Penny, BAO

Environmental Management Directorate

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July 9, 2001

Mr. Michael D. Holland
DOE Brookhaven Group Manager
U.S. Department of Energy
Brookhaven Group
Upton, NY 11973-5000

Dear Mr. Holland:

SUBJECT: Unreviewed Safety Issue Determination/Safety Evaluation (USID/SE) for the Lower Canal and Water Treatment House, Equipment, and Associated Soils Removal

Enclosed for your approval is the subject document (BGRR-SE-01-02, Rev. 0) covering portions of CWBS 4.01, Above- and Below-Ground Canal and Water Treatment House and Soils Removal. This document was informally submitted to the DOE Project Manager for the BGRR Decommissioning Project for technical review. All comments were addressed and the resolutions incorporated into the enclosed document. Physical removal cannot begin until DOE approval is received.

If you have any questions regarding the contents or analysis of BGRR-SE-01-02, please do not hesitate to call Steven Moss (ext. 7639) or Walter Lieneck (ext. 2394).

Sincerely,

L. M. Hill, Director
Environmental Management

SM/mcb
Enclosure: BGRR-SE-01-02, Rev. 0
cc (w/Enclosure):
M. Parsons, DOE/BAO
cc (w/o Enclosure):

C. Adey	M.S. Kumar	S. Musolino
K. Corbett	S. Layendecker	L. Nelson, DOE/BAO
M. Cowell	W. Lieneck	G. Penny, DOE/BAO
F. Crescenzo, DOE/BAO	S. Maloney	F. Petschauer
R. Desmarais, DOE/BAO	S Mallette, DOE/BAO	T. Sheridan
M. Dikeakos, DOE/BAO	S. Moss	File WBS 4.1

* * *

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Safety Evaluation Number: **BGRR – SE – 01 – 02** **Revision Number:** 0

Prepared by: S. H. Moss 5/29/01 **Date:** 05/22/01

Description of Proposed Activity: Lower Canal & Water Treatment House, Equipment & Associated Soil – Removal Action

Alternative 2 of the Engineering Evaluation/Cost Analysis (EE/CA) developed for the Lower Canal and Water Treatment House, Equipment and Associated Soil [Ref. 8], calls for the following removal actions:

1) Common Elements associated with each Alternative presented within the EE/CA (other than No Action – which does not meet the established regulatory limits for dose):
   a) Outdoor working pad area that surrounds the Canal and Water Treatment House on the north, east, and south sides
   b) Removal or remediation of the Lower Canal Piping Systems trench
   c) Removal or remediation of the East Yard Sump, which is located in the pad area on the east side of the Canal House structure
   d) Removal or remediation of the associated surface soils extending approximately 120 feet east of Building 701 and 160 feet south of Building 703
   e) Rerouting of the east parking area storm drain line
   f) Installation of three monitoring wells
2) Remediate Canal, seal it, remove equipment, adjacent concrete and asphalt to access the contaminated surface soil requiring
   remediation nearby the Canal
3) Cover Canal and provide sufficient drainage control to prevent water intrusion
4) Remediate soil to remove contamination, returning the surface soil areas to environmental background levels, as necessary.

Purpose:

The Brookhaven Graphite Research Reactor (BGRR) has been identified as Area of Concern (AOC) 9 in the Interagency Agreement [Ref. 15] between the Environmental Protection Agency (EPA) Region II, the Department of Energy (DOE), and New York State Department of Environmental Conservation (NYSDEC). This is a Federal Facility Agreement under the *Comprehensive Environmental Response Compensation, and Liability Act of 1980* (CERCLA) Section 120, Administrative Docket Number II-CERCLA-FFA-00201. The Lower Canal and Water Treatment House, Equipment, and Associated Soils are part of the BGRR, which is designated as Sub-AOC 9A.

References:

(1) Procedure No. ERD-OPM-4.4, "Safety Evaluations for Unreviewed Safety Issue Determinations", Rev.0 dated 1/18/00.
(2) BGRR-002, "Hazard Classification and Auditable Safety Analysis for Brookhaven Graphite Research Reactor (BGRR) Decommissioning Project", Rev. 3 dated January 19, 2001, as approved by DOE 01/31/01.
(3) BGRR-001, "Brookhaven Graphite Research Reactor (BGRR) Project Management Plan", Rev. 1 dated March 2, 2000.
(4) BNL SBMS Hazard Analysis Subject Area, issued March, 2001. [URL= https://sbms.bnl.gov/standard/2m/2m00t011.htm]
(5) DOE-STD-1027-92, "Hazard Categorization and Accident Analysis Techniques for Compliance with DOE order 5480.23, Nuclear Safety Analysis Reports" Change Notice No. 1 dated September 1997.
(6) LA-12846-MS, "Specific Activities and DOE-STD-1027-92 Hazard Category 2 Thresholds", LANL Fact Sheet issued November 1994.
(7) LA-12981-MS, "Table of DOE-STD-1027-92 Hazard Category 3 Threshold Quantities for the ICRP-30 List of 757 Radionuclides", LANL Fact Sheet issued August 1995.

(8) BGRR-033, "Lower Canal and Water Treatment House, Equipment, and Associated Soils, Draft Engineering Evaluation / Cost Analysis", Rev. B dated March 29, 2001.
(9) BGRR-027, "Sampling and Analysis Plan for the Canal and Water Treatment Houses, Equipment, and Associated Soils", Rev. 0 dated August 1, 2000.
(10) BGRR "Summary of Surveys and Data to Demonstrate Canal SAP Performance", dated January 31, 2001, as compiled by L. Luckett (URS).
(11) BGRR-SE-99-02, Pile Fan Sump, Piping and Soils Removal, as approved by DOE 10/15/99.
(12) NUREG/CR-0672, "Technology, Safety and Costs of Decommissioning a Reference Boiling Water Reactor Power Station", June 1980.
(13) Long Island Power Authority – Shoreham Nuclear Power Station – NRC Docket No. 50-322, "Updated Decommissioning Plan", February 1993.
(14) Brookhaven Graphite Research Reactor Decommissioning Project Health and Safety Plan (HASP)-BGRR-0006, dated September, 1999.
(15) BNL FFA under CERCLA Section 120, February 28, 1999 [IAG between U.S. EPA – Region II, U.S. DOE and NYSDEC].
(16) NEPA-CX No. BNL-361, "BGRR Stabilization, Isolation and Maintenance Activities", signed off by DOE 9/16/99.
(17) BGRR-SE-99-04, Above Ground Duct Removal, as approved by DOE 06/08/00.
(18) BGRR-043, "Job Safety Analysis for Remediation of the Lower Canal, Below Grade Piping Systems and Associated Soils", Rev. 0 dated 06/27/01 (Included as Attachment 1).
(19) ERD-BGRR-TP-01-03, "Technical Work Document for Remediation of the Lower Canal, Below Grade Piping Systems and Associated Soils" , Rev. 0 dated 07/02/01 (Included as Attachment 2).

SCREENING CRITERIA

Safety Function(s) of Systems Affected

1. Will the proposed activity affect the safety function(s) or failure mode(s) of the equipment/facility? Y (N) N/A

Because of its defunct status and defueled state, the BGRR has no current requirements for redundant systems and/or safety class or safety significant SSCs (Systems, Structures and Components). Therefore, no safety functions exist that are directly associated with current components or equipment considered part of the scope of the BGRR Decommissioning Project. Where no safety functions exist, there can be NO effect on the safety function by the proposed activity.

The Canal and Water Treatment Houses were shutdown after all BGRR fuel was removed from BNL site in 1972. They no longer serve the purpose for which they were designed and constructed. Hence, they may be considered as being Out-Of-Service or failed. No deconstruction activities or potential accidents associated with such activities can have any negative effect on the ability of the buildings/contents to perform their original functions, which are obsolete.

The proposed activity will not affect the safety function(s) of the facility [as there are none]; it will not affect the failure mode(s) of the equipment/facility, as the equipment/facility was previously and permanently shutdown. The answer to Question 1 of Safety Function(s) of System Affected is '**NO**'.

2. Will any new failure modes be introduced by the proposed activity? (Y) N N/A

BGRR-002, "Hazard Classification and Auditable Safety Analysis for the BGRR Decommissioning Project", Rev. 3 dated January 19, 2001 [Ref. 2], was approved by DOE on 01/31/01. It specifically excludes from review or consideration the impact of contamination removal activities directly associated with the decommissioning process. Guidance for the selection of appropriate failure modes to consider was taken from other decommissioning projects [Refs. 12 & 13], as well as previously approved USID/SEs associated with the Brookhaven Graphite Research Reactor Decommissioning Project [Refs. 11, 17]. The failure modes selected and associated accident analyses presented in Appendix A are; Crane Load Drop, Waste Container Drop,

Contaminated Waste Bag Rupture/Fire, Explosion of LPG Leaked from a Forklift, Oxyacetylene Explosion, Contamination Control Envelope Rupture, and Vacuum Filter Bag Rupture.

Neither the BGRR Job Safety Analysis for the Lower Canal & Water Treatment House, Equipment & Associated Soil Removal Action [Ref. 18], nor the BGRR Technical Work Document for the Lower Canal & Water Treatment House, Equipment & Associated Soil Removal Action [Ref. 19]; preclude the use of any of the above listed equipment (except for barring the flame cutting of contaminated items). Therefore, none of the accident scenarios listed above can be discounted at face value. Based on the physical characteristics of the materials to be removed (concrete, metal and soil), Combustible Waste Fire was deemed not a credible accident scenario.

With respect to the BGRR-ASA, the proposed activity represents a new activity, with its own unique spectrum of potential failure modes. Specifically, the proposed activity (CERCLA Non-Time-Critical Removal Action) represents an activity not covered by the BGRR-ASA (per Table 1.4-1 – ASA Applicability Table of Section 1.4 – Scope of Work).

As the proposed activity is specifically defined as being outside the scope of the BGRR-ASA and consists of demolition and remediation activities to be performed as part of a CERCLA Non-Time-Critical Removal Action, it may well introduce new failure modes not previously considered under the BGRR-ASA. The answer to Question 2 of the Safety Function(s) of System Affected is '**YES**'.

Effects on Safety

1. Could the proposed activity increase the probability of occurrence of an accident previously evaluated in the ABD? Y (N) N/A

For the Brookhaven Graphite Research Reactor Decommissioning Project, the Authorization Basis Documents include; the BGRR-ASA, Rev.3 (which was approved by DOE 01/31/01), the DOE Safety Evaluation Report as approved 01/30/01, the ERD Quality Assurance Implementation Guidelines, BGRR-DP Environment, Health and Safety Plan, and all DOE-approved USID/SEs for the BGRR-DP. Of those documents, only the BGRR-ASA contains original accident analysis data (the DOE-SER reiterates and amplifies on the contents of the ASA, but includes no new accident scenarios nor changes to the ones in the BGRR-ASA).

Even though the BGRR-ASA accident analysis excludes actual D&D work-related accidents; it must still be reviewed for the potential impact of the proposed activity on the probability of occurrences for the accident scenarios contained within the BGRR-ASA. Because of the "Routine Risk" nature of the defueled BGRR (classified as a "Radiological Facility"), a rigorous probabilistic risk assessment was not required as part of the Auditable Safety Analysis. Instead, using a graded approach and guidance originally offered in BNL ES&H Standard 1.3.3, "Safety Analysis Reports / Safety Assessment Documents", which was subsequently replaced by the BNL SBMS Subject Area, "Hazard Analysis" [Ref. 4], the Risk Assessment Tables of Section 3.2 of the BGRR-ASA were developed.

Among the events analyzed in BGRR-ASA Section 3.2 – Risk Assessment are; Seismic Event, High Winds, Graphite Dust Detonation, Loss of Pile Negative Pressure System Ventilation, Loss of Pile Negative Pressure System Filtration, Crane Load Drop, Fire, Facility Worker Exposure to Toxic Material.

The proposed activity has no capability to impact the probability of occurrence of Seismic Events or High Winds (which are natural phenomena). Additionally, as the proposed activity is limited to the removal actions on the Lower Canal & Water Treatment House, Equipment & Associated Soil; it has no potential to impact the probability of events occurring at other local buildings e.g., Buildings 701 & 702. This eliminates from further consideration; Graphite Dust Detonation, Loss of Pile Negative Pressure System Ventilation, Loss of Pile Negative Pressure System Filtration, and Building 701 Crane Load Drop. The only remaining accident scenarios from the BGRR-ASA to be considered are: Risk Assessment No. 007, covering Fire; and Risk Assessment No. 008, covering Facility Workers Exposure to Toxic / Hazardous Materials.

The proposed activity involves the exposure by removal (including cutting) of contaminated equipment, structural material and potentially contaminated soil. There are no significant amounts of combustible materials involved and primarily mechanical means will be used for separation (flame cutting, while specifically excluded only for contaminated material, is not expected to play a major role). The accident analysis of the proposed activity in Appendix A includes three accident scenarios, which already and independently address the potential for initiation of fire. These events are; Oxyacetylene Explosion, Explosion of LPG Leaked from a Forklift and Contaminated Waste Bag Rupture/Fire. The proposed activity, having its own fire probability assessment, represents no increase in the probability of fire as defined in BGRR-ASA Risk Assessment No.7.

Finally, as 'Potential Initiators' under Risk Assessment No. 008 covering Facility Worker Exposure to Toxic/Hazardous Materials are; natural phenomenon, operator error, or equipment failure causing breach of deactivated piping or equipment containing residual hazardous/toxic material. The only BGRR-DP workers or Sub-contractor workers are those directly involved in the decommissioning process, including the performance of the proposed activity. Therefore, the proposed activity does not increase the probability of occurrence of this event. It merely reflects one of the potential initiators of this event. The proposed activity represents no increase in the probability of occurrence of the event as defined in BGRR-ASA Risk Assessment No. 008.

So the answer to Question 1 of 'Effects on Safety' is '**NO**'.

The proposed activity does not increase the probability of any accident evaluated in the Authorization Basis Documentation.

2. Could the proposed activity increase the probability of occurrence of a malfunction of equipment, systems, or components that are Important-to-Safety? Y (N) N/A

As was already discussed in response to Screening Criterion No. 1 under 'Safety Function(s) of Systems Affected'; the BGRR has no current requirements for redundant systems and/or safety class or safety significant SSCs (Systems, Structures and Components) due to its defunct status and defueled state. Therefore, no safety functions exist that are directly associated with the proposed activity covered by this USID/SE. Without equipment, systems or components that are Important-to-Safety, there can be no probability of occurrence of a malfunction of equipment, systems or components that are Important-to-Safety; nor any increase in same.

The proposed activity **COULD NOT** increase the probability of occurrence of a malfunction of equipment, systems or components that are Important-to-Safety.

3. Could the proposed activity create the possibility of an accident of a different type than those previously evaluated in the ABD? (Y) N N/A

As already discussed in the response to Screening Criterion No. 2 under 'Safety Function(s) of Systems Affected', the answer to this question is '**YES**'. However, the consequences of any such accident, as discussed in Appendix A, are bounded under the consequences of accidents presented in the BGRR-ASA, based upon a comparison of maximum projected release.

4. Could the proposed activity create the possibility of an equipment, system, or component malfunction of a different type than those previously evaluated in the ABD? (Y) N N/A

As already discussed in the response to Screening Criterion No. 2 under 'Safety Function(s) of Systems Affected', the answer to this question is '**YES**'. However, the consequences of any such malfunction, as discussed in Appendix A, are bounded under the consequences of accidents presented in the BGRR-ASA.

5. Does the proposed activity reduce the Margin-of-Safety as defined in the basis for any ABD? Y (N) N/A

In ERD-OPM-4.4 [Ref. 1], the procedure states, "In the context of this procedure a Margin-of-Safety is reduced if the Safety Limit or Limiting Condition of Operation or Administrative Control as defined in the Authorization Basis Document(s) is violated". As this safety evaluation is based upon the guidance provided in the above referenced procedure, that definition of Margin-of-Safety compels the answer '**NO**'.

The proposed activity **DOES NOT** reduce the Margin-of-Safety as defined in the BGRR-ASA. The work is being reviewed under the USI process prior to authorization, and will not violate any of the Administrative Controls already contained in the BGRR-ASA, as long as the work is performed as described in the EE/CA, the task specific Technical Work Document and the Job Safety Analysis [Refs. 8, 18 and 19]

Authorization Basis Document(s) Changes

1. Is a change to the facility ABD(s) being made? (Y) N N/A

The BGRR-ASA refers to the performance of work outside the scope of the ASA as requiring the use of the USI process as defined in ERD-OPM-4.4 [Ref. 1]. The proposed activity covered here specifically falls under that classification (see ASA Table 1.4-1 – ASA Applicability Table, for CERCLA Removal Actions). The completed and approved USID/SE for the proposed activity should be considered as an addendum and amendment to the BGRR-ASA.

Therefore, it does constitute a change to the BGRR-ASA and requires the approval of the DOE Area Office Manager for the BGRR Decommissioning Project, prior to implementation. The answer to Question 1 under 'Authorization Basis Document(s) Changes' is '**YES**'.

SAFETY EVALUATION CONCLUSION

Based on the evaluation of the evidence cited above, the issue --

_____ Does NOT constitute an Unreviewed Safety Issue.

__√__ Does constitute an Unreviewed Safety Issue.

**** IF ANY OF THE ABOVE ARE YES, THEN A USI EXISTS. ****

Clyde T. Hennen for F. Peterson 6/29/01
BGRR Project Engineer Signature/ Date

Stephen V. Mezga 6/29/01
ERD ES&H Manager Signature/ Date

Watson 7/9/01
BGRR Project Manager Signature/ Date

Kim Little 6-29-01
ERD QA Representative Signature/ Date

APPENDIX A

ABNORMAL OPERATIONS ASSESSMENT

APPENDIX A - ABNORMAL OPERATIONS ASSESSMENT

Method of Abnormal Operations Assessment

The abnormal operations assessment of the Lower Canal & Water Treatment House, Equipment & Associated Soil Removal was based on a methodical review of each initiating event and the severity, probability, and risk category of the corresponding hazards associated with the activity. Only one accident-initiating event is postulated to occur at one time. Guidance for the selection of appropriate failure modes to consider was taken from: NUREG/CR-0672, "Technology, Safety and Costs of Decommissioning a Reference Boiling Water Reactor Power Station" [Ref. 12]; Long Island Power Authority, Shoreham Nuclear Power Station - NRC Docket No. 50-322, "Updated Decommissioning Plan" [Ref. 13]; BGRR-SE-99-02, "Pile Fan Sump, Piping and Soils Removal" as approved by DOE 10/15/99 [Ref. 11] and BGRR-SE-99-04, "Removal of Above Ground Duct for BGRR-DP" as approved by DOE 06/08/00 [Ref. 17]. The main failure modes to be considered include; Crane Load Drop, Waste Container Drop, Contaminated Waste Bag Rupture/Fire, Oxyacetylene Explosion, Explosion of LPG Leaked from a Forklift, Vacuum Filter Bag Rupture, and Contamination Control Envelope Rupture. The Technical Work Document for Lower Canal & Water Treatment House, Equipment & Associated Soil Removal [Ref. 17] specifically bars the practice of flame cutting contaminated equipment. Based on the physical characteristics of the materials to be removed (concrete, metal components and soil), Combustible Waste Fire was not a credible accident scenario. The potential use of explosives was not considered and so is outside the scope of this USID/SE. The risk-assessment tables which follow represent the determination of the extent of the hazards associated with the Lower Canal & Water Treatment House, Equipment & Associated Soil Removal, based on the current EE/CA, Technical Work Document and JSA.

BGRR-002, "Hazard Classification and Auditable Safety Analysis for Brookhaven Graphite Research reactor (BGRR) Decommissioning Project" [Ref.2] provides the methodology for examining the safety of decommissioning activities at the BGRR-DP. It has guidance for assessing the appropriate level of severity, probability, and risk. Table A.1-1 depicts the form used in this Safety Evaluation for Unreviewed Safety Issue Determination to perform the risk assessment. Tables A.1-2 through A.1-4 summarize the Risk Assessment Matrix found in BGRR-002 and used here.

Table A.1-1

RISK ASSESSMENT FORMAT						
Severity	I ( ) Catastrophic	II ( ) Critical	III ( ) Marginal	IV ( ) Negligible		
Probability	A ( ) Frequent	B ( ) Probable	C ( ) Occasional	D ( ) Remote	E ( ) Extr Remote	F ( ) Impossible
Risk Category	1 ( ) High	2 ( ) Moderate	3 ( ) Low	4 ( ) Routine		

Table A.1-2 summarizes the potential consequences of hazards falling into the four severity classifications established in BGRR-ASA. It considers the consequences for the following:

- Non-radiation release/exposure, on-site/off-site
- Radiation release/exposure, on-site/off-site
- Equipment loss
- Program downtime
- Program compromise
- Public-impact perception

Table A.1-2

HAZARD SEVERITY		
Category	**Descriptive Word**	**Potential Consequences**
I	Catastrophic	May cause death or system loss. > 100 rem Committed Effective Dose Equivalent (CEDE) on-site or > EPA Protective Action Guidelines off-site. {Eqpt. Loss>$1,000,000; Downtime >4 months}
II	Critical	May cause severe injury, severe occupational illness, or major system damage. >25 rem CEDE on-site or 10 mrem off-site. {Eqpt. Loss>$250,000; Downtime >3 weeks and <4 months}
III	Marginal	May cause minor injury, minor occupational illness, or minor system damage.> 5 rem annual limit on-site. {Eqpt. Loss>$50,000; Downtime >4 days and <3 weeks}
IV	Negligible	Will not result in injury, occupational illness, or system damage. > 3 rem admin annual limit or 1 rem admin quarterly limit. {Eqpt. Loss <$50,000; Downtime <4 days}

Table A.1-3 summarizes the probability categories established by the BGRR-ASA. They are based on the likelihood of the potential consequences occurring for a given hazard.

Table A.1-3

HAZARD PROBABILITY		
Category	**Descriptive Word**	**Potential Consequences**
A	Frequent	Likely to occur repeatedly during life cycle of system.
B	Probable	Likely to occur several times in life cycle of system.
C	Occasional	Likely to occur sometime in life cycle of system.
D	Remote	Not likely to occur in life cycle of system, but possible.
E	Extremely Remote	Probability of occurrence cannot be distinguished from zero.
F	Impossible	Physically inpossible to occur.

Table A.1-4 summarizes the risk categories established by the BGRR-ASA. Choosing a severity and a probability for a given hazard determines its risk category. Standard 1.3.3 establishes the documentation and minimum approval required for each risk category.

Table A.1-4

RISK CATEGORY						
Hazard Severity	**A Frequent**	**B Probable**	**C Occasional**	**D Remote**	**E Extremely Remote**	**F Impossible**
I Catastrophic	1. High	1. High	1. High	2. Moderate	3. Low	4. Routine
II Critical	1. High	1. High	2. Moderate	3. Low	3. Low	4. Routine
III Marginal	2. Moderate	2. Moderate	3. Low	3. Low	4. Routine	4. Routine
IV Negligible	4. Routine	4. Routine	4. Routine	4. Routine	4. Routine	4. Routine

Hazard mitigation takes the form of engineered features, administrative controls, operator training, or a combination of these. **Generally, the hazard's severity is not changed by mitigation, but its probability is reduced.**

Risk Assessment for the facility is given on the following pages where operator's error, equipment/system failure, an accident or natural phenomenon is the initiating event. Each event is analyzed on four tables: Hazard, Risk Assessment Before Mitigation, Hazard Mitigation, and Risk Assessment After Mitigation.

The Hazard table first identifies the initiating event and lists its possible consequences and its specific hazards. A list of potential initiators is also given.

The Hazard-Mitigation table lists the administrative controls, training, and engineered features that will mitigate the effects of the event. The Risk-Assessment tables contrast the risk involved due to an initiating event with and without mitigation.

Risk Assessment No. A001 covering Waste Container Drop

ACTIVITY: Lower Canal & Water Treatment House, Eqpt, & Associated Soil Removal **NUMBER:** A001
HAZARD: To On-site Personnel, Equipment, Environment

Event:	Waste Container Drop
Possible Consequences & Hazards:	Damage to facility structures / equipment Release of radioactive materials / radiation to the environment Exposure to radioactive materials through ingestion, inhalation, or dermal exposure Equipment, facility or personnel contamination Injury to worker Project delays / interruptions
Potential Initiators:	Natural phenomena, manufacturer defect, missile strike, operator error

Risk Assessment Prior to Mitigation

Severity:	I ( ) Catastrophic	II ( ) Critical	III ( ) Marginal	IV (X) Negligible		
Probability:	A ( ) Frequent	B (X) Probable	C ( ) Occasional	D ( ) Remote	E ( ) Extr Remote	F ( ) Impossible
Risk Category:	1 ( ) High	2 ( ) Moderate	3 ( ) Low	4 (X) Routine		

Hazard Mitigation:	Limited radiological inventory at risk and available for release from Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal (<<Nuclear Hazard Category 3 Threshold), based on the survey and sampling analysis data collected to date. Additional limitation on fraction of entire inventory available for release due to waste container drop as a result of the strength of the Strong Tight Containers, the applied barrier fixative, physical forms and distribution of inventory materials, and the sequential nature of the Lower Canal & Water Treatment House, Equipment & Associated Soil Removal. Use of approved Work Control Permit, Radiological Work Permit (including specific contamination mitigation measures), Task-specific Technical Work Documents, Task-specific Job Safety Analyses. Performance of work by trained and qualified personnel, familiar with the requirements of ERD-OPM-2.1 - Work Planning and Control for Operations, and BNL ES&H Manual Stds,1.6.0 - Material Handling - Equipment & Procedures, 1.6.1 - Material Handling - Operator Training & Qualification Use of Pre-job briefings and Pre-Start Checklists.

Risk Assessment Following Mitigation

Severity:	I ( ) Catastrophic	II ( ) Critical	III ( ) Marginal	IV (X) Negligible		
Probability:	A ( ) Frequent	B ( ) Probable	C (X) Occasional	D ( ) Remote	E ( ) ExtrRemote	F ( ) Impossible
Risk Category:	1 ( ) High	2 ( ) Moderate	3 ( ) Low	4 (X) Routine		

Description - Waste Container Drop

Hazard Probability (as defined in Table A.1-3)
The waste containers to be used during the Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal will be Sealand Containers, B-52, B-25 and/or B-12 boxes; with lids (strong tight containers). They will be moved only with appropriately load rated cranes, forklifts or front end loaders. Based upon collective experiences with waste container movements, both on-site and at commercial nuclear decommissioning sites; it is conservatively assumed that the unmitigated probability of a waste container drop is higher than that of a crane load drop (which was designated 'Occasional' in the BGRR-ASA). The next higher probability frequency class is '**PROBABLE**' (likely to occur several times in the life cycle of system).

Considering the mitigation factors listed in Risk Assessment No. A001, as well as the limited life cycle remaining (time required to perform Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal estimated at **183** days), the post-mitigation probability is reduced to '**OCCASIONAL**' (likely to occur sometime in the life-cycle of the system).

Hazard Severity (as defined by Table A.1-2)
Since the Canal and Water Treatment Houses were shutdown after all the BGRR fuel was removed from BNL site many years ago; there are no programmatic delays or repair costs associated with any damage to the Canal and Water Treatment Houses, caused by any Waste Container Drop. The Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal Working Area will be posted as a radiological control area with restrictions on access; so the potential for personnel injury or illness will be small. This is especially true considering the expertise and qualifications of the crane and/or fork-lift operator(s) and assistants.

Due to the sequential nature of the work and the limited volume available within the waste containers, any waste container drop would be limited to only a small portion of the Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal inventory source term, here assumed not to exceed **25%** of the total. In Appendix B - Source Term Development, the following radiological inventory was developed for the Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal

Isotope	Inventory [Ci]	Cat 3 Threshold [Ci]	Cat 3 Threshold Fraction
H-3	6.25E-04	1.60E+04	3.91E-08
C-14	1.09E-04	4.20E+02	2.59E-07
Fe-55	9.78E-07	5.40E+03	1.81E-10
Co-60	3.89E-04	2.80E+02	1.39E-06
Ni-63	1.65E-03	5.40E+03	3.05E-07
Sr-90	5.74E-02	1.60E+01	3.59E-03
Y-90	5.74E-02	1.42E+03	4.04E-05
Tc-99	2.49E-05	1.70E+03	1.46E-08
I-129	8.15E-06	6.00E-02	1.36E-04
Cs-137	2.00E-01	6.00E+01	3.33E-03
Eu-152	2.62E-04	2.00E+02	1.31E-06
Eu-154	1.27E-04	2.00E+02	6.35E-07
Eu-155	8.29E-06	9.40E+02	8.82E-09
Ra-226	1.98E-04	1.20E+01	1.65E-05
Th-232	3.63E-06	1.00E-01	3.63E-05
U-234	5.59E-05	4.20E+00	1.33E-05
U-235	2.62E-06	4.20E+00	6.24E-07
U-238	4.92E-05	4.20E+00	1.17E-05
Pu-238	9.63E-05	6.20E- 01	1.55E-04
Pu-239/40	5.86E-03	5.20E- 01	1.13E-02
Pu-241	8.37E-03	3.20E+01	2.62E-04
Am-241	1.38E-03	5.20E- 01	2.66E-03
			SUM= 2.15E-02

Based upon the guidance of DOE-STD-1027-92, Attachment 1 [Ref. 5], 25% of the inventory above corresponds to a maximal potential dose of less than **54 mrem** effective whole body; where projected dose is 10 rem for the release of 100% of the Hazard Category 3 threshold and calculated at 30 meters from point of release for one day of inhalation and direct exposure, while the ingestion pathway is determined over a longer period of time.

The potential consequences discussed here most closely correspond to the definition of Hazard Severity **NEGLIGIBLE** (per Table A.1-2, Hazard Severity).

Risk Category (as defined by Table A.1-4)

Both the pre-mitigation combination of Severity = **NEGLIGIBLE** with Probability = **PROBABLE**, and the post-mitigation combination of Severity = **NEGLIGIBLE** with Probability = **OCCASIONAL**, define the risk category as **ROUTINE** for the activities under this USID/SE.

Risk Assessment No. A002 covering Contaminated Waste Bag Rupture/Fire

ACTIVITY: Lower Canal & Water Treatment House, Eqpt, & Associated Soil Removal **NUMBER:** A002
HAZARD: To On-site Personnel, Equipment, Environment

Event:	Contaminated Waste Bag Rupture/Fire
Possible Consequences & Hazards:	Radiation exposure to on-site personnel. Release of radioactive materials / radiation to the building and/or environment. Exposure to radioactive materials through ingestion, inhalation, and/or dermal exposure. Contamination of building, equipment and/or environment Project delays.
Potential Initiators:	Natural phenomenon, operator's error, failure of equipment.

Risk Assessment Prior to Mitigation

Severity	I ( ) Catastrophic	II ( ) Critical	III ( ) Marginal	IV (X) Negligible		
Probability	A ( ) Frequent	B (X) Probable	C ( ) Occasional	D ( ) Remote	E ( ) Extr Remote	F ( ) Impossible
Risk Category	1 ( ) High	2 ( ) Moderate	3 ( ) Low	4 (X) Routine		

Hazard Mitigation:	Limited radiological inventory at risk and available for release from Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal (<<Nuclear Hazard Category 3 Threshold), based on the survey and sampling analysis data collected to date. Additional limitation on fraction of entire inventory available as a result of the applied fixative, physical forms and distribution of inventory materials, capacity of contaminated waste storage bag and sequential nature of Lower Canal & Water Treatment House, Equipment & Associated Soil Removal. Limitations on use of combustible materials for the Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal and restrictions on storing combustible material near the job-site. Use of approved Work Control Permit, Radiological Work Permit (including specific contamination mitigation measures), Task-specific Technical Work Documents, and Task-specific Job Safety Analyses Performance of work by trained and qualified personnel, familiar with the requirements of ERD-OPM-2.1, Work Planning and Control for Operations, Institutional BNL Rad Con Procedures Use of Pre-job briefings and Pre-Start Checklists. Coverage of work by trained and qualified Radiological Control Technicians. Assignment of a dedicated Waste Management Representative to project, providing expertise in the minimization and disposal of contaminated waste. Area protected against direct lightning strike by proximity of Reactor stack (preferred target due to height).

Risk Assessment Following Mitigation

Severity:	I ( ) Catastrophic	II ( ) Critical	III ( ) Marginal	IV (X) Negligible		
Probability:	A ( ) Frequent	B ( ) Probable	C (X) Occasional	D ( ) Remote	E ( ) Extr Remote	F ( ) Impossible
Risk Category:	1 ( ) High	2 ( ) Moderate	3 ( ) Low	4 (X) Routine		

Description - Contaminated Waste Bag Rupture/Fire

Hazard Probability (as defined in Table A.1-3)
Table 11.3-3, "Summary of Maximum-Exposed Individual Radiation Doses from Postulated BWR Decommissioning Accidents" of NUREG/CR-0672 [Ref. 12], gives frequency of occurrence for some specific decommissioning related activity accidents with releases. Among the incidents listed are: Vacuum Filter Bag Rupture with frequency = Medium (with Medium defined as below 10^{-2} per year and above 10^{-5} per year, which corresponds to 'Occasional' from Table A.1-3); and Combustible Waste Fire with frequency = High (with High defined as above 10^{-2} per year, which corresponds to 'Probable' from Table A.1-3). Assuming the more conservative value as representative of the Contaminated Waste Bag Rupture/Fire, makes the unmitigated probability '**PROBABLE**' (likely to occur several times in the life cycle of the system).

Considering the mitigation factors listed in Risk Assessment No. A002, as well as the limited life cycle remaining (time required to perform Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal estimated at **183** days), the post-mitigation probability is reduced to '**OCCASIONAL**' (likely to occur sometime in the life-cycle of the system).

Hazard Severity (as defined by Table A.1-2)
Since the Canal and Water Treatment House were shutdown after all the BGRR fuel was removed from BNL site many years ago; there are no programmatic delays or repair costs associated with any damage to the Canal and Water Treatment House, caused by any Contaminated Waste Bag Rupture/Fire. The Lower Canal & Water Treatment House, Equipment & Associated Soil Removal Working Area will be posted as a radiological control area with restrictions on access; so the potential for personnel injury or illness will be small. This is especially true considering the small size of the accident under consideration here.

Due to the limited volume available within a contaminated waste bag, any contaminated waste bag rupture/fire would be limited to only a small portion of inventory source term; assumed not to exceed 10% (as was already used in the approved BGRR-SE-99-02 [Ref. 11]). In Appendix B - Source Term Development, the following radiological inventory was developed for the Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal

Isotope	Inventory [Ci]	Cat 3 Threshold [Ci]	Cat 3 Threshold Fraction
H-3	6.25E-04	1.60E+04	3.91E-08
C-14	1.09E-04	4.20E+02	2.59E-07
Fe-55	9.78E-07	5.40E+03	1.81E-10
Co-60	3.89E-04	2.80E+02	1.39E-06
Ni-63	1.65E-03	5.40E+03	3.05E-07
Sr-90	5.74E-02	1.60E+01	3.59E-03
Y-90	5.74E-02	1.42E+03	4.04E-05
Tc-99	2.49E-05	1.70E+03	1.46E-08
I-129	8.15E-06	6.00E-02	1.36E-04
Cs-137	2.00E-01	6.00E+01	3.33E-03
Eu-152	2.62E-04	2.00E+02	1.31E-06
Eu-154	1.27E-04	2.00E+02	6.35E-07
Eu-155	8.29E-06	9.40E+02	8.82E-09
Ra-226	1.98E-04	1.20E+01	1.65E-05
Th-232	3.63E-06	1.00E-01	3.63E-05
U-234	5.59E-05	4.20E+00	1.33E-05
U-235	2.62E-06	4.20E+00	6.24E-07
U-238	4.92E-05	4.20E+00	1.17E-05
Pu-238	9.63E-05	6.20E- 01	1.55E-04
Pu-239/40	5.86E-03	5.20E- 01	1.13E-02
Pu-241	8.37E-03	3.20E+01	2.62E-04
Am-241	1.38E-03	5.20E- 01	2.66E-03
			SUM= 2.15E-02

Based upon the guidance of DOE-STD-1027-92, Attachment 1 [Ref. 5], 10% of the inventory above corresponds to a maximal potential dose of less than **22 mrem** effective whole body; where projected dose is 10 rem for the release of 100% of the Hazard Category 3 threshold and calculated at 30 meters from point of release for one day of inhalation and direct exposure, while the ingestion pathway is determined over a longer period of time.

The potential consequences discussed here most closely correspond to the definition of Hazard Severity '**NEGLIGIBLE**' (per Table A.1-2, Hazard Severity).

Risk Category (as defined by Table A.1-4)
Both the pre-mitigation combination of Severity = **NEGLIGIBLE** with Probability = **PROBABLE**, and the post-mitigation combination of Severity = **NEGLIGIBLE** with Probability = **OCCASIONAL**, define the risk category as **ROUTINE** for the activities under this USID/SE.

Risk Assessment No. A003 covering Explosion of LPG Leaked from a Forklift

ACTIVITY: Lower Canal & Water Treatment House, Eqpt, & Associated Soil Removal **NUMBER:** A003
HAZARD: To On-site Personnel, Equipment, Environment

Event:	Explosion of LPG Leaked from a Front End Loader (Forklift)
Possible Consequences & Hazards:	Fire / blast wave Contamination of area, equipment and/or environment Injury to worker Release of radioactive materials / radiation to the environment. Exposure to radioactive materials through ingestion, inhalation, and dermal exposure. Project delays / work plan interruptions
Potential Initiators:	Equipment failure, operator error, material handling vehicle failure / collision, missile strike

Risk Assessment Prior to Mitigation

Severity:	I ( ) Catastrophic	II ( ) Critical	III ( ) Marginal	IV (X) Negligible		
Probability:	A ( ) Frequent	B ( ) Probable	C ( ) Occasional	D (X) Remote	E ( ) Extr Remote	F ( ) Impossible
Risk Category:	1 ( ) High	2 ( ) Moderate	3 ( ) Low	4 (X) Routine		

Hazard Mitigation:	Limited radiological inventory at risk and available for release from Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal (<<Nuclear Hazard Category 3 Threshold), based on the survey and sampling analysis data collected to date. Additional limitation on fraction of entire inventory available as a result of the applied fixative, physical forms and distribution of inventory materials, and the sequential nature of the Lower Canal & Water Treatment House, Equipment & Associated Soil Removal. Limitations on use of combustible materials for the Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal and restrictions on the storage of combustible material near the job-site. Use of approved Work Control Permit, Radiological Work Permit, Task-specific Technical Work Documents, and Task-specific Job Safety Analyses. Performance of work by trained and qualified personnel, familiar with the requirements of ERD-OPM-2.1, Work Planning and Control for Operations, and BNL ES&H Manual Stds; 1.6.0 - Material Handling - Equipment & Procedures, 1.6.1 - Material handling - Operator Training & Qualification . Use of Pre-job briefings and Pre-Start Checklists.

Risk Assessment Following Mitigation

Severity:	I ( ) Catastrophic	II ( ) Critical	III ( ) Marginal	IV (X) Negligible		
Probability:	A ( ) Frequent	B ( ) Probable	C ( ) Occasional	D ( ) Remote	E (X) Extr Remote	F ( ) Impossible
Risk Category:	1 ( ) High	2 ( ) Moderate	3 ( ) Low	4 (X) Routine		

Description - Explosion of LPG Leaked from a Forklift

Hazard Probability (as defined in Table A.1-3)

Table 11.3-3, "Summary of Maximum-Exposed Individual Radiation Doses from Postulated BWR Decommissioning Accidents" of NUREG/CR-0672 [Ref. 12], gives the frequency of occurrence for some specific decommissioning related activity accidents with releases. Among the incidents listed is, Explosion of LPG Leaked from a Front-end Loader with frequency = Low (with Low defined as below 10^{-5} per year). Assuming comparable frequency here makes the unmitigated probability '**REMOTE**' (not likely to occur in life cycle of system, but possible).

Considering the mitigation factors listed in Risk Assessment No. A003, as well as the limited life cycle remaining (time required to perform Above Ground Duct Removal estimated at **183** days), the post-mitigation probability is reduced to '**EXTREMELY REMOTE**' (probability of occurrence cannot be distinguished from zero).

Hazard Severity (as defined by Table A.1-2)

Since the Canal and Water Treatment House were shutdown after all of the BGRR fuel was removed from BNL site many years ago; there are no programmatic delays or repair costs associated with any damage to the Lower Canal and Water Treatment House, caused by any Explosion of LPG Leaked from a Front-end Loader (beyond those associated with the Accident Investigation). The Lower Canal & Water Treatment House, Equipment & Associated Soil Removal Working Area will be posted for radiological control with restrictions on access; so the potential for personnel injury or illness will be small. This is especially true considering the expertise and qualifications of the fork-lift operator(s) and assistants.

Due to the sequential nature of the work, the limited volume (hence inventory) available within any waste container being carried at the time and the limited amount of nearby dispersible material available to additionally go airborne, any release due to an explosion of LPG leaked from a front-end loader would be limited to only a portion of the Lower Canal & Water Treatment House, Equipment & Associated Soil Removal inventory source term, assumed not to exceed 35% (25% + 10%). In Appendix B - Source Term Development, the following radiological inventory was developed for the Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal

Isotope	Inventory [Ci]	Cat 3 Threshold [Ci]	Cat 3 Threshold Fraction
H-3	6.25E-04	1.60E+04	3.91E-08
C-14	1.09E-04	4.20E+02	2.59E-07
Fe-55	9.78E-07	5.40E+03	1.81E-10
Co-60	3.89E-04	2.80E+02	1.39E-06
Ni-63	1.65E-03	5.40E+03	3.05E-07
Sr-90	5.74E-02	1.60E+01	3.59E-03
Y-90	5.74E-02	1.42E+03	4.04E-05
Tc-99	2.49E-05	1.70E+03	1.46E-08
I-129	8.15E-06	6.00E-02	1.36E-04
Cs-137	2.00E-01	6.00E+01	3.33E-03
Eu-152	2.62E-04	2.00E+02	1.31E-06
Eu-154	1.27E-04	2.00E+02	6.35E-07
Eu-155	8.29E-06	9.40E+02	8.82E-09
Ra-226	1.98E-04	1.20E+01	1.65E-05
Th-232	3.63E-06	1.00E-01	3.63E-05
U-234	5.59E-05	4.20E+00	1.33E-05
U-235	2.62E-06	4.20E+00	6.24E-07
U-238	4.92E-05	4.20E+00	1.17E-05
Pu-238	9.63E-05	6.20E- 01	1.55E-04
Pu-239/40	5.86E-03	5.20E- 01	1.13E-02
Pu-241	8.37E-03	3.20E+01	2.62E-04
Am-241	1.38E-03	5.20E- 01	2.66E-03
			SUM= 2.15E-02

Based upon the guidance of DOE-STD-1027-92, Attachment 1 [Ref. 5], 35% of the inventory above corresponds to a maximal potential dose of less than **76 mrem** effective whole body; where projected dose is 10 rem for the release of 100% of the Hazard Category 3 threshold and calculated at 30 meters from point of release for one day of inhalation and direct exposure, while the ingestion pathway is determined over a longer period of time.

The potential consequences discussed here most closely correspond to the definition of Hazard Severity '**NEGLIGIBLE**' (per Table A.1-2, Hazard Severity).

Risk Category (as defined by Table A.1-4)
Both the pre-mitigation combination of Severity = **NEGLIGIBLE** with Probability = **REMOTE**, and the post-mitigation combination of Severity = **NEGLIGIBLE** with Probability = **EXTREMELY REMOTE**, define the risk category as **ROUTINE** for the activities under this USID/SE.

Risk Assessment No. A004 covering Oxyacetylene Explosion

ACTIVITY: Lower Canal & Water Treatment House, Eqpt, & Associated Soil Removal **NUMBER:** A004
HAZARD: To On-site Personnel, Equipment, Environment

Event:	Oxyacetylene Explosion
Possible Consequences & Hazards:	Fire / blast wave Contamination of area, equipment and/or environment Injury to worker Release of radioactive materials / radiation to the environment. Exposure to radioactive materials through ingestion, inhalation, and dermal exposure. Project delays / work plan interruptions
Potential Initiators:	Equipment failure, operator error, material handling vehicle failure / collision, missile strike

Risk Assessment Prior to Mitigation

Severity:	I ( ) Catastrophic	II ( ) Critical	III ( ) Marginal	IV (X) Negligible		
Probability:	A ( ) Frequent	B ( ) Probable	C (X) Occasional	D ( ) Remote	E ( ) Extr Remote	F ( ) Impossible
Risk Category:	1 ( ) High	2 ( ) Moderate	3 ( ) Low	4 (X) Routine		

Hazard Mitigation:	Limited radiological inventory at risk and available for release from Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal (<<Nuclear Hazard Category 3 Threshold), based on the survey and sampling analysis data collected to date. Additional limitation on fraction of entire inventory available as a result of the applied fixative, physical forms and distribution of inventory materials, and the sequential nature of the Lower Canal & Water Treatment House, Equipment & Associated Soil Removal. Limitations on use of oxyacetylene for the Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal Activities and restrictions on the storage of oxyacetylene near the job-site. Use of approved Work Control Permit, Cutting and Burning Permit, Radiological Work Permit, Task-specific Technical Work Documents, and Task-specific Job Safety Analyses. Performance of work by trained and qualified personnel, familiar with the requirements of ERD-OPM-2.1, Work Planning and Control for Operations, and BNL ES&H Manual Std 4.3.0 - Cutting and Welding . Use of Pre-job briefings and Pre-Start Checklists.

Risk Assessment Following Mitigation

Severity:	I ( ) Catastrophic	II ( ) Critical	III ( ) Marginal	IV (X) Negligible		
Probability:	A ( ) Frequent	B ( ) Probable	C ( ) Occasional	D (X) Remote	E ( ) Extr Remote	F ( ) Impossible
Risk Category:	1 ( ) High	2 ( ) Moderate	3 ( ) Low	4 (X) Routine		

Description - Oxyacetylene Explosion

Hazard Probability (as defined in Table A.1-3)

Table 11.3-3, "Summary of Maximum-Exposed Individual Radiation Doses from Postulated BWR Decommissioning Accidents" of NUREG/CR-0672 [Ref. 12], gives the frequency of occurrence for some specific decommissioning related activity accidents with releases. Among the incidents listed is, Oxyacetylene Explosion with frequency = Medium (with Medium defined as below 10^{-2} but above 10^{-5} per year). Assuming comparable frequency here makes the unmitigated probability '**OCCASIONAL**' (likely to occur sometime in life cycle of system).

Considering the mitigation factors listed in Risk Assessment No. A004, as well as the limited life cycle remaining (time required to perform Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal estimated at **183** days), the post-mitigation probability is reduced to '**REMOTE**' (not likely to occur in life cycle of system, but possible).

Hazard Severity (as defined by Table A.1-2)

Since the Lower Canal and Water Treatment House were shutdown after all of the BGRR fuel was removed from BNL site many years ago; there are no programmatic delays or repair costs associated with any damage to the Lower Canal and Water Treatment House, caused by any Oxyacetylene Explosion (beyond that associated with the Accident Investigation). The Lower Canal & Water Treatment House, Equipment & Associated Soil Removal Working Area will be posted for radiological control with restrictions on access; so the potential for personnel injury or illness will be small. This is especially true considering the expertise and qualifications of the cutting torch operator(s) and assistants.

Due to the sequential nature of the work, and limited volume (hence inventory) available nearby while torch-cutting only radiologically clean portions of Lower Canal and Water Treatment House for size reduction to facilitate off-site transfer, any release due to an oxyacetylene explosion would be limited to only a portion of the Lower Canal & Water Treatment House, Equipment & Associated Soil Removal inventory source term, assumed not to exceed 10% of the total inventory (typical per the approved BGRR-SE-99-04 [Ref. 18]). In Appendix B - Source Term Development, the following radiological inventory was developed for the Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal

Isotope	Inventory [Ci]	Cat 3 Threshold [Ci]	Cat 3 Threshold Fraction
H-3	6.25E-04	1.60E+04	3.91E-08
C-14	1.09E-04	4.20E+02	2.59E-07
Fe-55	9.78E-07	5.40E+03	1.81E-10
Co-60	3.89E-04	2.80E+02	1.39E-06
Ni-63	1.65E-03	5.40E+03	3.05E-07
Sr-90	5.74E-02	1.60E+01	3.59E-03
Y-90	5.74E-02	1.42E+03	4.04E-05
Tc-99	2.49E-05	1.70E+03	1.46E-08
I-129	8.15E-06	6.00E-02	1.36E-04
Cs-137	2.00E-01	6.00E+01	3.33E-03
Eu-152	2.62E-04	2.00E+02	1.31E-06
Eu-154	1.27E-04	2.00E+02	6.35E-07
Eu-155	8.29E-06	9.40E+02	8.82E-09
Ra-226	1.98E-04	1.20E+01	1.65E-05
Th-232	3.63E-06	1.00E-01	3.63E-05
U-234	5.59E-05	4.20E+00	1.33E-05
U-235	2.62E-06	4.20E+00	6.24E-07
U-238	4.92E-05	4.20E+00	1.17E-05
Pu-238	9.63E-05	6.20E- 01	1.55E-04
Pu-239/40	5.86E-03	5.20E- 01	1.13E-02
Pu-241	8.37E-03	3.20E+01	2.62E-04
Am-241	1.38E-03	5.20E- 01	2.66E-03
			SUM= 2.15E-02

Based upon the guidance of DOE-STD-1027-92, Attachment 1 [Ref. 5], 10% of the inventory above corresponds to a maximal potential dose of less than **22 mrem** effective whole body; where projected dose is 10 rem for the release of 100% of the Hazard Category 3 threshold and calculated at 30 meters from point of release for one day of inhalation and direct exposure, while the ingestion pathway is determined over a longer period of time.

The potential consequences discussed here most closely correspond to the definition of Hazard Severity '**NEGLIGIBLE**' (per Table A.1-2, Hazard Severity).

Risk Category (as defined by Table A.1-4)
Both the pre-mitigation combination of Severity = **NEGLIGIBLE** with Probability = **OCCASIONAL**, and the post-mitigation combination of Severity = **NEGLIGIBLE** with Probability = **REMOTE**, define the risk category as **ROUTINE** for the activities under this USID/SE.

Risk Assessment No. A005 covering Crane Load Drop

ACTIVITY: Lower Canal & Water Treatment House, Eqpt, & Associated Soil Removal **NUMBER:** A005
HAZARD: To On-site Personnel, Equipment, Environment

Event:	Crane Load Drop
Possible Consequences & Hazards:	Damage to structures / equipment Injury to worker Release of radioactive materials / radiation to the environment. Exposure to radioactive materials through ingestion, inhalation, and/or dermal exposure. Contamination of work area or equipment Project delays, work plan interruptions
Potential Initiators:	Equipment failure, operator's error, manufacturer defect, missile strike, collision

Risk Assessment Prior to Mitigation

Severity:	I ( ) Catastrophic	II ( ) Critical	III ( ) Marginal	IV (X) Negligible		
Probability:	A ( ) Frequent	B ( ) Probable	C (X) Occasional	D ( ) Remote	E ( ) Extr Remote	F ( ) Impossible
Risk Category:	1 ( ) High	2 ( ) Moderate	3 ( ) Low	4 (X) Routine		

Hazard Mitigation:	Limited radiological inventory at risk and available for release from Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal (<<Nuclear Hazard Category 3 Threshold), based on the survey and sampling analysis data collected to date. Additional limitation on fraction of entire inventory available as a result of the applied fixative, physical forms and distribution of inventory materials, and the sequential nature of the Lower Canal & Water Treatment House, Equipment & Associated Soil Removal. Use of approved Work Control Permit, Radiological Work Permit, Task-specific Technical Work Documents, and Task-specific Job Safety Analyses. Use of Pre-job briefings and Pre-start checklists. Performance of work by trained and qualified personnel, familiar with the requirements of ERD-OPM-2.1, Work Planning and Control for Operations, and BNL ES&H Manual Stds;1.6.0 - Material Handling - Equipment & Procedures, 1.6.1 - Material handling - Operator Training & Qualification. Regular inspection and maintenance of cranes.

Risk Assessment Following Mitigation

Severity:	I ( ) Catastrophic	II ( ) Critical	III ( ) Marginal	IV (X) Negligible		
Probability:	A ( ) Frequent	B ( ) Probable	C ( ) Occasional	D (X) Remote	E ( ) Extr Remote	F ( ) Impossible
Risk Category:	1 ( ) High	2 ( ) Moderate	3 ( ) Low	4 (X) Routine		

Description - Crane Load Drop

Hazard Probability (as defined in Table A.1-3)
The largest crane to be used for the Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal will be the site provided 75-Ton Cherry-Picker (wheel mounted crane with telescoping boom). The heaviest lift(s) to be made will be the removal of the concrete blocks, interior building equipment/ structure, and some soil. The crane will be inspected for safety prior to use by Plant Engineering Division, with continuing inspection and maintenance by same. As in the Crane Load Drop accident discussed in the BGRR-ASA Risk Assessment No. 006; the crane will only be operated by dedicated, trained and qualified crane-operators provided by Plant Engineering or the Sub-contractor. It was conservatively assumed in the BGRR-ASA and again here that the unmitigated probability of a Crane Load Drop was **'OCCASIONAL'** (likely to occur sometime in the life-cycle of the system).

Considering the mitigation factors listed in Risk Assessment No. A005, as well as the limited life cycle remaining (time required to perform Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal Activities estimated at **183** days), the post-mitigation probability is reduced to **'REMOTE'** (not likely to occur in life-cycle of the system but possible).

Hazard Severity (as defined by Table A.1-2)
Since the Lower Canal and Water Treatment House was shutdown after all of the BGRR fuel was removed from BNL site many years ago, there are no programmatic delays or repair costs associated with any damage to the Lower Canal and Water Treatment House, caused by any Crane Load Drop (beyond that associated with the Accident Investigation). The Lower Canal & Water Treatment House, Equipment & Associated Soil Removal Working Area will be posted for radiological control with restrictions on access; so the potential for personnel injury or illness will be small. This is especially true considering the expertise and qualifications of the crane operator(s) and assistants.

Any crane load drop would be limited to only a portion of the Lower Canal & Water Treatment House, Equipment & Associated Soil inventory source term (only one load can fall in a crane load drop). For the sake of conservatism, the entire Lower Canal and Water Treatment House source term will be assumed as releasable as a result of the event. This assumes the load being dropped lands on the rest of the structure being worked on and calls its collapse and resulting in the release of the entire inventory. In Appendix B - Source Term Development, the following radiological inventory was developed for the Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal

Isotope	Inventory [Ci]	Cat 3 Threshold [Ci]	Cat 3 Threshold Fraction
H-3	6.25E-04	1.60E+04	3.91E-08
C-14	1.09E-04	4.20E+02	2.59E-07
Fe-55	9.78E-07	5.40E+03	1.81E-10
Co-60	3.89E-04	2.80E+02	1.39E-06
Ni-63	1.65E-03	5.40E+03	3.05E-07
Sr-90	5.74E-02	1.60E+01	3.59E-03
Y-90	5.74E-02	1.42E+03	4.04E-05
Tc-99	2.49E-05	1.70E+03	1.46E-08
I-129	8.15E-06	6.00E-02	1.36E-04
Cs-137	2.00E-01	6.00E+01	3.33E-03
Eu-152	2.62E-04	2.00E+02	1.31E-06
Eu-154	1.27E-04	2.00E+02	6.35E-07
Eu-155	8.29E-06	9.40E+02	8.82E-09
Ra-226	1.98E-04	1.20E+01	1.65E-05
Th-232	3.63E-06	1.00E-01	3.63E-05
U-234	5.59E-05	4.20E+00	1.33E-05
U-235	2.62E-06	4.20E+00	6.24E-07
U-238	4.92E-05	4.20E+00	1.17E-05
Pu-238	9.63E-05	6.20E- 01	1.55E-04
Pu-239/40	5.86E-03	5.20E- 01	1.13E-02
Pu-241	8.37E-03	3.20E+01	2.62E-04
Am-241	1.38E-03	5.20E- 01	2.66E-03
			SUM= 2.15E-02

Based upon the guidance of DOE-STD-1027-92, Attachment 1[Ref. 5], a release of the entire inventory corresponds to a maximal potential dose of less than **215 mrem** effective whole body; where projected dose is 10 rem for the release of 100% of the Hazard Category 3 threshold and calculated at 30 meters from point of release for one day of inhalation and direct exposure, while the ingestion pathway is determined over a longer period of time.

The potential consequences discussed here most closely correspond to the definition of Hazard Severity **NEGLIGIBLE** (per Table A.1-2, Hazard Severity).

Risk Category (as defined by Table A.1-4)
Both the pre-mitigation combination of Severity = **NEGLIGIBLE** with Probability = **OCCASIONAL**, and the post-mitigation combination of Severity = **NEGLIGIBLE** with Probability = **REMOTE**, define the risk category as **ROUTINE** for the activities under this USID/SE.

Risk Assessment No. A006 covering Vacuum Filter Bag Rupture

ACTIVITY: Lower Canal & Water Treatment House, Eqpt, & Associated Soil Removal **NUMBER:** A006
HAZARD: To On-site Personnel, Equipment, Environment

Event:	Vacuum Filter Bag Rupture
Possible Consequences & Hazards:	Release of radioactive materials / radiation to the environment. Exposure to radioactive materials through ingestion, inhalation, and/or dermal exposure. Contamination of work area or equipment Project delays, work plan interruptions
Potential Initiators:	Equipment failure, operator's error, manufacturer defect, missile strike, collision

Risk Assessment Prior to Mitigation

Severity:	I ( ) Catastrophic	II ( ) Critical	III ( ) Marginal	IV (X) Negligible		
Probability:	A ( ) Frequent	B ( ) Probable	C (X) Occasional	D ( ) Remote	E ( ) Extr Remote	F ( ) Impossible
Risk Category:	1 ( ) High	2 ( ) Moderate	3 ( ) Low	4 (X) Routine		

Hazard Mitigation:	Limited radiological inventory at risk and available for release from Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal (<<Nuclear Hazard Category 3 Threshold), based on the survey and sampling analysis data collected to date. Additional limitation on fraction of entire inventory available as a result of the applied fixative, physical forms and distribution of inventory materials, and the sequential nature of the Lower Canal & Water Treatment House, Equipment & Associated Soil Removal. Limitations on the capacity of vacuum filter bags for the Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal Activities with routine physical inspection of and radiological measurements on the vacuum bags when used. Use of approved Work Control Permit, Cutting and Burning Permit, Radiological Work Permit, Task-specific Technical Work Documents, and Task-specific Job Safety Analyses. Performance of work by trained and qualified personnel, familiar with the requirements of ERD-OPM-2.1, Work Planning and Control for Operations. Use of Pre-job briefings and Pre-Start Checklists.

Risk Assessment Following Mitigation

Severity:	I ( ) Catastrophic	II ( ) Critical	III ( ) Marginal	IV (X) Negligible		
Probability:	A ( ) Frequent	B ( ) Probable	C ( ) Occasional	D (X) Remote	E ( ) Extr Remote	F ( ) Impossible
Risk Category:	1 ( ) High	2 ( ) Moderate	3 ( ) Low	4 (X) Routine		

Description - Vacuum Filter Bag Rupture

Hazard Probability (as defined in Table A.1-3)
Table 11.3-3, "Summary of Maximum-Exposed Individual Radiation Doses from Postulated BWR Decommissioning Accidents" of NUREG/CR-0672 [Ref. 12], gives the frequency of occurrence for some specific decommissioning related activity accidents with releases. Among the incidents listed is, Vacuum Filter Bag Rupture with frequency = Medium (with Medium defined as below 10^{-2} but above 10^{-5} per year). Assuming comparable frequency here makes the unmitigated probability '**OCCASIONAL**' (likely to occur sometime in life cycle of system).

Considering the mitigation factors listed in Risk Assessment No. A006, as well as the limited life cycle remaining (time required to perform Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal estimated at **183** days), the post-mitigation probability is reduced to '**REMOTE**' (not likely to occur in life cycle of system, but possible).

Hazard Severity (as defined by Table A.1-2)
Since the Lower Canal and Water Treatment House were shutdown after all of the BGRR fuel was removed from BNL site many years ago; there are no programmatic delays or repair costs associated with any damage to the Lower Canal and Water Treatment House, caused by any Vacuum Filter Bag Rupture. The Lower Canal & Water Treatment House, Equipment & Associated Soil Removal Working Area will be posted for radiological control with restrictions on access; so the potential for personnel injury or illness will be small. This is especially true considering the expertise and qualifications of the personnel performing the work.

Due to the sequential nature of the work, the limited volume (hence inventory) available within the vacuum filter bag and the administrative limits on the exposure level issuing from it (prompting the changing out of the vacuum filter bag); any release due to a vacuum filter bag rupture would be limited to only a small fraction of the Lower Canal & Water Treatment House, Equipment & Associated Soil Removal inventory source term, assumed not to exceed 5% of the total (typical per NUREG/CR-0672 [Ref. 12]). In Appendix B - Source Term Development, the following radiological inventory was developed for the Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal

Isotope	Inventory [Ci]	Cat 3 Threshold [Ci]	Cat 3 Threshold Fraction
H-3	6.25E-04	1.60E+04	3.91E-08
C-14	1.09E-04	4.20E+02	2.59E-07
Fe-55	9.78E-07	5.40E+03	1.81E-10
Co-60	3.89E-04	2.80E+02	1.39E-06
Ni-63	1.65E-03	5.40E+03	3.05E-07
Sr-90	5.74E-02	1.60E+01	3.59E-03
Y-90	5.74E-02	1.42E+03	4.04E-05
Tc-99	2.49E-05	1.70E+03	1.46E-08
I-129	8.15E-06	6.00E-02	1.36E-04
Cs-137	2.00E-01	6.00E+01	3.33E-03
Eu-152	2.62E-04	2.00E+02	1.31E-06
Eu-154	1.27E-04	2.00E+02	6.35E-07
Eu-155	8.29E-06	9.40E+02	8.82E-09
Ra-226	1.98E-04	1.20E+01	1.65E-05
Th-232	3.63E-06	1.00E-01	3.63E-05
U-234	5.59E-05	4.20E+00	1.33E-05
U-235	2.62E-06	4.20E+00	6.24E-07
U-238	4.92E-05	4.20E+00	1.17E-05
Pu-238	9.63E-05	6.20E- 01	1.55E-04
Pu-239/40	5.86E-03	5.20E- 01	1.13E-02
Pu-241	8.37E-03	3.20E+01	2.62E-04
Am-241	1.38E-03	5.20E- 01	2.66E-03
			SUM= 2.15E-02

Based upon the guidance of DOE-STD-1027-92, Attachment 1 [Ref. 5], 5% of the inventory above corresponds to a maximal potential dose of less than **11 mrem** effective whole body; where projected dose is 10 rem for the release of 100% of the Hazard Category 3 threshold and calculated at 30 meters from point of release for one day of inhalation and direct exposure, while the ingestion pathway is determined over a longer period of time.

The potential consequences discussed here most closely correspond to the definition of Hazard Severity '**NEGLIGIBLE**' (per Table A.1-2, Hazard Severity).

Risk Category (as defined by Table A.1-4)

Both the pre-mitigation combination of Severity = **NEGLIGIBLE** with Probability = **OCCASIONAL**, and the post-mitigation combination of Severity = **NEGLIGIBLE** with Probability = **REMOTE**, define the risk category as **ROUTINE** for the activities under this USID/SE.

Risk Assessment No. A007 covering Contamination Control Envelope Rupture

ACTIVITY: Lower Canal & Water Treatment House, Eqpt, & Associated Soil Removal **NUMBER:** A007
HAZARD: To On-site Personnel, Equipment, Environment

Event:	Contamination Control Envelope Rupture
Possible Consequences & Hazards:	Release of radioactive materials / radiation to the environment. Exposure to radioactive materials through ingestion, inhalation, and/or dermal exposure. Contamination of work area or equipment Project delays, work plan interruptions
Potential Initiators:	Equipment failure, operator's error, manufacturer defect, missile strike, collision

Risk Assessment Prior to Mitigation

Severity:	I ( ) Catastrophic	II ( ) Critical	III ( ) Marginal	IV (X) Negligible		
Probability:	A ( ) Frequent	B (X) Probable	C ( ) Occasional	D ( ) Remote	E ( ) Extr Remote	F ( ) Impossible
Risk Category:	1 ( ) High	2 ( ) Moderate	3 ( ) Low	4 (X) Routine		

Hazard Mitigation:	Limited radiological inventory at risk and available for release from Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal (<<Nuclear Hazard Category 3 Threshold), based on the survey and sampling analysis data collected to date. Additional limitation on fraction of entire inventory available as a result of the applied fixative, physical forms and distribution of inventory materials, and the sequential nature of the Lower Canal & Water Treatment House, Equipment & Associated Soil Removal. Administrative Controls on the allowable amount of radioactivity within the Contamination Control Envelope, as measured by background dose rate. Use of approved Work Control Permit, Cutting and Burning Permit, Radiological Work Permit, Task-specific Technical Work Documents, and Task-specific Job Safety Analyses. Performance of work by trained and qualified personnel, familiar with the requirements of ERD-OPM-2.1, Work Planning and Control for Operations. Use of Pre-job briefings and Pre-Start Checklists.

Risk Assessment Following Mitigation

Severity:	I ( ) Catastrophic	II ( ) Critical	III ( ) Marginal	IV (X) Negligible		
Probability:	A ( ) Frequent	B ( ) Probable	C (X) Occasional	D ( ) Remote	E ( ) Extr Remote	F ( ) Impossible
Risk Category:	1 ( ) High	2 ( ) Moderate	3 ( ) Low	4 (X) Routine		

Description - Contamination Control Envelope Rupture

Hazard Probability (as defined in Table A.1-3)
Table 11.3-3, "Summary of Maximum-Exposed Individual Radiation Doses from Postulated BWR Decommissioning Accidents" of NUREG/CR-0672 [Ref. 12], gives the frequency of occurrence for some specific decommissioning related activity accidents with releases. Among the incidents listed is, Contamination Control Envelope Rupture with frequency = High (with High defined as above 10^{-2} per year). Assuming comparable frequency here makes the unmitigated probability '**PROBABLE**' (likely to occur several times in life cycle of system).

Considering the mitigation factors listed in Risk Assessment No. A007, as well as the limited life cycle remaining (time required to perform Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal estimated at **183** days), the post-mitigation probability is reduced to '**OCCASIONAL**' (likely to occur sometime in life cycle of system).

Hazard Severity (as defined by Table A.1-2)
Since the Lower Canal and Water Treatment House were shutdown after all of the BGRR fuel was removed from BNL site many years ago; there are no programmatic delays or repair costs associated with any damage to the Lower Ground Canal and Water Treatment House, caused by any Contamination Control Envelope Rupture. The Lower Canal & Water Treatment House, Equipment & Associated Soil Removal Working Area will be posted for radiological control with restrictions on access; so the potential for personnel injury or illness will be small. This is especially true considering the expertise and qualifications of the personnel performing the work.

Due to the sequential nature of the work, the limited volume (hence inventory) in communication with the Contamination Control Envelope, and administrative controls on the buildup of background levels of activity or contamination within the contamination control envelope; any release due to a contamination control envelope bag rupture would be limited to only a small fraction of the Lower Canal & Water Treatment House, Equipment & Associated Soil Removal inventory source term, assumed not to exceed 20% of entire inventory (typical per NUREG/CR-0672 [Ref. 12]). In Appendix B - Source Term Development, the following radiological inventory was developed for the Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal

Isotope	Inventory [Ci]	Cat 3 Threshold [Ci]	Cat 3 Threshold Fraction
H-3	6.25E-04	1.60E+04	3.91E-08
C-14	1.09E-04	4.20E+02	2.59E-07
Fe-55	9.78E-07	5.40E+03	1.81E-10
Co-60	3.89E-04	2.80E+02	1.39E-06
Ni-63	1.65E-03	5.40E+03	3.05E-07
Sr-90	5.74E-02	1.60E+01	3.59E-03
Y-90	5.74E-02	1.42E+03	4.04E-05
Tc-99	2.49E-05	1.70E+03	1.46E-08
I-129	8.15E-06	6.00E-02	1.36E-04
Cs-137	2.00E-01	6.00E+01	3.33E-03
Eu-152	2.62E-04	2.00E+02	1.31E-06
Eu-154	1.27E-04	2.00E+02	6.35E-07
Eu-155	8.29E-06	9.40E+02	8.82E-09
Ra-226	1.98E-04	1.20E+01	1.65E-05
Th-232	3.63E-06	1.00E-01	3.63E-05
U-234	5.59E-05	4.20E+00	1.33E-05
U-235	2.62E-06	4.20E+00	6.24E-07
U-238	4.92E-05	4.20E+00	1.17E-05
Pu-238	9.63E-05	6.20E- 01	1.55E-04
Pu-239/40	5.86E-03	5.20E- 01	1.13E-02
Pu-241	8.37E-03	3.20E+01	2.62E-04
Am-241	1.38E-03	5.20E- 01	2.66E-03
			SUM= 2.15E-02

Based upon the guidance of DOE-STD-1027-92, Attachment 1 [Ref. 5], 20% of this Cat 3 threshold fractional sum (2.15E-02) corresponds to a maximal potential dose of less than **43 mrem** effective whole body; where projected dose is 10 rem for the release of 100% of the Hazard Category 3 threshold and calculated at 30 meters from point of release for one day of inhalation and direct exposure, while the ingestion pathway is determined over a longer period of time.

The potential consequences discussed here most closely correspond to the definition of Hazard Severity '**NEGLIGIBLE**' (per Table A.1-2, Hazard Severity).

Risk Category (as defined by Table A.1-4)
Both the pre-mitigation combination of Severity = **NEGLIGIBLE** with Probability = **PROBABLE**, and the post-mitigation combination of Severity = **NEGLIGIBLE** with Probability = **OCCASIONAL**, define the risk category as **ROUTINE** for the activities under this USID/SE.

Risk Assessment Summary

This section and Tables A.1-5 and A.1-6 summarize the Risk Assessment for the Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal given above. Seven types of events are addressed under the Risk Assessment for the Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal in this Safety Evaluation for Unreviewed Safety Issue Determination for the activities covered:

- 001 Waste Container Drop
- 002 Contaminated Waste Bag Rupture/Fire
- 003 Explosion of LPG Leaked from a Forklift
- 004 Oxyacetylene Explosion
- 005 Crane Load Drop
- 006 Vacuum Filter Bag Rupture
- 007 Contamination Control Envelope Rupture

These are discussed in detail as part of the Abnormal Operations Assessment above. These failure modes represent the known or anticipated types possible for the Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal. The specific examples represent the most severe combination of consequences and frequency deemed credible. Thus, each separate Risk Assessment Table represents an individual envelope encompassing a variety of similar or related events whose severity and probability fall within the bounds of the specific event. Each such event includes all lesser similar ones with lower overall risk (a product of the functions of severity or consequence, and probability or frequency). This combination of assorted types of events caused by any of a variety of potential initiators defines a bounding spectrum of accidents. The spectrum can cover or subtend numerous specific but unnamed incidents under their overlapping umbrellas, so long as the specific event does not exceed the envelope for the type it represents.

As summarized in the tables below, with the administrative controls and mitigating factors considered, only **ROUTINE** risks are associated with the Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal scope described in this USID/SE.

Table A.1-5

PRE-MITIGATION RISK CATEGORIES				
No.	**Event**	**Hazard Severity (1)**	**Hazard Frequency (1)**	**Risk (2)**
A001	Waste Container Drop	Negligible	Probable	Routine
A002	Contaminated Waste Bag Rupure/Fire	Negligible	Probable	Routine
A003	Explosion of LPG Leaked from a Forklift	Negligible	Remote	Routine
A004	Oxyacetylene Explosion	Negligible	Occasional	Routine
A005	Crane Load Drop	Negligible	Occasional	Routine
A006	Vacuum Filter Bag Rupture	Negligible	Occasional	Routine
A007	Contamination Control Envelope Rupture	Negligible	Probable	Routine

1. Severity and frequency are discussed in Section A.1-2.
2. Risk (based on severity and frequency) is defined in Table A.1-4.

Table A.1-6

POST-MITIGATION RISK CATEGORIES				
No.	**Event**	**Hazard Severity (1)**	**Hazard Frequency (1)**	**Risk (2)**
A001	Waste Container Drop	Negligible	Occasional	Routine
A002	Contaminated Waste Bag Rupture/Fire	Negligible	Occasional	Routine
A003	Explosion of LPG Leaked from a Forklift	Negligible	Extremely Remote	Routine
A004	Oxyacetylene Explosion	Negligible	Remote	Routine
A005	Crane Load Drop	Negligible	Remote	Routine
A006	Vacuum Filter Bag Rupture	Negligible	Remote	Routine
A007	Contamination Control Envelope Rupture	Negligible	Occasional	Routine

1. Severity and frequency are discussed in Section A.1-2.
2. Risk (based on severity and frequency) is defined in Table A.1-4.

The Risk Assessment concludes that all events with or without mitigation present only a Routine Risk. This analysis did not postulate any accidents or natural phenomena that could result in a credible release mechanism for any radiological inventories other than those discussed above and in Appendix B - Source Term Development. Therefore, it is the conclusion of this analysis that the Lower Canal & Water Treatment House, Equipment, & Associated Soil Removal does not represent a significant risk to the public, the environment or the workers on the BGRR Decommissioning Project.

APPENDIX B

SOURCE TERM DEVELOPMENT

BGRR-SE-01-02 Source Term Inventory - Total

as of 06/08/01

RADIO-NUCLIDE	(1) HALF LIFE [Yr]	(2) TOTAL ACTIVITY [Ci]	(3) HAZ.CAT. 3 THRESHOLD [Ci]	(4) HAZ.CAT. 3 FRACTION	(1) HAZ.CAT. 2 THRESHOLD [Ci]	(5) HAZ.CAT. 2 FRACTION
003H	1.23E+01	6.25E-04	1.60E+04	3.91E-08	2.90E+05	2.16E-09
014C	5.73E+03	1.09E-04	4.20E+02	2.59E-07	1.38E+06	7.88E-11
055Fe	2.70E+00	9.78E-07	5.40E+03	1.81E-10	1.11E+07	8.83E-14
060Co	5.27E+00	3.89E-04	2.80E+02	1.39E-06	1.92E+05	2.02E-09
063Ni	1.00E+02	1.65E-03	5.40E+03	3.05E-07	4.54E+06	3.63E-10
090Sr	2.88E+01	5.74E-02	1.60E+01	3.59E-03	2.21E+04	2.60E-06
090Y	7.31E-03	5.74E-02	1.42E+03	4.04E-05	4.30E+05	1.34E-07
099Tc	2.14E+05	2.49E-05	1.70E+03	1.46E-08	3.88E+06	6.40E-12
129I	1.57E+07	8.15E-06	6.00E-02	1.36E-04	4.30E+05	1.89E-11
137Cs	3.02E+01	2.00E-01	6.00E+01	3.33E-03	8.65E+04	2.31E-06
152Eu	1.30E+01	2.62E-04	2.00E+02	1.31E-06	1.36E+05	1.93E-09
154Eu	8.50E+00	1.27E-04	2.00E+02	6.35E-07	1.15E+05	1.11E-09
155Eu	4.90E+00	8.29E-06	9.40E+02	8.82E-09	7.53E+05	1.10E-11
226Ra	1.60E+03	1.98E-04	1.20E+01	1.65E-05	5.50E+01	3.61E-06
232Th	1.41E+10	3.63E-06	1.00E-01	3.63E-05	1.75E+01	2.08E-07
234U	2.45E+05	5.59E-05	4.20E+00	1.33E-05	2.22E+02	2.52E-07
235U	7.04E+08	2.62E-06	4.20E+00	6.24E-07	2.38E+02	1.10E-08
238U	4.47E+09	4.92E-05	4.20E+00	1.17E-05	2.39E+02	2.06E-07
238Pu	8.77E+01	9.63E-05	6.20E-01	1.55E-04	6.17E+01	1.56E-06
239/40Pu	2.44E+04	5.86E-03	5.20E-01	1.13E-02	5.52E+01	1.06E-04
241Pu	1.44E+01	8.37E-03	3.20E+01	2.62E-04	2.89E+03	2.90E-06
241Am	4.33E+02	1.38E-03	5.20E-01	2.66E-03	5.48E+01	2.52E-05
SUM				2.15E-02		1.45E-04
			==========>	2.15E+02 mRem for total release		

1) Values taken from LA-12846-MS, "Specific Activities and DOE-STD-1027-92 Hazard Category 2 Thresholds"
2) Values as calculated on the following pages.
3) Values taken from LA-12981-MS, "Table of DOE-STD-1027-92 Hazard Category 3 Threshold Quantities for the ICRP-30 list of 757 Radionuclides" (except for Tritium whose value was taken from Change 1 to DOE-STD-1027-92).
4) Values developed by dividing the actual isotopic inventory by the respective Haz Cat 3 Threshold.
5) Values developed by dividing the actual isotopic inventory by the respective Haz Cat 2 Threshold.

BGRR-SE-01-02 Source Term Inventory - Soil

as of 04/16/01

	(1)	(2)	(3)	(4)	(1)	(5)
RADIO-NUCLIDE	HALF LIFE [Yr]	TOTAL ACTIVITY [Ci]	HAZ.CAT. 3 THRESHOLD [Ci]	HAZ.CAT. 3 FRACTION	HAZ.CAT. 2 THRESHOLD [Ci]	HAZ.CAT. 2 FRACTION
003H	1.23E+01	5.61E-04	1.60E+04	3.51E-08	2.90E+05	1.93E-09
014C	5.73E+03	9.77E-05	4.20E+02	2.33E-07	1.38E+06	7.07E-11
055Fe	2.70E+00	8.77E-07	5.40E+03	1.62E-10	1.11E+07	7.91E-14
060Co	5.27E+00	3.48E-04	2.80E+02	1.24E-06	1.92E+05	1.81E-09
063Ni	1.00E+02	1.48E-03	5.40E+03	2.74E-07	4.54E+06	3.26E-10
090Sr	2.88E+01	5.15E-02	1.60E+01	3.22E-03	2.21E+04	2.33E-06
090Y	7.31E-03	5.15E-02	1.42E+03	3.63E-05	4.30E+05	1.20E-07
099Tc	2.14E+05	2.23E-05	1.70E+03	1.31E-08	3.88E+06	5.74E-12
129I	1.57E+07	7.31E-06	6.00E-02	1.22E-04	4.30E+05	1.70E-11
137Cs	3.02E+01	1.79E-01	6.00E+01	2.98E-03	8.65E+04	2.07E-06
152Eu	1.30E+01	2.35E-04	2.00E+02	1.18E-06	1.36E+05	1.73E-09
154Eu	8.50E+00	1.14E-04	2.00E+02	5.70E-07	1.15E+05	9.94E-10
155Eu	4.90E+00	7.44E-06	9.40E+02	7.91E-09	7.53E+05	9.87E-12
226Ra	1.60E+03	1.78E-04	1.20E+01	1.48E-05	5.50E+01	3.24E-06
232Th	1.41E+10	3.26E-06	1.00E-01	3.26E-05	1.75E+01	1.86E-07
234U	2.45E+05	5.01E-05	4.20E+00	1.19E-05	2.22E+02	2.26E-07
235U	7.04E+08	2.35E-06	4.20E+00	5.60E-07	2.38E+02	9.88E-09
238U	4.47E+09	4.41E-05	4.20E+00	1.05E-05	2.39E+02	1.85E-07
238Pu	8.77E+01	8.64E-05	6.20E-01	1.39E-04	6.17E+01	1.40E-06
239/40Pu	2.44E+04	5.26E-03	5.20E-01	1.01E-02	5.52E+01	9.53E-05
241Pu	1.44E+01	7.51E-03	3.20E+01	2.35E-04	2.89E+03	2.60E-06
241Am	4.33E+02	1.24E-03	5.20E-01	2.38E-03	5.48E+01	2.26E-05
SUM				1.93E-02		1.30E-04
			==========>	1.93E+02 mRem for total release		

1) Values taken from LA-12846-MS, "Specific Activities and DOE-STD-1027-92 Hazard Category 2 Thresholds"
2) Values as calculated on the following pages.
3) Values taken from LA-12981-MS, "Table of DOE-STD-1027-92 Hazard Category 3 Threshold Quantities for the ICRP-30 list of 757 Radionuclides" (except for Tritium whose value was taken from Change 1 to DOE-STD-1027-92).
4) Values developed by dividing the actual isotopic inventory by the respective Haz Cat 3 Threshold.
5) Values developed by dividing the actual isotopic inventory by the respective Haz Cat 2 Threshold.

BGRR-SE-01-02 Source Term Inventory - Concrete

as of 04/16/01

RADIO-NUCLIDE	HALF LIFE [Yr] (1)	TOTAL ACTIVITY [Ci] (2)	HAZ.CAT. 3 THRESHOLD [Ci] (3)	HAZ.CAT. 3 FRACTION (4)	HAZ.CAT. 2 THRESHOLD [Ci] (1)	HAZ.CAT. 2 FRACTION (5)
003H	1.23E+01	6.43E-05	1.60E+04	4.02E-09	2.90E+05	2.22E-10
014C	5.73E+03	1.12E-05	4.20E+02	2.67E-08	1.38E+06	8.10E-12
055Fe	2.70E+00	1.01E-07	5.40E+03	1.87E-11	1.11E+07	9.11E-15
060Co	5.27E+00	3.99E-05	2.80E+02	1.43E-07	1.92E+05	2.08E-10
063Ni	1.00E+02	1.69E-04	5.40E+03	3.13E-08	4.54E+06	3.72E-11
090Sr	2.88E+01	5.91E-03	1.60E+01	3.69E-04	2.21E+04	2.68E-07
090Y	7.31E-03	5.91E-03	1.42E+03	4.16E-06	4.30E+05	1.37E-08
099Tc	2.14E+05	2.55E-06	1.70E+03	1.50E-09	3.88E+06	6.57E-13
129I	1.57E+07	8.38E-07	6.00E-02	1.40E-05	4.30E+05	1.95E-12
137Cs	3.02E+01	2.05E-02	6.00E+01	3.42E-04	8.65E+04	2.37E-07
152Eu	1.30E+01	2.70E-05	2.00E+02	1.35E-07	1.36E+05	1.99E-10
154Eu	8.50E+00	1.30E-05	2.00E+02	6.50E-08	1.15E+05	1.13E-10
155Eu	4.90E+00	8.54E-07	9.40E+02	9.09E-10	7.53E+05	1.13E-12
226Ra	1.60E+03	2.04E-05	1.20E+01	1.70E-06	5.50E+01	3.71E-07
232Th	1.41E+10	3.74E-07	1.00E-01	3.74E-06	1.75E+01	2.14E-08
234U	2.45E+05	5.75E-06	4.20E+00	1.37E-06	2.22E+02	2.59E-08
235U	7.04E+08	2.69E-07	4.20E+00	6.40E-08	2.38E+02	1.13E-09
238U	4.47E+09	5.06E-06	4.20E+00	1.20E-06	2.39E+02	2.12E-08
238Pu	8.77E+01	9.91E-06	6.20E-01	1.60E-05	6.17E+01	1.61E-07
239/40Pu	2.44E+04	6.03E-04	5.20E-01	1.16E-03	5.52E+01	1.09E-05
241Pu	1.44E+01	8.61E-04	3.20E+01	2.69E-05	2.89E+03	2.98E-07
241Am	4.33E+02	1.43E-04	5.20E-01	2.75E-04	5.48E+01	2.61E-06
SUM				2.22E-03		1.50E-05

==========> 2.22E+01 mRem for total release

1) Values taken from LA-12846-MS, "Specific Activities and DOE-STD-1027-92 Hazard Category 2 Thresholds"
2) Values as calculated on the following pages.
3) Values taken from LA-12981-MS, "Table of DOE-STD-1027-92 Hazard Category 3 Threshold Quantities for the ICRP-30 list of 757 Radionuclides" (except for Tritium whose value was taken from Change 1 to DOE-STD-1027-92).
4) Values developed by dividing the actual isotopic inventory by the respective Haz Cat 3 Threshold.
5) Values developed by dividing the actual isotopic inventory by the respective Haz Cat 2 Threshold.

BGRR-SE-01-02 Source Term Inventory - Piping

as of 06/08/01

	(1)	(2)	(3)	(4)	(1)	(5)
RADIO-NUCLIDE	HALF LIFE [Yr]	TOTAL ACTIVITY [Ci]	HAZ.CAT. 3 THRESHOLD [Ci]	HAZ.CAT. 3 FRACTION	HAZ.CAT. 2 THRESHOLD [Ci]	HAZ.CAT. 2 FRACTION
060Co	5.27E+00	6.78E-07	2.80E+02	2.42E-09	1.92E+05	3.53E-12
090Sr	2.88E+01	3.96E-06	1.60E+01	2.48E-07	2.21E+04	1.79E-10
090Y	7.31E-03	3.96E-06	1.42E+03	2.79E-09	4.30E+05	9.21E-12
137Cs	3.02E+01	3.01E-07	6.00E+01	5.02E-09	8.65E+04	3.48E-12
SUM				2.58E-07		1.96E-10
			=========>	2.58E-03 mRem for total release		

1) Values taken from LA-12846-MS, "Specific Activities and DOE-STD-1027-92 Hazard Category 2 Thresholds"
2) Values as calculated on the following pages.
3) Values taken from LA-12981-MS, "Table of DOE-STD-1027-92 Hazard Category 3 Threshold Quantities for the ICRP-30 list of 757 Radionuclides" (except for Tritium whose value was taken from Change 1 to DOE-STD-1027-92).
4) Values developed by dividing the actual isotopic inventory by the respective Haz Cat 3 Threshold.
5) Values developed by dividing the actual isotopic inventory by the respective Haz Cat 2 Threshold.

Lower Canal & Water Treatment House, Equipment & Associated Soils Removal Activity

(1) Characterization surveys and analysis of soil samples have identified pockets of radioactivity: The major isotopes observed were Cs-137 and Sr-90; Co-60 was observed only slightly above detection levels in a limited number of samples; Am-241 was "Not Detected" by gamma spectroscopy on all samples.

(2) In the absence of full analytical laboratory results for all prior nuclides of interest, Activity levels will be based on values given for major isotopes in the EE/CA (Cs-137, Sr-90) combined with the values for the minimum detection limits of other isotopes previously found (Co-60, Am-241) and, scaling off these values for the nuclides not otherwise measured, but associated with nuclides actually found, as given on Table 2.3.2-1, "Residual BOP Inventory Based on B&W NEL and ISOCS Results", in the BGRR-ASA [Ref.2].

(3) The EE/CA states under "Comparison of Alternatives, Cost, Waste, Radioactivity, and Risk", for Alternative No. 2:

Waste = 272 Cu. Ft.
Soil Activity Removed @ 51.5 mCi of Sr-90, 123.0 mCi of Cs-137
Concrete Activity Removed @ 2.1 mCi of Sr-90, 20.5 mCi of Cs-137

The scaled values for other nuclides will be developed separately based on Cs-137, then Sr-90, with the more conservative distribution used for development of Source Term.

(4)

CONCRETE RADIO-NUCLIDE	BGRR-ASA ACTIVITY [Ci]	**Sr-90** BASED [Ci]	**Cs-137** BASED [Ci]	CAT. 3 THRESH'D [Ci]	**Sr-90** BASED FRACT.	**Cs-137** BASED FRACT.
H-3	8.44E-04	2.29E-05	6.43E-05	1.60E+04	1.43E-09	4.02E-09
C-14	1.47E-04	3.98E-06	1.12E-05	4.20E+02	9.48E-09	2.67E-08
Fe-55	1.32E-06	3.58E-08	1.01E-07	5.40E+03	6.62E-12	1.86E-11
Co-60	5.24E-04	1.42E-05	3.99E-05	2.80E+02	5.07E-08	1.43E-07
Ni-63	2.22E-03	6.02E-05	1.69E-04	5.40E+03	1.11E-08	3.13E-08
Sr-90	7.75E-02	**2.10E-03**	5.91E-03	1.60E+01	1.31E-04	3.69E-04
Y-90	7.75E-02	2.10E-03	5.91E-03	1.42E+03	1.48E-06	4.16E-06
Tc-99	3.35E-05	9.08E-07	2.55E-06	1.70E+03	5.34E-10	1.50E-09
I-129	1.10E-05	2.98E-07	8.38E-07	6.00E-02	4.97E-06	1.40E-05
Cs-137	2.69E-01	7.29E-03	**2.05E-02**	6.00E+01	1.21E-04	3.42E-04
Eu-152	3.54E-04	9.59E-06	2.70E-05	2.00E+02	4.80E-08	1.35E-07
Eu-154	1.71E-04	4.63E-06	1.30E-05	2.00E+02	2.32E-08	6.52E-08
Eu-155	1.12E-05	3.03E-07	8.54E-07	9.40E+02	3.23E-10	9.08E-10
Ra-226	2.68E-04	7.26E-06	2.04E-05	1.20E+01	6.05E-07	1.70E-06
Th-232	4.91E-06	1.33E-07	3.74E-07	1.00E-01	1.33E-06	3.74E-06
U-234	7.54E-05	2.04E-06	5.75E-06	4.20E+00	4.86E-07	1.37E-06
U-235	3.53E-06	9.57E-08	2.69E-07	4.20E+00	2.28E-08	6.41E-08
U-238	6.64E-05	1.80E-06	5.06E-06	4.20E+00	4.28E-07	1.20E-06
Pu-238	1.30E-04	3.52E-06	9.91E-06	6.20E-01	5.68E-06	1.60E-05
Pu-239/40	7.91E-03	2.14E-04	6.03E-04	5.20E-01	4.12E-04	1.16E-03
Pu-241	1.13E-02	3.06E-04	8.61E-04	3.20E+01	9.57E-06	2.69E-05
Am-241	1.87E-03	5.07E-05	1.43E-04	5.20E-01	9.74E-05	2.74E-04
Use Cs-137 scaled values for concrete				**SUM**	7.87E-04	2.21E-03

(5)

SOIL RADIO-NUCLIDE	BGRR-ASA ACTIVITY [Ci]	**Sr-90** BASED [Ci]	**Cs-137** BASED [Ci]	CAT. 3 THRESH'D [Ci]	**Sr-90** BASED FRACT.	**Cs-137** BASED FRACT.
H-3	8.44E-04	5.61E-04	3.86E-04	1.60E+04	3.51E-08	2.41E-08
C-14	1.47E-04	9.77E-05	6.72E-05	4.20E+02	2.33E-07	1.60E-07
Fe-55	1.32E-06	8.77E-07	6.04E-07	5.40E+03	1.62E-10	1.12E-10
Co-60	5.24E-04	3.48E-04	2.40E-04	2.80E+02	1.24E-06	8.56E-07
Ni-63	2.22E-03	1.48E-03	1.02E-03	5.40E+03	2.73E-07	1.88E-07
Sr-90	7.75E-02	**5.15E-02**	3.54E-02	1.60E+01	3.22E-03	2.21E-03
Y-90	7.75E-02	5.15E-02	3.54E-02	1.42E+03	3.63E-05	2.50E-05
Tc-99	3.35E-05	2.23E-05	1.53E-05	1.70E+03	1.31E-08	9.01E-09
I-129	1.10E-05	7.31E-06	5.03E-06	6.00E-02	1.22E-04	8.38E-05
Cs-137	2.69E-01	1.79E-01	**1.23E-01**	6.00E+01	2.98E-03	2.05E-03
Eu-152	3.54E-04	2.35E-04	1.62E-04	2.00E+02	1.18E-06	8.09E-07
Eu-154	1.71E-04	1.14E-04	7.82E-05	2.00E+02	5.68E-07	3.91E-07
Eu-155	1.12E-05	7.44E-06	5.12E-06	9.40E+02	7.92E-09	5.45E-09
Ra-226	2.68E-04	1.78E-04	1.23E-04	1.20E+01	1.48E-05	1.02E-05
Th-232	4.91E-06	3.26E-06	2.25E-06	1.00E-01	3.26E-05	2.25E-05
U-234	7.54E-05	5.01E-05	3.45E-05	4.20E+00	1.19E-05	8.21E-06
U-235	3.53E-06	2.35E-06	1.61E-06	4.20E+00	5.59E-07	3.84E-07
U-238	6.64E-05	4.41E-05	3.04E-05	4.20E+00	1.05E-05	7.23E-06
Pu-238	1.30E-04	8.64E-05	5.94E-05	6.20E-01	1.39E-04	9.59E-05
Pu-239/40	7.91E-03	5.26E-03	3.62E-03	5.20E-01	1.01E-02	6.96E-03
Pu-241	1.13E-02	7.51E-03	5.17E-03	3.20E+01	2.35E-04	1.61E-04
Am-241	1.87E-03	1.24E-03	8.55E-04	5.20E-01	2.39E-03	1.64E-03
Use Sr-90 scaled values for Soil				**SUM**	1.93E-02	1.33E-02

(6) Based upon the detailed methodology, as described in the Technical Work Document [Ref. 19], for underground piping sampling, isolation and removal; there is no credible mechanism for release of any potential residual contamination which may be present. Irrespective of that fact, all piping to be removed [except for the 3" air line and 12" chilled water lines which are known to be clean and are being removed solely to facilitate East Yard Sump removal] will be assumed as contaminated along its entire interior surface to the average level of the smear(s) taken of the Pneumatic Port #4, which read : No Alpha, Beta @ 1251.6 dpm/100 cm^2, Co-60 @ 4.65E-05 uCi/100 cm^2, Cs-137 @ 2.06E-05 uCi/100 cm^2. The excess Beta Activity (above and beyond the Cs-137 component) will be attributed to Sr-90 (and Y-90).

Beta @ 1251.6 dpm/100 cm^2 = 5.64E-04 uCi/100 cm^2
Cs-137 = 2.06E-05 uCi/100 cm^2
Sr-90 = 2.72E-04 uCi/100 cm^2
Y-90 = 2.72E-04 uCi/100 cm^2
Co-60 = 4.65E-05 uCi/100 cm^2

Piping Run	Length [ft]	Dia. [in]	Int. Surf. Area [cm^2]
Pneumatic Tubing	1000	2	4.86E+05
703 Lab Drain	200	2	9.73E+04
F Waste Line	200	6	2.92E+05
North Pad Drain	100	4	9.73E+04
	25	6	3.65E+04
South Pad Drain	75	4	7.30E+04
Canal Discharge	225	4	2.19E+05
EYS Vent	40	2	1.95E+04
Canal WWS Disch.	250	1.5	9.12E+04
WT House Drains	10	2	4.86E+03
	50	3	3.65E+04
	6	4	5.84E+03
		Sum	1.46E+06 cm^2

Cs-137 =	2.06E-05 uCi/100 cm^2	X	1.46E+06 cm^2	=	3.01E-07 Ci
Sr-90 =	2.72E-04 uCi/100 cm^2	X	1.46E+06 cm^2	=	3.96E-06 Ci
Y-90 =	2.72E-04 uCi/100 cm^2	X	1.46E+06 cm^2	=	3.96E-06 Ci
Co-60 =	4.65E-05 uCi/100 cm^2	X	1.46E+06 cm^2	=	6.78E-07 Ci

Comparison of Alternatives, Cost, Waste, Radioactivity, and Risk

	Comparison of Radioactivity and Risks in BGRR Canal Remediation Alternatives	Cost with Contingency	Waste (cubic feet)	Units	Activity Removed				Activity Remaining				Risk Remaining	
					Concrete		Soil		Concrete		Soil		Dose	Excess
					Sr-90	Cs-137	Sr-90	Cs-137	Sr-90	Cs-137	Sr-90	Cs-137	mrem/yr	cancers/yr
1	No action alternative: Continue surveillance and monitoring (radiological and hazardous); as well as appropriate security measures to ensure public health and safety.	$0	0	mCi	0.00	0.00	0.00	0.00	3.45	33.05	56.85	133.40	0.70	5.0E-06
				pCi/g					100 avg	1,000 avg 26,000 peak	400	1,510	at time = 35 y	
2	Remediate Canal, Remove Equipment and remediate Assoc Surface Soils: Canal remains in place, equipment removed; remove upper layer of floor contamination, and apply fixative to floors and walls; remove east yard sump, concrete pad area and below grade piping and systems; install weather- tight cover, and drainage control, apply asphalt.	$521,410	272	mCi	2.1	20.5	51.5	123.0	1.35	12.55	5.35	10.40	6.00E-03	4.00E-08
				pCi/g					5.3	50	400	1,510	at time = 150 y	
3	Partial Removal of Canal, Equipment, and Assoc Soils to elevation 86' 4": Remove floor and wall contamination and apply fixative; remove portions of floor that have contamination to soil and remediate; remediate concrete pad, east yard sump, below grade piping and associated soil; backfill, install weather- tight cover, and drainage control, apply asphalt.	$960,942	869	mCi	3.00	28.90	53.30	129.85	0.45	4.15	3.55	3.55	6.00E-03	4.00E-08
				pCi/g					5.3	50	100	100	at time = 150 y	
4	Remove Canal, Equipment, and Assoc Soils. to 86' 4" elev. Remove Canal to building 701, column #7; install permanent drainage control; remediate soils beneath and adjacent to Canal to elevation 86' 4"; remediate concrete pad, east yard sump, below grade piping and assoc soils; backfill and install drainage control.	$2,493,716	22,400	mCi	3.40	32.60	53.30	129.85	0.05	0.45	3.55	3.55	0.70	5.0E-06
				pCi/g					3	30	100	100	at time = 35 y	
5	Removal of Canal, Equipment and Assoc. Soil to 75' elev. Remove Canal to building 701, column #7; install permanent drainage control; remediate soils beneath and adjacent to Canal to elevation 75'; remediate concrete pad, east yard sump, below grade piping and associated soils; backfill and install drainage control.	$3,656,298	29,600	mCi	3.40	32.60	54.96	131.51	0.05	0.45	1.89	1.89	0.70	5.0E-06
				pCi/g					3	30	50	50	at time = 35 y	

Table 2.3.2-1 RESIDUAL BOP INVENTORY BASED ON B&W NEL AND ISOCS RESULTS

NEL ID# / BNL ID# / Material Type / Tot. Weight [lbs] / Tot. Weight [g]	Combined N&S BGD Hxers 3600 1.63E+06	Combined N&S BGD Media 4233 1.92E+06	Combined N&S BGD Mesh 5760 2.61E+06	Combined N&S BGD Fines 2780 1.26E+06	Combined Canal & House Concrete 116960 5.31E+07	*Combined W.T. House Concrete 35200 1.60E+07	*Combined BOP Rad. Inv. Summary [Ci]	Nuclide Specific Cat 3 Threshold	Nuclide Specific Cat 3 Fraction
H-3 [Ci]	8.42E-06	3.42E-03	2.65E-02	2.03E-03	8.44E-04	1.92E-06	3.28E-02	1.60E+04	2.05E-06
C-14 [Ci]	8.04E-06	6.26E-04	4.53E-03	3.95E-04	1.47E-04	3.34E-07	5.71E-03	4.20E+02	1.36E-05
***Fe-55 [Ci]	1.08E-07	1.61E-06	1.18E-05	6.46E-06	1.32E-06	2.20E-07	2.15E-05	5.40E+03	3.98E-09
Co-60 [Ci]	4.32E-05	6.41E-04	4.70E-03	2.57E-03	5.24E-04	8.77E-05	8.56E-03	2.80E+02	3.06E-05
Ni-63 [Ci]	3.87E-04	3.71E-03	6.10E-02	1.88E-02	2.22E-03	5.06E-06	8.61E-02	5.40E+03	1.59E-05
Sr-90 [Ci]	7.41E-03	2.69E+00	1.90E-01	7.53E-02	7.75E-02	1.78E-04	3.04E+00	1.60E+01	1.90E-01
Y-90 [Ci]	7.41E-03	2.69E+00	1.90E-01	7.53E-02	7.75E-02	1.78E-04	3.04E+00	1.42E+03	2.14E-03
Tc-99 [Ci]	5.40E-05	4.90E-04	6.83E-04	4.59E-05	3.35E-05	7.65E-08	1.31E-03	1.70E+03	7.68E-07
I-129 [Ci]	1.32E-05	1.69E-04	2.12E-04	2.27E-05	1.10E-05	2.51E-08	4.29E-04	6.00E-02	7.15E-03
Cs-137 [Ci]	8.65E-03	6.95E+00	2.94E+00	3.14E-01	2.69E-01	6.14E-04	1.05E+01	6.00E+01	1.75E-01
Eu-152 [Ci]	2.41E-05	1.43E-03	3.53E-03	3.76E-04	3.54E-04	5.92E-05	5.78E-03	2.00E+02	2.89E-05
Eu-154 [Ci]	9.85E-06	8.01E-04	1.75E-03	3.13E-05	1.71E-04	2.86E-05	2.80E-03	2.00E+02	1.40E-05
Eu-155 [Ci]	1.69E-05	0.00E+00	0.00E+00	0.00E+00	1.12E-05	1.86E-07	2.82E-05	9.40E+02	3.00E-08
Ra-226 [Ci]	1.68E-05	2.34E-03	1.05E-03	1.88E-04	2.68E-04	2.98E-05	3.89E-03	1.20E+01	3.24E-04
Th-232 [Ci]	2.17E-06	3.26E-05	2.71E-05	3.97E-06	4.91E-06	5.46E-07	7.13E-05	1.00E-01	7.13E-04
U-234 [Ci]	8.56E-05	1.44E-04	4.95E-04	2.88E-04	7.54E-05	8.37E-06	1.10E-03	4.20E+00	2.61E-04
U-235 [Ci]	9.76E-06	7.49E-06	1.98E-05	1.02E-05	3.53E-06	3.92E-07	5.12E-05	4.20E+00	1.22E-05
U-238 [Ci]	5.45E-06	1.10E-04	4.68E-04	3.03E-04	6.64E-05	7.34E-06	9.61E-04	4.20E+00	2.29E-04
Pu-238 [Ci]	6.61E-06	7.01E-04	6.98E-04	3.33E-04	1.30E-04	1.44E-05	1.88E-03	6.20E-01	3.04E-03
Pu-239/40 [Ci]	3.65E-04	3.38E-02	5.20E-02	1.99E-02	7.91E-03	8.78E-04	1.15E-01	5.20E-01	2.21E-01
**Pu-241 [Ci]	5.23E-04	4.84E-02	7.45E-02	2.86E-02	1.13E-02	1.26E-03	1.65E-01	3.20E+01	5.14E-03
Am-241 [Ci]	7.74E-05	1.13E-02	1.11E-02	2.61E-03	1.87E-03	2.08E-04	2.72E-02	5.20E-01	5.23E-02
*For ISOCS only characterization data available for these samples, scaled values were attributed for nuclides other than Co-60, Cs-137, and Am-241.								SUM	6.57E-01
**Due to limited number of samples analyzed for Pu-241, (Hxers only) all other columns scaled off Hxers.									
***Though Fe-55 was not analyzed for in the BOP samples, its values are scaled from those found in the composite pile graphite sample analyzed for Fe-55 (which was below MDA so the MDA value was used).									

ASL #	DATE	TIME	MAT'L	ALPHA [uCi/mL]	BETA [uCi/mL]	TRITIUM [uCi/mL]	MDL - uCi/mL Alpha	Beta	Tritium	GAMMA Nuclide	ACTIVITY [pCi/gm]	ND-Limit [pCi/gm]
21012404-01 Pneu. Port #4 701 @ 110' N.	01/24/01	1300 hrs	Smear	-0.6 dpm/smear	1251.6 dpm/smear		8.7 dpm/smear	19.9 dpm/smear		Co-60 Cs-137	4.65E-05 2.06E-05	uCi/smear uCi/smear

ATTACHMENT 1

BGRR-043

Job Safety Analysis for

Remediation of the Lower Canal,

Below Grade Piping Systems, and Associated Soils

ERD-BGRR TASK-SPECIFIC JOB SAFETY ANALYSIS

Project Task: **REMEDIATION OF THE LOWER CANAL, BELOW GRADE PIPING SYSTEMS, AND ASSOCIATED SOILS**

Walk-through Participants:
B. Gunbay
T. Rountree
H. Bachner
P. Bergh

Date: June 27, 2001

Reference Documentation:

1. Technical Work Document, ERD-BGRR-TP-01-03
2. Work Permit No. _____

Attachments: A. Emergency Call-out List

Reviewed by:
H. Bachner
S. Musolino
R. Litzke
M. Lilimpakis
S. Moss
T. Monahan
A. Raphael

Preparer: Stephen V. Mellor For 6/29/01
Tom Rountree Date

Approved by: Walter Lieneck 6/29/01
Walter Lieneck Date

SECTION 5.1 PIPING ISOLATION

Task	Step or Activity	Hazard *	Control
Mobilize equipment and supplies (This section is applicable to all set-up work)	Move equipment/supplies by hand	Back injuries ESH Cat. – 1 ESH Risk - Low	• Personnel trained to BNL standards (Back Injury Prevention (HP-IND-010) • Personnel limited to lifting 50# without help
		Pinch points ESH Cat. – 1 ESH Risk - Low	• Continuous training during morning safety meetings • Workers trained to assess and eliminate work hazard prior to work commencing
	Move equipment/supplies with machinery	Personnel is struck or caught between the equipment ESH Cat. – 1 ESH Risk - Moderate	• Operator trained to BNL standards (Forklift Operator and Practical HP-Q001/A), • Equipment has back-up alarm as required by OSHA, • Personnel trained to be alert to site hazards
Isolate and cut piping (This section will be referenced through out the JSA)	Drill ¼" hole in top of pipes	Injury from drill ESH Cat. – 1 ESH Risk – Low	• Supervisor field verifies workers proficiency with tool.
		Exposure to chemical ESH Cat. – 12 ESH Risk – Low	• No chemicals were sent through pipe as the wastes went to the "F" tanks
		Exposure to radiological contaminants ESH Cat. – 2 ESH Risk – Moderate	• Use of an RWP • Coverage of RCT
	Inject foam into holes	Exposure to chemical ESH Cat. – 12	• Review of MSDS prior to work

Task	Step or Activity	Hazard *	Control
		ESH Risk – Low	
	Install contamination controls at cut locations	Injury from tools ESH Cat. – 1 ESH Risk – Low	• Supervisor field verifies workers proficiency with tool.
	Cutting piping	Injury from tools ESH Cat. – 1 ESH Risk – Low	• Supervisor field verifies workers proficiency with tool.
	Install fittings (including Options 1 & 2)	Injury from tools ESH Cat. – 1 ESH Risk – Low	• Supervisor field verifies workers proficiency with tool.
	Excavate lines (Option 1 & 2)	Machinery fails and injuries workers ESH Cat. – 1 ESH Risk – Moderate	• Equipment initially inspected by PE, • Daily inspections by operator
		Personnel is struck by or caught between the equipment ESH Cat. – 1 ESH Risk - Moderate	• Operator trained to BNL standards, • Back-up alarm on equipment, • Rope off swing area as needed, • Personnel trained to be alert to site hazards
		Contact with buried utilities ESH Cat. – 1 ESH Risk – Low	• Use of Digging Permit, • Hand dig within 2 ft of known utilities
		Personnel falls into excavation	• Excavation barricaded as needed with appropriate signage,

Task	Step or Activity	Hazard *	Control
		ESH Cat. – 6 ESH Risk - Low	• Personnel trained to be alert to site hazards
		Material falling into excavation injuring workers ESH Cat. – 1 ESH Risk – Low	• All excavated materials placed so that the toe of the materials is at least 2 ft from the edge
	Personnel enter excavation	Trench collapses ESH Cat. – 6 ESH Risk – Moderate	• Excavations will be sloped or use trench box for excavations greater than 5 feet in depth • Competent person inspects excavation as per regulations
		Excavations 4 feet and over are considered by OSHA to be a confined space ESH Cat. – 5 ESH Risk – Low	• Spaces excepted to be Class 1, but each will be evaluated as per BNL ESH 2.2.4
	Seal penetration with grout or equal	Exposure to chemicals ESH Cat. – 12 ESH Risk – Moderate	• Personnel will wear suitable gloves when handling material • Review of the MSDS prior to work
	Access to lines in building 801 (Option 2) and install new pipe hangers (Note 2 in TWD)	Elevated work ESH Cat. – 11 ESH Risk – Low	• Work will be preformed on a permanent walkway with guard rails • Use of fall protection equipment as needed
		Injury from tools	• Supervisor field verifies workers proficiency with

Task	Step or Activity	Hazard *	Control
		ESH Cat. – 1 ESH Risk – Low	tool
	Verify valve HOV-25 is shut prior to cutting (Note 3 in TWD)	Personal injury ESH Cat. – 4 ESH Risk – Low	• Use of BNL LO/TO program

SECTION 5.2 CANAL, WATER TREATMENT HOUSE PAD, PIPING, AND SOILS REMOVAL

Task	Step or Activity	Hazard *	Control
Move scabbling and core bore equipment into the canal	Move scabbling or core bore equipment/supplies by hand	Back injuries ESH Cat. – 1 ESH Risk - Low	• Personnel trained to BNL standards (Back Injury Prevention (HP-IND-010) • Personnel limited to lifting 50# without help
		Pinch points ESH Cat. – 1 ESH Risk – Low	• Continuous training during morning safety meetings • Workers trained to assess and eliminate work hazard prior to work commencing
		Confined space entry ESH Cat. – 5 ESH Risk - Moderate	• Personnel trained to BNL standards • When setting up equipment, Canal is a Class 1 space • When scabbler is operating, no one will be in canal • When core bore is operating, the space is a Class 2A for the noise and an attendant will be outside of the space to alert the occupants to evacuate if a problem arises in the building
	Install trolley hoist(s)	Falls into canal ESH Cat. – 1 ESH Risk – Moderate	• Hoists can be installed while standing on concrete canal covers • Concrete covers inspected prior to work
		Hand injuries ESH Cat. – 1 ESH Risk – Low	• Workers trained to assess and eliminate work hazard prior to work commencing
	Lower scabbler into canal	Personnel struck by equipment	• Personnel will not be under the load and use of tag lie to control load

Task	Step or Activity	Hazard *	Control
		equipment ESH Cat. – 1 ESH Risk – Low	
	Personnel entry into canal	Falls ESH Cat. – 11 ESH – Risk - Low	• Entry with a ladder set at proper angle and tied off.
	Set up scabbler	Back injuries ESH Cat – 1 ESH Risk – Low	• Personnel trained to BNL standards (Back Injury Prevention (HP-IND-010) • Personnel limited to lifting 50# without help
		Personnel injury from tools ESH Cat. – 1 ESH Risk – Low	• Supervisor field verifies workers proficiency with tool.
Operation of scabbler (Section 5.2.8 to 5.2.35)	Operation of scabbler	Personnel injury from improper operation of scabbler ESH Cat. – 1 ESH Risk - Moderate	• Operators trained on unit prior to operation in the canal
		Noise Hazard ESH Cat. – 14 ESH Risk – High (<100 dbA)	• Personnel not allowed in canal during operation • Use of hearing protection as required • Personnel in hearing conservation program
		Exposure to airborne radioactivity ESH Cat. – 2 ESH Risk – Moderate	• Scabbler connected to HEPA vacuum, minimal dust • Monitoring

Task	Step or Activity	Hazard *	Control
		Personal injury from hydraulic line failure ESH Cat. – 1 ESH Risk - Moderate	• Lines checked daily
Operate core bore unit to remove sumps (Section 5.2.36 to 5.2.46)	Operation of core bore unit	Personnel injury from improper operation of Core bore unit ESH Cat. – 1 ESH Risk – Low	• Operators trained on unit prior to operation in the canal
		Noise Hazard ESH Cat. – 14 ESH Risk – Moderate	• Personnel trained to BNL standards, • Use of hearing protection as required
		Personnel struck by core bore machine ESH Cat. – 1 ESH Risk – Low	• Personnel trained in use of machine, • Core bore anchored to floor
		Radiological exposure ESH Cat. – 2 ESH Risk – Moderate	• Use of an RWP, • Coverage by RCT, • Personnel trained as per JTA • Dust controlled with water, water collected with a HEPA vacuum
	Remove concrete from Sumps S-2 & 3	Personal injury from hand tools ESH Cat. – 1 ESH Risk – Low	• Supervisor field verifies workers proficiency with tool
Fill penetrations with grout (Section	Mix and apply grout	Chemical exposure ESH Cat. – 12	• Chemicals in grout can cause skin dermatitis, workers will wear latex gloves, or equal.

Task	Step or Activity	Hazard *	Control
5.2.47 to 5.2.49)		ESH Risk – Low	• MSDS reviewed prior to work
Decontaminate or fix contamination on the stainless steel liner in the canal walk way sump (CWWS) (Section 5.2.52 to 5.2.54)	Vacuum loose contamination	Noise ESH Cat. – 14 ESH Risk – Moderate	• Noise level between 85 – 100 dbA • Vacuum on canal walkway level, not in canal • Hearing protection as required.
		Airborne radioactivity ESH Cat. – 2 ESH Risk – Moderate	• Use of an RWP and respiratory protection as required • Air monitoring
	Fix contamination on SS liner with paint	Airborne chemical exposure ESH Cat. – 12 ESH Risk - Low	• Previous painting in this area shows no hazards
		Skin exposure to paint ESH Cat. – 12 ESH - Negligible	• Personnel will be wearing radiological PPE when painting
Remove stainless steel liner (Section 5.2.55)	Cut piping	Personal injury from tools ESH Cat. – 1 ESH Risk – Low	• Supervisor field verifies workers proficiency with tools
		Radiological exposure ESH Cat. – 2 ESH Risk – Moderate	• While entry into the canal walk way is controlled by an RWP, cutting of the pipe will be done remotely
	Remove sump with	Personnel struck by sump as it is lifted put ESH Cat. – 1	• Personnel kept back from lift • Use of tag lines

Task	Step or Activity	Hazard *	Control
		ESH Risk – Low Rigging failure ESH Cat. – 10 ESH Risk - Low	• Rigging performed by BNL trained riggers
Apply fixative to canal floors, walls and ceilings (Section 5.2.61)	Apply paint	Airborne chemical exposure ESH Cat. – 12 ESH Risk - Low Skin exposure to paint ESH Cat. – 12 ESH - Negligible	• Previous painting in this area shows no hazards • Personnel will be wearing radiological PPE when painting
Remove Water treatment house concrete pad (5.2.63 to 5.2.69)	Operate ram to break apart concrete	Carbon monoxide exposure from engine exhaust ESH Cat. – 12 ESH Risk – Low Airborne radioactivity ESH Cat. – 2 ESH Risk – Moderate Noise ESH Cat. – 14 ESH Risk – Moderate Personnel injury from equipment	• Engine exhaust piped to outside of the tent. This process is being used at this time and CO levels remain below the TWA • Tent has a 2,500 cfm HEPA filtered exhaust system for general exhaust ventilation • Use of an RWP • Work will be in respirators • Use of HEPA exhaust and misting to control airborne dust • From historic data, noise level will exceed 85 dbA. Personnel in a hearing conservation program and will wear hearing protection • Operator trained in use of equipment • Workers trained to inform operator of intentions

Task	Step or Activity	Hazard *	Control
		ESH Cat. – 1 ESH Risk – Low	prior to moving around equipment • Operator checks equipment daily to look for equipment defects. If defects are found, equipment is not used until it is fixed.
	Load concrete into waste containers via machinery and by hand	Back injuries ESH Cat. – 1 ESH Risk – Low	• Personnel trained to BNL standards (Back Injury Prevention (HP-IND-010) • Personnel limited to lifting 50# without help
		Personnel injury from equipment ESH Cat. – 1 ESH Risk – Low	See above
Excavate soils to approximately 10 feet below grade to remove piping (Section 5.2.70 to 5.2.79)	Excavate soils with machine	Excavator or personnel fall into excavation ESH Cat. – 1 ESH Risk – Low	• Operator trained in use of equipment • Workers trained to stay back from excavation • Excavation will be inside of tent so no casual observers can get close to excavation • Excavation barricaded if deemed necessary
		Personnel injury from equipment ESH Cat. – 1 ESH Risk – Low	• See above
		Carbon monoxide exposure from engine exhaust ESH Cat. – 12	• Engine exhaust piped to outside of the tent. This process is being used at this time and CO levels remain below the TWA • Tent has a 2,500 cfm HEPA filtered exhaust

Task	Step or Activity	Hazard *	Control
		ESH Risk – Low	system for general exhaust ventilation
		Airborne radioactivity ESH Cat. – 2 ESH Risk – Moderate	• Use of an RWP and required protection • Tent has a 2,500 cfm HEPA filter exhaust
	Entry into excavation to cut piping and take samples	Excavation collapses ESH Cat. – 6 ESH Risk – High	• Use of a trench box or sloping • Inspection by competent person
		Confined space entry ESH Cat. – 5 ESH Risk - High	• Due to risk from the excavation collapse the space will be a 2C and all requirements of ES&H 2.2.4 will be followed
	Cutting of piping	See Section 5.1 for hazards and controls	
	Lift piping out of excavation	Piping slips out of rigging and causes personnel injuries ESH Cat. – 10 ESH Risk – Low	• Piping is less than 6" diameter and will be cut in manageable lengths • Personnel trained in lifting
Removal of east yard sump (EYS) and associated piping. Excavate soils to approximately 20 feet below grade (Section 5.2.80 to 5.2.99)	Excavate soils to expose the EYS	Excavation collapses ESH Cat. – 6 ESH Risk – High	• Excavation will be sloped as per OSHA regulations. • Inspections by the competent person
		Personnel injury from the excavator ESH Cat. – 1 ESH Risk – Low	• Operator trained in use of equipment • Operator inspects equipment prior to use • Workers trained to inform operator of intentions prior to moving around equipment

Task	Step or Activity	Hazard *	Control
		Carbon monoxide exposure from engine exhaust ESH Cat. – 12 ESH Risk – Low	• See above
	Entry into excavation to cut piping and take samples	Excavation collapses ESH Cat. – 6 ESH Risk – High	• Excavation will be sloped as required by regulations and possible use of a trench box, if necessary • Inspection by the competent person
	Confined space entry	Personnel injury ESH Cat. – 5 ESH Risk – High	• Due to risk from the excavation collapse the space will be a 2C and all requirements of ES&H 2.2.4 will be followed
	Cutting of piping	See Section 5.1 for hazards and controls	• EYS lift will be a critical lift with all appropriate reviews.
	Remove EYS as a single piece	Spread of radiological contamination during the lift ESH Cat. – 2 ESH Risk - Moderate	• A critical lift plan will be prepared and reviewed. • Fixative will be applied to the interior of the sump
		EYS rigging fails ESH Cat. – 10 ESH Risk - HIGH	• Rigging inspected prior to use.
Remove Canal House pad and 3 below grade	Operate ram to break apart concrete (Note this work will not be in the tent)	Airborne radioactivity ESH Cat. – 2 ESH Risk – Moderate	• Use of an RWP • Work will be in respirators

Task	Step or Activity	Hazard *	Control
concrete vaults (Section 5.2.100 to 5.2.126)			• Use of HEPA exhaust and misting to control airborne dust
		Noise ESH Cat. – 14 ESH Risk – Moderate	• From historic data, noise level will exceed 85 dbA. Personnel in a hearing conservation program and will wear hearing protection
		Personnel injury from equipment ESH Cat. – 1 ESH Risk – Low	• Operator trained in use of equipment • Workers trained to inform operator of intentions prior to moving around equipment • Operator checks equipment daily to look for equipment defects. If defects are found, equipment is not used until it is fixed.
	Load concrete into waste containers via machinery and by hand	Back injuries ESH Cat. – 1 ESH Risk – Low	• Personnel trained to BNL standards (Back Injury Prevention (HP-IND-010) • Personnel limited to lifting 50# without help
		Personnel injury from equipment ESH Cat. – 1 ESH Risk – Low	• See above
	Excavate soils from around vaults, approximately 5 feet deep	Personnel injury from the excavator ESH Cat. – 1 ESH Risk – Low	• Operator trained in use of equipment • Operator inspects equipment prior to use • Workers trained to inform operator of intentions prior to moving around equipment
	Entry into excavation to cut piping or survey soils	Confined Space entry ESH Cat. – 5	• The space will be evaluated as per ES&H 2.2.4

Task	Step or Activity	Hazard *	Control
		ESH Risk - Moderate	to determine its classification
	Cutting of piping	See Section 5.1 for hazards and controls	
	Remove vaults with a crane	Rigging fails and personnel are injured ESH Cat. – 10 ESH Risk - Low	• Vaults are approximately 1,500# and will be rigged and lifted by BNL qualified riggers and crane operator
Install weather tight cover over canal opening in parking lot (Section 5.2.127 to 5.2.132)	Install tent to be the temporary weather tight cover over the canal opening	Personnel injury from tools ESH Cat. – 1 ESH Risk – Low	• Supervisor field verifies workers proficiency with tools
	Move temporary tent from the canal area	Rigging fails while being lifted ESH Cat. – 5 ESH Risk – Low	• Rigging and lifting will be performed by qualified BNL personnel • Rigging inspected prior to use.

SECTION 5.3 NORTH TRENCH, PIPING, and SOIL REMOVAL, SECTION 5.4 SOUTH TRENCH, PIPING and SOIL REMOVAL, and SECTION 5.5 STORM DRAIN REROUTING

Task	Step or Activity	Hazard *	Control
Excavate trench's	Remove asphalt with excavator	Personnel injury from equipment ESH Cat. – 1 ESH Risk – Low	• Operator trained in use of equipment • Workers trained to inform operator of intentions prior to moving around equipment • Operator checks equipment daily to look for equipment defects. If defects are found, equipment is not used until it is fixed.
	Excavations less than 5 foot in depth	Personnel injury from equipment ESH Cat. – 1 ESH Risk – Low	• Equipment operated by qualified personnel • Workers trained to inform operator of intentions prior to moving around equipment
		Contact with buried utilities ESH Cat. – 1 ESH Risk – Low	• Use of a digging permit • Hand dig around know utilities and unknown objects
		Radiological contamination ESH Cat. – 2 ESH Risk - Moderate	• Use of an RWP • Monitoring
	Excavations over 5 foot deep	Excavation collapse ESH Cat. – 6 ESH Risk – High	• Use of sloping and/or trench boxes as necessary • Inspection of excavation by a competent person
		Personnel injury from	• Equipment operated by qualified personnel

Task	Step or Activity	Hazard *	Control
		equipment ESH Cat. – 1 ESH Risk – Low Contact with buried utilities ESH Cat. – 1 ESH Risk – Low Radiological contamination ESH Cat. – 2 ESH Risk - Moderate	• Workers trained to inform operator of intentions prior to moving around equipment • Use of a digging permit • Hand dig around know utilities and unknown objects • Use of an RWP • Monitoring
	Cutting of piping (Note that this method will not have to be used on the cutting of the storm sewer)	See Section 5.1 for hazards and controls	

SECTION 5.6 SURFACE SOIL REMEDIATION

Task	Step or Activity	Hazard *	Control
Remove asphalt and concrete in east parking lot	Remove asphalt with excavator	Personnel struck by equipment ESH Cat. – 1 ESH Risk – Low	• Personnel trained to make eye contact with operator prior to moving around equipment. • Equipment swing area roped off as needed
		Personnel injury from equipment failure ESH Cat. – 1 ESH Risk – Low	• Operator inspects equipment on a daily basis
		Personnel injury from loading waste container ESH Cat. – 1 ESH Risk –Low	• Material will be loaded into containers with equipment
	Remove concrete with equipment (*When equipment to be used is determined, this section will be revised)*		
Remove contaminated soils	Excavate soils less than 5 ' in depth	Personnel injury from equipment ESH Cat. – 1 ESH Risk – Low	• Equipment operated by qualified personnel • Workers trained to inform operator of intentions prior to moving around equipment
		Contact with buried utilities ESH Cat. – 1 ESH Risk – Low	• Use of a digging permit • Hand dig around know utilities and unknown objects
		Radiological contamination	• Use of an RWP

Task	Step or Activity	Hazard *	Control
		contamination ESH Cat. – 2 ESH Risk - Moderate	• Monitoring
	Excavations over 5' in depth	Excavation collapse ESH Cat. – 6 ESH Risk – High	• Use of sloping and/or trench boxes as necessary • Inspection of excavation by a competent person
		Personnel injury from equipment ESH Cat. – 1 ESH Risk – Low	• Equipment operated by qualified personnel • Workers trained to inform operator of intentions prior to moving around equipment
		Contact with buried utilities ESH Cat. – 1 ESH Risk – Low	• Use of a digging permit • Hand dig around know utilities and unknown objects
		Radiological contamination ESH Cat. – 2 ESH Risk - Moderate	• Use of an RWP • Monitoring

SECTION 5.7 REMEDIATION ARE RESTORATION

Task	Step or Activity	Hazard *	Control
Install permanent canal isolation barrier	Access into canal	Falls ESH Cat. – 1 ESH Risk – Low	• Access to canal via a ladder which is tied off
	Take measurement in canal for barrier	Radiological exposure to sheet metal workers ESH Cat. – 2 ESH Risk – Moderate	• Use of an RWP to enter area • Work will be skill-of-the-craft
		Confined space entry ESH Cat. – 5 ESH Risk - Low	• Canal for this work is classified as a Class 1 space
	Install anchor bolts and metal cover	Radiological exposure to sheet metal workers ESH Cat. – 2 ESH Risk – Moderate	• Use of an RWP to enter area • Work will be skill-of-the-craft
		Personnel injury from tools ESH Cat. – 1 ESH Risk - Low	• Metal workers qualified to use tools up to and including powder-actuated guns • Skill of the craft
Install permanent weather tight cover over canal opening	Install anchors into existing concrete	Personnel injury form tools ESH Cat. – 1 ESH Risk – Low	• Supervisor field verifies workers proficiency with tools • Tools such as powder-actuated tools requires documented manufacturers training
		Noise ESH Cat. – 14	• Noise monitoring as needed • If needed, personnel in the BNL Hearing

Task	Step or Activity	Hazard *	Control
		ESH Risk – Moderate	Conservation Program
		Elevated work ESH Cat. 11 ESH Risk - Moderate	• Fall protection as required
	Install decking onto anchors	Personnel injured while handling the decking ESH Cat. – 1 ESH Risk – Moderate	• Personnel trained to recognize the hand hazard and wear appropriate work gloves
		Personnel struck by decking while being placed by a crane ESH Cat. – 1 ESH Risk – Low	• Personnel and operator trained to make each other aware of intentions. • Use of tag lines
		Rigging fails and personnel are injured ESH Cat. – 10 ESH Risk – Low	• Rigging inspected and installed by trained and qualified personnel.
		Falls ESH Cat. – 11 ESH Risk – Moderate	• Fall protection as required
	Place concrete on decking	Chemical exposure ESH Cat. – 12 ESH Risk - Low	• Workers will wear appropriate PPE such as gloves and boots
Restore parking lot	Backfill areas with fill, grade fill and lay asphalt	Personnel struck by trucks ESH Cat. – 1	• Work will be performed by a pre-approved BNL BOA contractor

Task	Step or Activity	Hazard *	Control
		ESH Risk - Low	

* ES&H Categories and risks from ES&H 1.3.6 "Work Planning and Control for Operations", Attachment 4, Table 2 "Screening Guidelines for Work Planning & Control and Application of the Quality Graded Approach"

ERD-BGRR TASK-SPECIFIC JOB SAFETY ANALYSIS				
Task	Steps or Activity	Hazards	Control	Comments
UNANTICIPATED HAZARDS - ES&H Coordinator will add any additional information if hazards change within scope of work.				

Attachment A

Emergency Response

First Aid/Medical Assistance.....**2222 or 911 or 344-2222 cellular**

Spills Reporting..... **2222**

	Voice	Pager or Cell
Project Manager (Walter Lieneck)	344-2394	516-779-3118
Project Engineer (Stephen Pulsford)	344-4752	554-7038
Project ES&H Manager (Stephen Musolino)	344-4211	441-8136
Construction/~~Facility~~ Manager (Hank Bachner)	344-8246	554-4062
ES&H Coordinator (Bob Litzke)	344-5689	631-558-6547
Local Emergency Coordinator (Bob Litzke)	344-5689	631-558-6547
Industrial Hygiene/Industrial Safety (T. Rountree)	344-8248	554-4313
DOE BGRR Project Manager (Mark Parsons)	344-7978	
DOE Facility Rep. for BGRR (Maria Dikeakos)	344-3950	800-796-7363 pin 1066603

Preliminary MEDICAL CARE is provided through Fire/Rescue and Occupational Medicine Clinic

ATTACHMENT B
REQUIRED TRAINING for PLANT ENGINEERING

Overview of Training and Qualifications Requirements	PE Laborers	PE Rigger	PE HEMO		Remarks
BNL Employee Requirements GE-53E)	•	•	•		
Laborer (EP-551)	•				
Riggers (EP-561)		•			
Heavy Equipment Mechanic Operator (EP-581)			•		
BGRR SPECIFCI REQUIREMENTS					
Routine Bioassay Whole Body Count (RP-WBC1)	•	•	•		
Radioactive Waste Generator (HP-RADIGEN)	•	•	•		
HAZWOPER - 40 Hour (HP-EP-030)	•	•	•		
BGRR Local Emergency Plan (ER-3.0)	•	•	•		

ATTACHMENT 2

ERD-BGRR-TP-01-03

Technical Work Document for

Remediation of the Lower Canal,

Below Grade Piping Systems, and Associated Soils

ERD Operations Procedures Manual

TECHNICAL WORK DOCUMENT

REMEDIATION OF THE LOWER CANAL, BELOW GRADE PIPING SYSTEMS, AND ASSOCIATED SOILS

Text Pages: 1-47
Attachments: 8.1-8.5

Temporary Procedure

Approved: _____ Date: 7/9/01

Walter Leneck, Manager
BGRR Decommissioning Project

Preparers: **C. Newson / B. Gunbay**

Expiration Date: **December 31, 2001**

ERD-OPM No.: **ERD-BGRR-TP-01-03, Rev. 0**

1.0 PURPOSE AND SCOPE

1.1 The purpose of this procedure is to provide the detailed work instructions for the remediation of the BGRR Lower Canal, Below Grade Piping Systems, and Associated Soils east of Building 701. The remediation work area is defined as the area approximately 120 feet east of Building 701 Column 7 and 160 feet south of the south wall of Building 703.

1.2 This Technical Work Document (TWD) consists of sections that will be used to direct the work activities in discreet groupings to complete the remediation:

1.2.1 Section 5.1, Piping Isolations

This section will verify piping is isolated (and drained) or isolate (and drain, if necessary) piping that will be excavated and removed in all areas of the remediation work activities.

1.2.2 Section 5.2, Canal, Water Treatment House Pad Piping and Soils

This section will provide the instructions for:

1. Scabbling and shaving the concrete from the floor and walls of the Canal and walkway areas. (See Sketches 11 and 12)
2. Removing the internals of the Canal Walkway Sump and applying a fixative (concrete sealer).
3. Removing the Canal concrete pad work area, the 4” cast iron drain piping with an 8” Vitrified Tile (VT) secondary containment piping to the East Yard Sump (EYS) as outlined in DWG BLDG. 709, A3841-S1, sheet 1 of 4.
4. Removing the Water Treatment House concrete floor pad, floor drain piping under the pad. DWG M-1, Job # 3686-A Sheet 1 of 11.
5. Removing the Water Treatment House adjacent concrete floor pad, the 4” cast iron drain piping with an 8” VT secondary containment piping under the pad increasing to 6" cast iron and 12" VT secondary containment to the "F" Waste line. DWG A3841-S1, Sheet 1 of 4.
6. Removing the EYS, piping, and associated contaminated soils, BLDG 709, DWG 3686-S-1 and S-2, sheets 1 and 2 of 2.
7. Removing the three Canal House vaults located on the south side of the Canal House. DWG A3841-S1, Sheet 1 of 4.
8. Removing sections of the two abandoned 12” chilled water piping located under the Water Treatment House east wall, as required. DWG 3841-S1.

9. Removing the Pneumatic transfer tubes, the 8” VT secondary containment piping and trench along the east edge of this work area between north and south manholes. The Pneumatic tube removals can also be performed independently, as the tubes are located 2' below the surface. The removals of piping can be accomplished from the south end without excavating all the piping. A short section, i.e., 6' to 8' long, can be excavated near the south manhole towards the north manhole and the piping can be removed in short sections from here. The 8" VT secondary containment can be removed at a later date along with other piping and contaminated soils. DWG's M-703-50-A, M-801-4A
10. Removing associated contaminated soils related to the above excavation activities.
11. Installation of a temporary, weather tight cover over the Lower Canal area at grade elevation to prevent any rainwater intrusion in the future.

1.2.3 Section 5.3, North Trench, Piping and Soils

This section will provide the instructions for:

1. The excavation of a trench on the north side of the Canal House, from Building 701 east high bay door at Building 701 column 7, going east to the piping penetration wall on the north side of Building 801. DWG M-607-30-A.

1A. Removal of one or more "plugs" from the floor of Building 701 will be necessary to access the piping in the North trench. The plugs are made of concrete approximately 8" thick. The asbestos floor tiles covering the plugs will be removed. Then 3/4" Hilti anchors will be installed in the 4 corners of the plug. Eye bolts will be installed into the anchor and using appropriate lifting equipment (i.e., slings, shackles, etc.) remove the plugs either with a forklift or hydraulic jacks. Should this approach not work, a hydraulic ram hoe will be used to break the concrete and remove the plug. Should the ram hoe be used, holes may be drilled into the concrete so that the broken concrete can be removed prior to the concrete falling into the pipe trench.

2. Removing the 6" welded steel Semi-Hot drain line which changes to 6" cast iron "F" Waste line and the 12” VT secondary containment pipe along with the 2” SS Building 703 west wing tank pit line in a 4” VT secondary containment pipe to the north side of Building 801. DWG's A3841-S1 Sheet 1 of 4, M-607-30-A.

3. Removing the Pneumatic transfer tubes and 8” VT secondary containment piping, from the trench located at elevation 108’ of Building 701, Column 7 going East to the manway at elevation 105'. Also from the manway going north to the south wall penetration of Building 703. DWG's M-607-30-A, M-703-50, M-801-4A.
4. Removing the 4” welded black steel Canal Discharge line and 6” VT secondary containment pipe, from the east of Canal House concrete pad area to the A&B waste line trench on the north side of Building 801. DWG's M-607-30-A, M-811-5A.
5. Removing the 1 ½” SS "D" Waste (Walkway Sump and EYS discharge) line, in a 4” orangeburg secondary containment pipe, from the east of Canal Ho use concrete pad area to the piping penetration wall on the north side of Building 801, outside the “D” tank room. DWG M-1, Job # 3252-A Sheet 3 of 5.
6. Removing associated contaminated soils related to the above excavation activities.

1.2.4 Section 5.4, South Trench, Piping and Soils

This section will provide the instructions for:

1. Removing the pneumatic transfer piping from the south manhole to the penetrations located at the south wall of Building 801. DWG's M-607-30A, M1-3252-A Sheet 3 of 5.
2. Removing associated contaminated soils related to the above excavation activities.

1.2.5 Section 5.5, Storm Drain Rerouting

This section will provide the instructions for:

1. The rerouting of the BGRR elev. 143’ equipment room drains.
2. Rerouting of the Building 701 south side roof drains.
3. Rerouting of the Building 701 Machine Room floor drain and equipment drain.
4. Isolation of the floor drain under the Building 701 east Control Rod Drive Mechanism area.
5. Rerouting of the storm drain line currently going north from the south storm drain manway of Building 709, to the east end storm drain system outfall.
6. Removing associated contaminated soils related to the above excavation activities.

1.2.6 Section 5.6, Surface Soil Remediation

This section will provide the instructions for:

1. Removal of the layers of asphalt and concrete in the east parking area, approximately 120 feet east of Building 701 column 7 and 160 feet south from the south wall of Building 703.
2. Removal of surface contaminated soils.

1.2.7 Section 5.7, Remediation Area Restoration

This section will provide instructions for installing the permanent barrier between the Canal at Building 701 column 7 (west of joint). Removing the temporary containment and installing the permanent cover over the Canal area. Backfilling and grading the area for drainage control, and application of asphalt to the area to maintain the grading following confirmatory verification by Independent Verification Contractor (IVC).

1.3 Prior to commencement of the work activities of any individual section, the affected piping systems shall be reviewed for isolation requirements as prescribed in Section 5.1, Piping Isolations.

1.4 The work activities prescribed herein will be performed by BNL contractors qualified to perform certain specialized activities such as asbestos abatement, personnel assigned to the BGRR Decommissioning Project (BGRR-DP), and BNL Plant Engineering personnel.

1.5 Steps and sections of this procedure do not have to be performed in sequence unless they are part of a logical order to reduce exposure to workers or the environment of radiological or hazardous materials as long as appropriate permits and authorizations are obtained prior to performing the work activity.

2.0 RESPONSIBILITIES

2.1 The BGRR-DP Field Engineer (FE) is responsible for direction of all field work activities prescribed in this Work Document including the oversight of outside contractors, BGRR-DP, and BNL personnel to ensure both contractual compliance and compliance with BNL work policies and procedures.

2.2 The BGRR-DP Project Engineer or designee is responsible for the technical content of this Work Document.

2.3 The Environmental Management (EM) Environment, Safety and Health Manager (ES&H) or designee is responsible for the assessment of environment, safety and health issues associated with the work activities delineated herein.

2.4 The BGRR-DP Facility Support (FS) Representative is responsible for implementation of the requirements of the BNL RadCon Manual through the Institutional and Facility Support RadCon procedures.

2.5 The ES&H Coordinator or Industrial Hygiene/Industrial Safety Representative (IH/IS Rep) and the FE are responsible to analyze the non-radiological hazards associated with the work through implementation of ERD-OPM-4.6, Hazard Materials Assessment, Analysis, and Mitigation for BGRR Decommissioning Activities and prepare task-specific Job Safety Analysis and/or Analyses (JSA/JSAs).

2.6 The EM Quality Assurance Program Manager is responsible to ensure compliance to the ERD Quality Assurance Implementation Guidelines (QAIG) and that they are incorporated into all phases of the process and review of the Task Quality Plan for the work activities prescribed herein per Ref. 7.2.

2.7 The Waste Management Representative (WMR) is responsible for identification of appropriate waste containers and/or packaging, determination of waste disposal pathways, required sampling for waste disposal, the proper storage of waste prior to shipment for disposal and shipment. The FE and WMR are to ensure that all waste is produced in manner consistent with disposal requirements, i.e. size, content, etc.

2.8 The Competent Person in charge of an excavation is one who has had specific training in, and is knowledgeable about soil analysis, the use of protective systems, and the requirements of 29 CFR 1926, SUBPART P, Trenching and Excavations, is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

3.0 PREREQUISITES

3.1 A task-specific Job Safety Analysis and/or Analyses (JSA/JSAs) for these work activities has/have been approved and reviewed by all personnel involved with these tasks.

FE Initial: _____ Date: _____

3.2 The Unreviewed Safety Issue Determination/Safety Evaluation (USID/SE) No. BGRR-SE-01-02 has been approved by DOE.

FE Initial: _____ Date: _____

3.3 A Radiological Work Permit (RWP) is required for the work activities prescribed in each section. The radiological hazards involved in the performance of each section of activities shall be evaluated and addressed in the specific RWP. Verification sign-off is provided in each section.

3.4 A Hazardous Materials Assessment has been completed in accordance with Ref. 7.3 for the work areas of each section covered in this procedure, and all identified hazardous materials have been removed or stabilized to ensure a safe working environment.

IH/IS Rep. Initial: _____ Date: _____

3.5 Waste disposal container(s) and/or packaging available for radiological and hazardous items removed during these work activities. Proper waste storage has been established for anticipated wastes.

WMR Initial: _____ Date: _____

3.6 Piping Isolations activities have been completed or are noted for completion following excavation in accordance with Section 5.1, Piping Isolations of this Technical Work Document.

FE Initial: _____ Date: _____

3.7 Digging permit is completed for the released work areas in accordance with EP-ES&H-801A, "Plant Engineering Digging Permit and Daily Trench & Excavation Inspection Guide", Reference 7.7.

FE Initial: _____ Date: _____

3.8 Hot Work Permits (as applicable) are required for some isolations. These permits have been applied for and approved prior to performing any hot work.

FE Initial: _____ Date: _____

3.9 Suffolk County Department of Health Services (SCDHS) has been notified and the approximate removal schedule for EYS, Canal house Walkway Sump, Canal Discharge piping, pneumatic transfer tubes and north trench drain line, has been forwarded. All communications with SCDHS will go through the Environmental Department representative Jason Remien, extension 3477, e-mail Remien@bnl.gov.

FE Initial: _____ Date: _____

4.0 PRECAUTIONS AND LIMITATIONS

<u>CAUTION 1</u>: No flame cutting of components, which are known or suspected to be radiologically contaminated is permitted. Flame cutting could result in the release of radioactive contaminants into the air.

4.1 This document is a TEMPORARY procedure valid only for the specific work activities delineated in **Section 5.0**, and may only be implemented in conjunction with an approved Work Permit, and other approved appropriate documents and permits (e.g., RWP, digging permit) as stated on and attached to the implementing Work Permit.

4.2 The internal surfaces of piping and soils may be contaminated with radionuclides such as Co-60, Cs-137, Sr-90, Am-241, Pu-239, and others.

4.3 Both the JSA and USID/SE are based on NO FLAME CUTTING of components that are known or suspected to be radiologically contaminated. If it is later determined that such flame cutting is required, both of these documents shall be revised. Revision of the USID/SE requires DOE approval.

4.4 Flame cutting of components that have been surveyed and verified not to be radiologically contaminated is allowed. This will be documented in the specific RWP for that task.

4.5 Tools and equipment used to implement the activities shall be selected based on the effectiveness in accomplishing the task while minimizing the workers exposure to both radiological and non-radiological hazards, and release of such hazardous substances to the environment. Prior to determining the methods and equipment utilized the FE, ES&H and/or IH/IS Representative and the FS Representative shall evaluate and agree upon these methods.

4.6 No power-operated equipment such as rotary grinders, wire brushes, or power-washers shall be used for decontamination of components unless approved by the FE, IH/IS Representative and the FS Representative. This will be documented in the specific RWP for that task. Pre-approved methods for decontamination shall be limited to use of masslin wipes, abrasive pads, hand-held wire brushes, and approved liquid cleaners.

4.7 All excavations shall be performed with a Competent Person in charge of the excavation and in accordance with 29CFR1926, Subpart P.

4.8 Excavations 4 feet or deeper can be confined spaces. The ES&H and/or IH/IS Representative shall evaluate each excavation as per BNL ES&H 2.2.4 "Confined Space."

4.9 All excavations will be barricaded to alert personnel of the excavation.

4.10 All soils removed from the excavation and other materials shall be placed at least 2 feet (safe distance) from the edge of the excavation.

4.11 Surface soil segregation criteria unless otherwise provided is the Preliminary Cleanup Goal (PCG) for Cs-137, which is 23 pCi/gm, and for Sr-90 is 15 pCi/gm.

4.12 The Suffolk County Department of Health Services (SCDHS) requires notification (minimum 48 hours - preferably 2 weeks) in accordance with Article 12 compliance when piping and tanks are removed from the ground. A SCDHS representative may want to witness the removal of the piping and tanks. This applies to the East Yard Sump, Canal House Walkway Sump, Canal discharge piping, pneumatic transfer tubes and the north trench drain lines to Building 801.

5.0 PROCEDURE

5.1 Piping Isolations

Subsection 5.1 will isolate (and drain, as necessary) or verify isolated (and drained) piping that will be excavated and removed in all areas of the remediation work activities.

Prior to performing any removals under ERD-BGRR-TP-01-03, the piping isolations shall be completed or verified completed in accordance with subsection 5.1. Excavation may be required to expose the piping prior to performing the isolations.

5.1.1 A RWP has been issued for isolations (there may be multiple RWPs as the work is in several different areas). Please fill in as necessary:

RWP No: _____ FE Initial: _____ Date: _____

RWP No: _____ FE Initial: _____ Date: _____

RWP No: _____ FE Initial: _____ Date: _____

RWP No: _____ FE Initial: _____ Date: _____

5.1.2 The JSA for isolations has been reviewed to verify that no additional hazards may exist due to changing field conditions or configurations (there may be multiple JSAs as the isolations are in several areas).

FE Initial: _____ Date: _____

IH/IS Representative: _____ Date: _____

5.1.3 The following lines will be isolated (and drained, as necessary) and/or verified isolated (and drained) and removed:

1. Pad Area drains (2) located South of the Canal House and (1) doorway drain at the east entrance along with associated 4" Cast Iron pipe and 8"VT as secondary containment, to the East Yard Sump (EYS).

2. Water Treatment house drains 9 open and 1 capped with associated 2" and 3" Duriron and 4" Stainless Steel pipe in orangeburg secondary containment pipe to the EYS.

3. 2" SS EYS vent pipe in 4" orangeburg secondary containment pipe.

4. 2" SS EYS pump suction line in 4" orangeburg secondary containment pipe.

5. 1 1/2" SS EYS discharge line, which connects to the 1 1/2" Walkway sump discharge line in 4" orangeburg secondary containment pipe that ends at Building 801 "D" Tank room.

6. 2" SS waste line in 4" VT secondary containment pipe from Building 701 to the manhole North of "F & D" Tank rooms in Building 801.

7. Four 2" copper, brass, aluminum tubes in 8" VT secondary containment pipe from Building 701 to Building 703 (2 tubes which are already isolated in Building 703) and Building 801 (2 tubes). Also, 2 additional tubes that were never put in service (to Cyclotron) from the manhole to Building 801.

8. 6" Cast Iron (CI) waste line in 12" VT secondary containment pipe from Building 701 to the "D" Tank room in Building 801.

9. Pad area drains (3) located North and East of Canal House and associated 4" and 6" CI piping in 8" and 12" VT secondary containment pipe to the 6" CI line above from Building 701 to "F" Tank room in Building 801.

10. 4" Carbon Steel Canal Discharge line in 6" VT secondary containment pipe to Building 811 at A & B line trench.

11. Two 12" Cooling Water lines and a 3" Compressed air line from the Valve Pit to Building 703. These 3 lines are out of service and they can be abandoned in place. However, during the removal and excavation of EYS they will be in the way so select sections of these pipes will be removed to aid the remediation of area soils.

5.1.4 The isolations are grouped together into three areas. The following guidelines are for performing the cuts with minimal and/or no spread of contamination:

a. Prior to cutting a pipe for isolation a 1/4" hole will be drilled on the top of pipe, within the section to be removed, and expanding foam will be injected into the cut area. Allow at least two hours for the foam to cure before proceeding with the cuts**.**

b. Support the pipes to be cut prior to cutting to prevent binding the saw.

c. At the cut locations, install contamination control materials, i.e., catch bags, witch hats, etc.

d. Use only mechanical saw or cutting device for cuts. No torch cutting of contaminated material is allowed.

e. After the cuts are complete install a containment barrier over the open ends of pipes unless otherwise indicated with a specific method below.

1. At the trench located in the Northeast corner of Building 701, Reference Drawings M-607-30-A, M-701-4-A, M-703-50-A:

   A. Four 2" brass, copper, aluminum Pneumatic Tubes - cut approximately a 1'-0" long section off and remove. Install 2" Fernco type rubber cap with clamp on to the tubes going west and plastic pipe caps onto the tubes going east.

      FE Initial: _____ Date: _____

   B. 2" Stainless Steel waste line - cut approximately a 1'-0" long section off and remove. Install a 2" Dresser type coupling with a 2" by 4" long threaded nipple and a treaded nipple onto the pipe going west and plastic pipe cap onto the pipe going east. See **Sketch 1**.

      FE Initial: _____ Date: _____

   C. 6" Cast Black Iron waste line - cut, at a minimum of, 1'-0" section and remove. Install a 6" Roust-about type pipe cap onto the pipe going west and a plastic cap onto the pipe going east.

      FE Initial: _____ Date: _____

2. The following two isolations have two options. Depending on the actual field conditions utilize either one of the options.

   Prior to performing the following isolation - either option and Item 3 (2" Pneumatic tubes), obtain permission from Building 801 manager

   FE Initial: _____ Date: _____

   OPTION 1:

   The isolations will be performed outside, in the underground chambers.

   Excavate the area North of Building 801, "F & D" tank rooms in these areas:

   A. The chamber for the 6" discharge line. Reference Drawings M-607-30-A, M-801-202-A. Excavate both around and above the chamber. In the chamber, cut about a 1' -0" section of the 6" cast iron line and remove. Install a Fernco type rubber pipe cap with clamp onto section towards "F" Tank room. Also, perform one additional cut outside of the chamber and remove the penetration into the chamber. Seal the penetration with a suitable material, i.e., hydraulic cement, concrete mix. Do not backfill at this time.

      FE Initial: _____ Date: _____

B. The chamber for the 1-1/2" Stainless Steel line. Excavate both around and above the chamber. Reference Drawing M-1, Sheet 3 of 5, Job No. 3252-A

NOTE 1: *Verify, HFBR discharge line that "Tees" in is isolated "SHUT" at valve HOV-25 prior to cutting. The valve is located in "D" room.*

A Tag has been issued for HOV-25 in the "Shut" position under Brookhaven Lockout/Tagout Program – ES&H 1.5.1.

FE Initial: _____ Date: _____

In the chamber, cut about a 1' -0" section of the 1-1/2" line, install a Socket Weld 1 1/2" Stainless Steel, 3,000-pound cap onto the section towards the tank room. All welding will be performed by qualified personnel and in accordance with Central Shops SOP 6.0.0 "Welding Procedures". Perform one additional cut outside of the chamber and remove the penetration into the chamber. Seal the penetration with suitable material, i.e. hydraulic cement, concrete mix. Do not backfill at this time.

FE Initial: _____ Date: _____

OPTION 2:

The isolations will be performed in Building 801 "F & D" Tank rooms.

A. 6" Cast Iron waste line discharge line in Building 801, "F" Tank room. Reference Drawings M-607-30-A, M-801-202-A. Cut pipe after the transition as indicated in **Sketch 4**. Remove a short section and install Fernco type rubber pipe cap with clamp onto section remaining on tank.

FE Initial: _____ Date: _____

At the North side of Building 801 "F & D" tank rooms, excavate both around and above the chamber for the 6" line. In the chamber, cut and remove the penetration into the Tank room. Also, perform one additional cut outside of the chamber and remove the penetration into the chamber. Seal this penetration with suitable material, i.e., hydraulic cement, concrete mix. Do not backfill at this time.

FE Initial: _____ Date: _____

NOTE 2: *Prior to cutting install a new pipe hanger as depicted in Sketch 2.*

NOTE 3: *Verify, HFBR discharge line that "Tees" in is isolated "SHUT" at valve HOV-25 prior to cutting. The valve is located in "D" room.*

A Tag has been issued for HOV-25 in the "Shut" position under Brookhaven Lockout/Tagout Program – ES&H 1.5.1.

FE Initial: _____ Date: _____

B. 1 1/2" Stainless Steel Walkway sump and EYS discharge line in Building 801"D" Tank room. Reference Drawing M-1, Sheet 3 of 5, Job No. 3252-A

Cut the elbow off and install a Socket Weld 1 1/2" Stainless Steel, 3000-pound cap on the vertical section. All welding will be performed by qualified personnel and in accordance with Central Shops SOP 6.0.0 "Welding Procedures". See **Sketch 3**.

FE Initial: _____ Date: _____

Excavate the area around the chamber for the 1 1/2" Stainless Steel line. In the chamber cut line and remove the penetration into the "D" Tank room in Building 801. Additionally perform an additional cut outside of the chamber and remove the penetration into the chamber. Seal this penetration with a suitable material, i.e., hydraulic cement, concrete mix.
Do not backfill at this time.

FE Initial: _____ Date: _____

END OF OPTIONS

C. 2" Stainless Steel waste line at the manhole North of "F & D" Tank rooms. Excavate near manhole, undo the mechanical couplings or cut as shown on **Sketch 5** and install plastic caps on both ends. If the penetration into the manhole can be removed seal this penetration with a suitable material, i.e. hydraulic cement, concrete mix. If not install 2" Fernco type rubber cap with clamp. Do not backfill at this time.

FE Initial: _____ Date: _____

D. Excavate the area for the 4" Canal discharge line. Reference Drawings M-811-5-A, M-811-15-A. Cut a section of the line, install Fernco type rubber pipe cap with clamp onto section towards Building 811 (trench end) and seal the end of 6" Vitrous Tile Channel with expanding foam. See **Sketch 6.** Do not backfill at this time.

FE Initial: _____ Date: _____

The remaining pipes underground will be removed under Section 5.3, North Trench, Piping, and Soil, which will be concurrent with these activities.

3. The 2" Pneumatic tubes at south side of Building 801. Reference Drawings M-607-30-A, M-801-4A. Excavate area so that the block wall can be taken down for access into the chamber. Cut all 4 lines close to the inside wall as depicted in **Sketch 7**, install 2" Fernco type rubber caps with clamps on to the tubes going into Building 801.

   FE Initial: _____ Date: _____

5.2 Canal, Water Treatment House Pad, Piping, and Soils Removal

The majority of the work performed in this section is with the temporary Canal Service Building in place. The Temporary Building will be in place until the completion of step 5.2.125, installation of a temporary cover over the Canal opening. The cover may be temporarily removed for excavation activities under the EYS but not during inclement weather as the main reason for the cover is to prevent rainwater intrusion. Removal of the Temporary structure will provide the necessary access to the remaining areas that will be remediated in this section.

Throughout the implementation of section 5.2, collect and/or obtain samples for each waste stream, i.e., concrete, soil, piping systems and asphalt, per Attachment 8.5.

5.2.1 This section provides the instructions for:

1. Scabbling and shaving the concrete from the floor and walls of the Canal and released walkway areas. (Sketches 11 and 12)

2. Removing the internals of the Canal Walkway Sump and applying a fixative, i.e. concrete sealer.

3. Removing the Canal concrete pad work area, the 4" cast iron drain piping with an 8" Vitrified Tile (VT) secondary containment piping, and contaminated soils as outlined in DWG Bldg. 709, A3841-S1, sheet 1 of 4.

4. Removing the Water Treatment House concrete floor pad, piping under the pad, and associated contaminated soils. DWG M-1, Job # 3686-A Sheet 1 of 11.

5. Removing the Water Treatment House adjacent concrete floor pad, the 4" and 6" cast iron drain piping with an 8" and 12" VT secondary containment piping under the pad, and associated contaminated soils. DWG A3841-S1, Sheet 1 of 4.

6. Removing the East Yard Sump, piping, and associated contaminated soils, Bldg. 709, DWG 3686-S-2, sheet 2 of 2.

7. Removing the three Canal House vaults located on the south side of the Canal House. DWG A3841-S1, Sheet 1 of 4.

8. Removing the two abandoned 12" chilled water-piping sections as required.

9. Removing the pneumatic transfer tubes and 8" VT secondary containment piping, and trench located in this portion of the work activity area. The Pneumatic tube removals can also be performed independently, as the tubes

are located 2' below the surface. The removals of piping can be accomplished from the south end without excavating all the piping. A short section, i.e. 6' to 8' long, can be excavated near the south manhole towards the north manhole and the piping can be removed in short sections from here. The 8" VT secondary containment can be removed at a later date along with other piping and contaminated soils. DWG's M-703-50-A, M-801-4A.

10. Installation of a temporary weather tight cover over the Lower Canal area at grade elevation to prevent any rainwater intrusion in the immediate future.

5.2.2 A RWP has been issued for section 5.2.

RWP No:_____ FE Initial:_____ Date: _____

5.2.3 The JSA has been reviewed to verify that no additional hazards may exist due to changing field conditions or configuration.

FE Initial: _____ Date: _____

IH/IS Representative: _____ Date: _____

5.2.4 Verify that approved waste container(s) are available to accept material.

WMR Initial: _____ Date: _____

<u>Lower Canal</u> - Floor Elevation 91' 4" and Walls to Elevation 100' 4"

5.2.5 **The floor of the Canal west of the Canal construction joint will be shaved and or scabbled to the Building 701 column 7 line where there is a temporary barrier installed to isolate the Canal from the west end Canal and Deep Pit. See Sketch 11 for plan view of 91'4" Elevation.**

5.2.6 Move the shaving and/or scabbling equipment and support equipment into the Canal.

5.2.7 Establish containment controls for the wall or floor area to be remediated.

5.2.8 During the second and any successive shaving/scabbling passes over the same area, samples of the removed concrete should be analyzed using field laboratory instruments to determine the contamination being removed by the shaving/scabbling equipment. The preliminary cleanup goal for Cs-137 of 23 pCi/gm and for Sr-90 of 15 pCi/gm will be used to determine satisfactory remediation of the concrete.

5.2.9 The shaving/scabbling equipment will need to be relocated following the satisfactory remediation of an area as determined by sampling and analysis.

5.2.10 Move the shaving/scabbling equipment to the next area to be remediated.

5.2.11 Repeat steps 5.2.6 through step 5.2.10 for the remaining areas of the Canal being remediated.

5.2.12 The north Canal wall west of the Canal joint has been remediated.

FE Initial: _____ Date: _____

5.2.13 The south Canal wall west of the Canal joint has been remediated.

FE Initial: _____ Date: _____

5.2.14 The Canal floor east of the Canal joint has been remediated.

FE Initial: _____ Date: _____

5.2.15 The north Canal wall east of the Canal joint has been remediated.

FE Initial: _____ Date: _____

5.2.16 The south Canal wall east of the Canal joint has been remediated.

FE Initial: _____ Date: _____

5.2.17 The east Canal wall has been remediated.

FE Initial: _____ Date: _____

<u>Canal Walkway</u> - Floor Elevation 97' 4" and Walls to Elevation 104' 9" (Ceiling)

5.2.18 The Canal area walls, floor, and ceiling above the Canal will be remediated using the shaving/scabbling equipment, i.e. needle guns, bush hammers, chisels. The sequence for the remediation will be the ceiling, walls, and then the floor areas. See **Sketch 12** for plan view of Elevation 97' 4".

5.2.19 Protect the remediated areas of the Canal walls and floor from possible contamination from the remediation to be performed on the area walls and floor. This can be accomplished by taping clean Herculite and/or heavy plastic on to the clean surfaces.

5.2.20 Move the scabbling equipment and support equipment into the area above the Canal.

5.2.21 Establish containment controls for the ceiling area to be remediated.

5.2.22 During the second and any successive scabbling passes over the same area, samples of the removed concrete should be analyzed using field laboratory instruments to determine the contamination being removed by the shaving/scabbling equipment. The preliminary cleanup goal for Cs-137 of 23 pCi/gm and for Sr-90 of 15 pCi/gm will be used to determine satisfactory remediation of the concrete.

5.2.23 The scabbling equipment will need to be relocated following the satisfactory remediation of an area as determined through sampling and analysis.

5.2.24 Move the scabbling equipment to the next area to be remediated.

5.2.25 Cover the remediated area with Herculite and/or plastic.

5.2.26 Repeat steps 5.2.19 through step 5.2.25 for the remaining areas of the Canal being remediated.

5.2.27 The north area wall has been remediated.

FE Initial: _____ Date: _____

5.2.28 The south area wall has been remediated.

FE Initial: _____ Date: _____

5.2.29 The west area wall has been remediated.

FE Initial: _____ Date: _____

5.2.30 The east area wall has been remediated.

FE Initial: _____ Date: _____

5.2.31 The north floor area has been remediated.

FE Initial: _____ Date: _____

5.2.32 The south floor area has been remediated.

FE Initial: _____ Date: _____

5.2.33 The ceiling area has been remediated.

FE Initial: _____ Date: _____

5.2.34 Remove the equipment from the remediation area.

5.2.35 Remove the contamination control materials from the area.

Canal Sumps S2 and S3

5.2.36 The Canal Sumps designated S-2 and S-3 were characterized and the 12 inches of concrete at the base of the S-3 sump was found to contaminated through the entire 12 inches. Therefore, it is assumed that S-2 sump is contaminated in the same magnitude. The concrete in these sumps will be removed using a concrete core-boring machine - wet method. The water will be controlled and collected with a wet vacuum. Several core bores will be performed to remove the concrete from the base and the sidewalls of each sump.

5.2.37 Lower the core boring and support equipment into the Canal.

5.2.38 Establish contamination controls for the Canal floor sump to be core bored.

5.2.39 Using a 4" bit, core bore 3 sides of the sump, approximately 3" away from the sump vertical walls. See **Sketch 8.**

5.2.40 Using the same 4" bit, core bore the sump floor next to the Canal wall. See **Sketch 8.**

5.2.41 Use a hammer and chisel or appropriate mechanical equipment to remove any remaining concrete between the Canal floor sump and the Canal floor or wall.

5.2.42 Remove the contaminated concrete from the Canal floor sump.

5.2.43 Using scabbling equipment, i.e. Needle guns, bush hammers and chisels, remediate the south wall of the sump (the canal wall side).

5.2.44 The remediation has been completed for the Canal floor sump designated S-2.

FE Initial: _____ Date: _____

5.2.45 Repeat steps 5.2.38 through 5.2.44 for the remaining Canal Floor Sump.

5.2.46 The remediation has been completed for the Canal floor sump designated S-3.

FE Initial: _____ Date: _____

5.2.47 There were several core bores performed in the Canal walls and floor and in the Canal walkway area during the characterization of the Canal area. The Canal floor sumps S-2 and S-3 have been remediated by removing the concrete floor of each. These penetrations in the Canal and Walkway areas will be filled with a mix of concrete mix topped with hydraulic cement.

5.2.48 Prepare the penetrations to be filled with concrete/cement by lightly wetting or misting.

5.2.49 Fill each of the penetrations with concrete/cement mix until an even surface is obtained with the respective adjacent surfaces.

5.2.50 All penetrations in the Canal and Walkway area have been filled with grout.

FE Initial: _____ Date: _____

Canal Walkway Sump

5.2.51 The Canal Walkway Sump SS lining will be removed; the attached piping (two incoming Canal Walkway drains) will be surveyed to document radiological characteristics, plugged at the sump and filled with grout. The remaining concrete sump will be remediated to remove loose contamination and a fixative applied. See **Sketch 9** for details of sump.

5.2.52 Establish contamination control around the Canal Walkway Sump in preparation for removal of the SS liner.

5.2.53 Decontaminate and/or fix the contamination in the SS liner of the Canal Walkway Sump.

5.2.54 Vacuum to remove any loose debris/particles in the two incoming Canal Walkway area floor drain lines attached to the steel liner.

5.2.55 Cut the 2 incoming lines to the Canal Walkway sump using an ID cutting device or chisels.

5.2.56 Remove the SS liner.

5.2.57 Assess the radiological contamination of the concrete of the Canal Walkway Sump.

5.2.58 Remediate the contamination in the Canal Walkway Sump to remove loose contamination only.

5.2.59 Survey the two incoming Canal Walkway drains to the extent possible.

FS Rep. Initial: _____ Date: _____

FE Initial: _____ Date: _____

5.2.60 Install expandable plugs at the inlets and fill piping with grout mixture.

FE Initial: _____ Date: _____

5.2.61 Apply fixative to the Canal walls and floor, the Canal Walkway ceiling, walls, floor and the Canal Walkway Sump.

FE Initial: _____ Date: _____

5.2.62 Decontaminate, if possible all the scabbling equipment and move out of the Canal area. If not, all equipment will be tagged to document their condition and will be stored per FS direction.

FE Initial: _____ Date: _____

5.2.63 Perform a radiological survey of the Canal, Canal Walkway area ceiling, walls, and floor and the Canal Walkway Sump to document the final as left radiological conditions. This will become the base survey for the lower Canal.

FS Rep. Initial: _____ Date: _____

FE Initial: _____ Date: _____

Water Treatment Foundation

5.2.64 The Water Treatment foundation concrete pad and the adjacent work area pad will be removed, the piping below these pads and the associated contaminated soils will be removed.

5.2.65 A hydraulic operated ram mounted on a backhoe will be used to breakup the concrete pads for removal. Apply a fixative, i.e. latex paint, to the concrete pad area to be broken to minimize airborne contamination. During this process a high velocity high DP vacuum can be utilized to keep the dust down as well as light misting of the concrete with a garden sprayer type portable sprayer.

5.2.66 Establish contamination control of the area.

5.2.67 Using the hydraulic ram break the concrete into pieces manageable for disposal as debris. Debris is defined as less than 10 inches thick and 8 feet diagonal measurements. This is to meet the requirements for the disposal facility.

5.2.68 Remove the pieces and place into approved waste containers.

5.2.69 Excavate, using a backhoe, excavator, or hand methods, uncover the piping under the removed concrete pad.

5.2.70 Segregate contaminated materials per Technical Work Document ERD-BGRR-TP-01-05. The PCG for Cs-137 is 23 pCi/gm and for Sr-90 is 15 pCi/gm.

5.2.71 Secondary containment piping should be breached and sampled for contamination. If contamination is found, then appropriate contamination controls shall be used for removal of the secondary containment piping.

5.2.72 The piping should be cut into manageable lengths for packaging and disposal.

5.2.73 Where the piping is to be cut, install contamination control materials to prevent the spread of contamination. If necessary (Radiological survey data will be used to determine this need), prior to cutting a pipe, a 1/4" hole will be drilled on the top of pipe, within the section to be removed. Check to see if there is any water within the pipe. If no water is present expanding foam will be injected into the cut area. Allow at least two hours for the foam to cure before proceeding with the cuts. If there is water present, place a collection container under the pipe, i.e. witch hat, and drill a second 1/4" hole for water drainage. After the water is drained proceed with the expanding foam.

5.2.74 Using a mechanical saw, i.e. band saw, reciprocating saw or snap cutter cut the piping. When a mechanical saw is used to cut the piping, a vacuum hose will be attached to a HEPA vacuum to collect saw filings.

5.2.75 Install a containment bag with absorbent material or plastic pipe caps over the cut ends of the piping and place the cut piece into the shipping container.

5.2.76 Repeat above steps 5.2.72 through 5.2.75 for the remaining pipes.

5.2.77 When the piping has been removed, sample and analyze the soil under the piping at the pipe joints as a minimum using ISOCS and Beta Scint field laboratory instruments.

NOTE 4: *If contaminated soil, above the PCG (*Cs-137 is 23 pCi/gm and Sr-90 is 15 pCi/gm.), *is found to be at a depth of three feet below the piping elevation, the BGRR Project Manager or his designee shall authorize any deeper excavation to remove contaminated soils. This should be trended immediately.*

5.2.78 Remove contaminated soil and place into containers for disposal.

5.2.79 The final dimensions of the excavation are:

_____Feet Long _____ Feet Wide _____Feet Deep

FE Initial: _____ Date: _____

5.2.80 Conduct Final Status Survey of the overburden soil and excavated trench in accordance with an approved Technical Work Document.

FE Initial: _____ Date: _____

East Yard Sump

5.2.81 The East Yard Sump, associated piping and contaminated soils will be removed while the Canal Temporary structure is in place. It may be necessary to remove sections of the two 12" diameter abandoned chiller water lines and pneumatic transfer tube lines during the excavation of the East Yard Sump. DWG's M-607-30A, 3686-S-1 and S-2 sheets1 and 2 of 2.

5.2.82 Removal of the contaminated soil associated with the EYS may require the removal of the abandoned chiller water lines and portions of the pneumatic transfer tubes to provide the necessary excavation layback area.

5.2.83 Establish contamination controls for the excavation of the East Yard Sump piping and concrete sump.

5.2.84 Excavate, using a backhoe, excavator, or hand methods, to uncover the piping connected to the EYS.

5.2.85 Segregate contaminated materials per Technical Work Document ERD-BGRR-TP-01-05. The PCG for Cs-137 is 23 pCi/gm and for Sr-90 is 15 pCi/gm.

5.2.86 Secondary containment piping should be breached and sampled for contamination. If contamination is found, then appropriate contamination controls shall be used for removal of the secondary containment piping.

5.2.87 The piping should be cut into manageable lengths for packaging and disposal.

5.2.88 Where the piping is to be cut, install contamination control materials to prevent the spread of contamination. If necessary (Radiological survey data will be used to determine this need), prior to cutting a pipe, a 1/4" hole will be drilled on the top of pipe, within the section to be removed, and expanding foam will be injected into the cut area. Allow at least two hours for the foam to cure before proceeding with the cuts**.**

5.2.89 Using a mechanical saw, i.e. band saw, reciprocating saw or snap cutter cut the piping. When a mechanical saw is used to cut the piping, a vacuum hose will be attached to a HEPA vacuum to collect saw filings.

5.2.90 Install a containment bag with absorbent material or plastic pipe caps over the cut ends of the piping and place the cut piece into the shipping container.

5.2.91 When the piping has been removed, sample and analyze the soil under the piping at the pipe joints as a minimum using ISOCS and Beta Scint field laboratory instruments.

NOTE: 5: *East yard sump will be rigged according to the approved Rigging Plan, which will be on the job site at all times.*

REPEAT OF NOTE 4: *If contaminated soil, above the PCG (*Cs-137 is 23 pCi/gm and Sr-90 is 15 pCi/gm.*), is found to be at a depth of three feet below the piping elevation, the BGRR Project Manager or his designee shall authorize any deeper excavation to remove contaminated soils. This should be trended immediately.*

5.2.92 Remove contaminated soil and place into containers for disposal as per ERD-BGRR-TP-01-05.

5.2.93 Excavate the concrete EYS, segregating contaminated soil.

5.2.94 Establish contamination controls at a lay down area for the concrete EYS.

5.2.95 Remove the EYS from the excavation. The EYS weighs approximately 14,000 pounds without the cover.

5.2.96 Remove contaminated soil below and around the East Yard Sump excavation and place into containers for disposal.

REPEAT OF NOTE 4: *If contaminated soil, above the PCG (*Cs-137 is 23 pCi/gm and Sr-90 is 15 pCi/gm.*), is found to be at a depth of three feet below the piping elevation, the BGRR Project Manager or his designee shall authorize any deeper excavation to remove contaminated soils. This should be trended immediately.*

5.2.97 If it is necessary to remove either portions of the two-abandoned 12-inch diameter chilled water line pipes or the pneumatic transfer tubes, during the excavations, cut and remove the piping. The chilled water and pneumatic lines are historically clean lines. However, they should be surveyed prior to cutting. List below the additional piping that was removed or N/A.

Type and amount of piping removed: _____

FE Initial: _____ Date: _____

5.2.98 The final dimensions of the excavation are:

_____Feet Long _____ Feet Wide _____Feet Deep

FE Initial: _____ Date: _____

5.2.99 Conduct Final Status Survey of the overburden soil and excavated trench in accordance with an approved technical work document.

FE Initial: _____ Date: _____

5.2.100 The excavated areas of the South Trench can be backfilled At-Risk, prior to IVC, with soil that is deemed to be clean per Technical Work Document ERD-BGRR-TP-01-05, with concurrence form the Project Manager or designee. The PCG for Cs-137 is 23 pCi/gm and for Sr-90 is 15 pCi/gm

PM Initial: _____ Date: _____

Canal House Area

5.2.101 Canal House south work area concrete pad, three below grade concrete vaults the piping below these pads and the associated contaminated soils will be removed.

5.2.102 The vaults were to be removed several years ago when modifications were made to the Canal area. It appears as if the vaults were filled and not removed.

5.2.103 A hydraulic operated ram mounted on a backhoe will be used to breakup the concrete pads for removal. Apply a fixative, i.e. latex paint to the concrete pad area to be broken to minimize airborne contamination. During this process a high velocity high DP vacuum can be utilized to keep the dust down as well as light misting of the concrete with a garden sprayer type portable sprayer.

5.2.104 Establish contamination control of the area.

5.2.105 Using the hydraulic ram break the concrete into pieces manageable for disposal as debris. Debris is defined as less than 10 inches thick and 8 feet diagonal measurements. This is to meet the requirements for the disposal facility.

5.2.106 Remove the pieces and load into waste containers.

5.2.107 Excavate, using a backhoe, excavator, bobcat, or hand methods, uncover the vaults and piping under the removed concrete pad.

5.2.108 Segregate contaminated materials per Technical Work Document ERD-BGRR-TP-01-05. The PCG for Cs-137 is 23 pCi/gm and for Sr-90 is 15 pCi/gm.

5.2.109 Perform radiation monitoring during the excavation of the three vaults.

5.2.110 Secondary containment piping should be breached and sampled for contamination. If contamination is found, then appropriate contamination controls shall be used for removal of the secondary containment piping.

5.2.111 The piping should be cut into manageable lengths for packaging and disposal.

5.2.112 Where the piping is to be cut, install contamination control materials to prevent the spread of contamination. If necessary (Radiological survey data will be used to determine this need), prior to cutting a pipe, a 1/4" hole will be drilled on the top of pipe, within the section to be removed, and expanding foam will be injected into the cut area. Allow at least two hours for the foam to cure before proceeding with the cuts.

5.2.113 Using a mechanical saw or cutting device cut the piping. When a mechanical saw is used to cut the piping, a vacuum hose will be attached to a HEPA vacuum to collect saw filings.

5.2.114 Install a containment bag with absorbent material or plastic pipe caps over the cut ends of the piping and place the cut piece into the shipping container.

5.2.115 WHEN the piping has been removed, sample and analyze the soil under the piping at the pipe joints as a minimum using ISOCS and Beta Scint field laboratory instruments.

REPEAT OF NOTE 4: *If contaminated soil, above the PCG (*Cs-137 is 23 pCi/gm and Sr-90 is 15 pCi/gm.*), is found to be at a depth of three feet below the piping elevation, the BGRR Project Manager or his designee shall authorize any deeper excavation to remove contaminated soils. This should be trended immediately*

5.2.116 Remove contaminated soil and place into containers for disposal.

5.2.117 Set up a contamination control lay down area for the three vaults, or have a disposal container ready to accept the vaults as they are removed from the ground.

5.2.118 Remove the three vaults and place onto the lay down area or directly into containers for disposal. The concrete filled vaults weigh approximately 1500 pounds each.

5.2.119 When each vault is removed, sample and analyze the soil under each vault as a minimum using ISOCS and Beta Scint field laboratory instruments.

REPEAT OF NOTE 4: *If contaminated soil, above the PCG (*Cs-137 is 23 pCi/gm and Sr-90 is 15 pCi/gm.*), is found to be at a depth of three feet below the piping elevation, the BGRR Project Manager or his designee shall authorize any deeper excavation to remove contaminated soils. This should be trended immediately*

5.2.120 Remove contaminated soil below and adjacent to the three vaults.

5.2.121 The final dimensions of the excavation are:

_____Feet Long _____ Feet Wide _____Feet Deep

FE Initial: _____ Date: _____

5.2.122 Conduct Final Status Survey of the overburden soil and excavated trench in accordance with an approved Technical Work Document.

FE Initial: _____ Date: _____

Temporary Covering of Canal Opening

5.2.123 The following steps will install or verify installed a manufactured temporary weather tight cover over the Canal opening, contamination control measures in place inside the temporary enclosure for the Canal area, and removal of the temporary structure.

5.2.124 Install/erect the temporary cover per the manufacturers instructions over the lower Canal area prior to relocating the existing Temporary Structure.

5.2.125 Verify that the temporary cover installed over the Canal opening to the lower Canal area is weather tight. The temporary cover will be replaced with a permanent cover when the Below Grade Piping removal and associated contaminated soils removal has been completed and the area is ready for backfill and grading for drainage control.

FE Initial: _____ Date: _____

5.2.126 Verify adequate contamination control is in place to allow the temporary structure over the Canal House area to be removed.

FS Rep. Initial: _____ Date: _____

FE Initial: _____ Date: _____

5.2.127 Prepare a laydown area for the temporary structure over the Canal House area. Consideration should be given to the Below Ground Coolers and Filters area over the Below Ground Ducts just west of the Instrument House Building 708.

5.2.128 Remove the Temporary Structure over the Canal House area and place it in the prepared laydown area. Prior to moving the Temporary Structure the adjacent south area will be clear of Above Ground Ducts. The rigging details will and the routing will be discussed at that time.

5.3 North Trench, Piping, and Soil Removal

The North Trench is defined as the piping trench that runs east from the Building 701 east Roll-up truck bay door to the north side of Building 801, north to the Canal discharge line connection to the A & B waste lines, and the southwest portion of the Canal discharge line to the Canal pad area. The grade elevation is 109'. The 6" and 2" drain lines begin at elevation 106' at the east roll-up truck bay door and are at elevation 104' at the Building 801 north wall. The 4" Canal discharge line is at elevation 101' at the north Canal House wall. There are two abandoned 12" chilled water lines and one 3" air line that transit the north trench. These lines should be cut and removed if they interfere with the removal of the piping from the trench and/or the removal of contaminated soil.

During the excavation of the areas below, especially deeper elevations (more than 4' deep) it is probable to come across distressed and/or damaged tile storm drain lines. These lines will be replaced with PVC piping without any additional Work Documents. If such lines are replaced it will be noted within the Work Permit. Similarly the Off Gas Lines from 811 to 801 (Out of Service lines) will be cut and capped and the penetrations will be sealed. Facilities Support will be notified prior to cutting these pipes. These activities will be noted in the Work Permit as well.

Throughout the implementation of section 5.3, collect and/or obtain samples for each waste stream, i.e., concrete, soil, piping systems and asphalt per Attachment 8.5.

North Trench

5.3.1 This section will provide the instructions for:

1. The excavation of a trench on the north side of the Canal House, from Building 701 east high bay door at Building 701 column 7, going east to the piping penetration wall on the north side of Building 801. DWG M-607-30-A
2. Removing the 6" welded steel Semi-Hot drain line which changes to 6" cast iron "F" Waste line and the 12" VT secondary containment pipe along with the 2" SS Building 703 west wing tank pit line in a 4" VT secondary containment pipe to the north side of Building 801. DWG's A3841-S1 Sheet 1 of 4, M-607-30-A.
3. Removing the Pneumatic transfer tubes and 8" VT secondary containment piping, from the trench located at elevation 108' of Building 701, Column 7 going East to the manway at elevation 105'. Also from the manway going north to the south wall penetration of Building 703. DWG's M-6-7-30-A, M-703-50, M-801-4A.
4. Removing the 4" welded black steel Canal Discharge line and 6" VT secondary containment pipe, from the east of Canal House concrete pad area to the A&B waste line trench on the north side of Building 801. DWG's M-607-30-A, M-811-5A.

5. Removing the 1 ½" SS "D" Waste (Walkway Sump and EYS discharge) line, in a 4" orangeburg secondary containment pipe, from the east of Canal House concrete pad area to the piping penetration wall on the north side of Building 801, outside the "D" Tank room. DWG M-1 Job # 3252-A Sheet 3 of 5.
6. Removing associated contaminated soils related to the above excavation activities.

5.3.2 A RWP has been issued for section 5.3.

RWP No: _____ FE Initial: _____ Date: _____

5.3.3 The JSA has been reviewed to verify that no additional hazards may exist due to changing field conditions or configuration.

FE Initial: _____ Date: _____

IH/IS Representative: _____ Date: _____

5.3.4 Verify that waste container(s) are available to accept the material.

WMR Initial: _____ Date: _____

5.3.5 Verify that all piping isolations have been made in accordance with Section 5.1, Piping Isolations.

FE Initial: _____ Date: _____

NOTE 6: *Perform soil sampling to segregate contaminated soil for disposal. The PCG for Cs-137 is 23 pCi/gm and for Sr-90 is 15 pCi/gm*

NOTE 7: *A competent person shall be designated for the excavation. Approved excavation plans shall be maintained at the job site. All excavations will be performed in accordance with 29CFR1926, SUBPART P.*

5.3.6 The trained excavation Competent Person for excavating the North Trench is:

_____
(Print Name)

_____ Date: _____
(Signature)

5.3.7 Excavate, using a backhoe, excavator, bobcat, or hand methods, the asphalt, concrete and soils to uncover the piping in the North Trench.

5.3.8 Segregate contaminated materials per Technical Work Document ERD-BGRR-TP-01-05. The PCG for Cs-137 is 23 pCi/gm and for Sr-90 is 15 pCi/gm.

5.3.9 When the piping has been uncovered and is verified to be isolated, then remove the piping from the trench.

5.3.10 Secondary containment piping should be breached and sampled for contamination. If contamination is found, then appropriate contamination controls shall be used for removal of the secondary containment piping.

5.3.11 The piping should be cut into manageable lengths for packaging and disposal.

5.3.12 Where the piping is to be cut, install contamination control materials to prevent the spread of contamination. If necessary (Radiological survey data will be used to determine this need), prior to cutting a pipe, a 1/4" hole will be drilled on the top of pipe, within the section to be removed, and expanding foam will be injected into the cut area. Allow at least two hours for the foam to cure before proceeding with the cuts.

5.3.13 Using mechanical methods, i.e., snap cutter, band or reciprocating saw, cut the piping. When a saw is used, a vacuum hose will be attached to a HEPA vacuum to collect filings.

5.3.14 Install a containment bag with absorbent material or plastic pipe caps over the cut ends of the piping and place the cut piece into the shipping container.

5.3.15 Repeat the above steps 5.3.10 through 5.3.14 for the remaining sections of piping to be removed from the North Trench.

5.3.16 When the piping has been removed from the North Trench, sample and analyze the soil under the piping at the pipe joints as a minimum using ISOCS and Beta Scint field laboratory instruments.

REPEAT OF NOTE 4: *If contaminated soil, above the PCG (*Cs-137 is 23 pCi/gm and Sr-90 is 15 pCi/gm.*), is found to be at a depth of three feet below the piping elevation, the BGRR Project Manager or his designee shall authorize any deeper excavation to remove contaminated soils. This should be trended immediately.*

5.3.17 Remove contaminated soil from the trench and place into containers for disposal.

5.3.18 The final dimensions of the excavation are:

_____Feet Long _____ Feet Wide _____Feet Deep

FE Initial: _____ Date: _____

5.3.19 Conduct Final Status Survey of the overburden soil and excavated trench in accordance an approved technical work document.

FE Initial: _____ Date: _____

5.3.20 The North Trench excavation, piping removal, and contaminated soil removal is complete.

FE Initial: _____ Date: _____

5.3.21 The North Trench excavation area can be backfilled At-Risk, prior to IVC, with soil that is deemed to be clean per Technical Work Document ERD-BGRR-TP-01-05, with concurrence from the Project Manager or designee. The PCG for Cs-137 is 23 pCi/gm and for Sr-90 is 15 pCi/gm.

PM Initial: _____ Date: _____

Canal House Discharge

5.3.22 Steps 5.3.23 through 5.3.25 excavates, removes piping, and removes contaminated soil associated with the Canal discharge line and the Canal Walkway Sump discharge line that runs from the east side of the Canal House to the north side of Building 801 to the A&B waste lines trench. DWG's M-607-30-A, M-1 Job # 3868A Sheet 1of 11, M-1 Job # 3252-A Sheet 3 of 5.

5.3.23 All excavations will be performed in accordance with 29CFR1926 SUBPART P. The trained excavation Competent Person for excavating the Canal House Floor Drain trench is:

_____
(Print Name)

_____ Date: _____
(Signature)

5.3.24 Repeat the above steps, 5.3.2 through 5.3.19 for the Canal discharge line, Canal Walkway Sump discharge line, and pneumatic transfer tube lines removal.

Dimensions of excavation record:

_____ Feet long _____ Feet wide _____ Feet deep

FE Initial: _____ Date: _____

5.3.25 Conduct Final Status Survey of the overburden soil and trench in accordance with an approved technical work document.

FE Initial: _____ Date: _____

5.3.26 The Canal discharge line, Canal Walkway Sump discharge line and the pneumatic transfer tubes trench excavation, piping and contaminated soil removal is complete.

FE Initial: _____ Date: _____

5.3.27 The excavated areas above can be backfilled At-Risk, prior to IVC, with soil that is deemed to be clean per Technical Work Document ERD-BGRR-TP-01-05. The PCG for Cs-137 is 23 pCi/gm and for Sr-90 is 15 pCi/gm.

PM Initial: _____ Date: _____

5.4 South Trench, Piping and Soil Removal

Throughout the implementation of section 5.4, collect and/or obtain samples for each waste stream, i.e., concrete, soil, piping systems and asphalt, as per Attachment 8.5.

5.4.1 This section will provide the instructions for:

1. Excavation of the piping trench located on the east side of the Canal House from the intersection of the pneumatic tubes and the Canal EYS and Walkway Sumps discharge line (at the end of the north trench) south to the pneumatic transfer tube manway and then going east and north to the piping penetration wall on the south side of Building 801. DWG's M-607-30A, M1-3252-A, Sheet 3 of 5,

2. Removing the pneumatic transfer piping and 8" VT secondary containment piping, from the EYS, Canal Walkway Sump discharge line intersection with the pneumatic tube transfer lines running south to the pneumatic transfer tube south manway and east to the Building 801 south wall. DWG M-607-30A.

3. Removing associated contaminated soil

5.4.2 A RWP has been issued for this section:

RWP No: _____ FE Initial: _____ Date: _____

5.4.3 The JSA has been reviewed to verify that no additional hazards may exist due to changing field conditions or configuration.

FE Initial: _____ Date: _____

IH/IS Representative: _____ Date: _____

5.4.4 Verify that waste container(s) are available to accept the material.

WMR Initial: _____ Date: _____

5.4.5 Verify that all piping isolations have been made in accordance with Section 5.1, Piping Isolations.

FE Initial: _____ Date: _____

REPEAT OF NOTE 6: *Perform soil sampling to segregate contaminated soil for disposal. The PCG for Cs-137 is 23 pCi/gm and for Sr-90 is 15 pCi/gm.*

REPEAT OF NOTE 7: *A competent person shall be designated for the excavation. Approved excavation plans shall be maintained at the job site.*

5.4.6 All excavations will be performed in accordance with 29CFR1926 SUBPART P. The trained excavation Competent Person for excavating the South Trench is:

_____
(Print Name)

_____ Date: _____
(Signature)

5.4.7 Excavate, using a backhoe, excavator, or hand methods, the asphalt, concrete and soils to uncover the piping in the South Trench.

5.4.8 Segregate contaminated materials per Technical Work Document ERD-BGRR-TP-01-05. The PCG for Cs-137 is 23 pCi/gm and for Sr-90 is 15 pCi/gm.

5.4.9 When the piping has been uncovered and is verified to be isolated, then remove the piping from the trench.

5.4.10 Secondary containment piping should be breached and sampled for contamination. If contamination is found, then appropriate contamination controls shall be used for removal of the secondary containment piping.

5.4.11 The piping should be cut into manageable lengths for packaging and disposal.

5.4.12 Where the piping is to be cut, install contamination control materials to prevent the spread of contamination. If necessary (Radiological survey data will be used to determine this need), prior to cutting a pipe, a 1/4" hole will be drilled on the top of pipe, within the section to be removed, and expanding foam will be injected into the cut area. Allow at least two hours for the foam to cure before proceeding with the cuts.

5.4.13 Using mechanical methods, i.e., snap cutter, band or reciprocating saw, cut the piping. When a saw is used, a vacuum hose will be attached to a HEPA vacuum to collect filings.

5.4.14 Install a containment bag with absorbent material or plastic pipe caps over the cut ends of the piping and place the cut piece into the shipping container.

5.4.15 Repeat the above steps 5.4.10 through 5.4.13 for the remaining sections of piping to be removed from the South Trench.

5.4.16 When the piping has been removed from the South Trench, sample and analyze the soil under the piping at the pipe joints as a minimum using ISOCS and Beta Scint field laboratory instruments.

REPEAT OF NOTE 4: *If contaminated soil, above the PCG (*Cs-137 is 23 pCi/gm and Sr-90 is 15 pCi/gm.*), is found to be at a depth of three feet below the piping elevation, the BGRR Project Manager or his designee shall authorize any deeper excavation to remove contaminated soils. This should be trended immediately.*

5.4.17 Remove contaminated soil from the trench and place into containers for disposal. The final dimensions of the excavation are:

_____Feet Long _____ Feet Wide _____Feet Deep

FE Initial: _____ Date: _____

5.4.18 Conduct Final Status Survey of the overburden soil and excavated trench in accordance an approved technical work document.

FE Initial: _____ Date: _____

5.4.19 The South Trench excavation, piping removal, and contaminated soil removal is complete.

FE Initial: _____ Date: _____

5.4.20 The excavated areas of the South Trench can be backfilled At-Risk, prior to IVC, with soil that is deemed to be clean per Technical Work Document ERD-BGRR-TP-01-05, with concurrence from the Project Manager or designee. The PCG for Cs-137 is 23 pCi/gm and for Sr-90 is 15 pCi/gm

PM Initial: _____ Date: _____

5.5 Storm Drain Rerouting

BNL Plant Engineer is preparing the detailed instructions for items, 1 through 6. They will be incorporated into this package when they are available in accordance with ERD-OPM
1.0.

Throughout the implementation of section 5.5, collect and/or obtain samples for each waste stream, i.e., concrete, soil, piping systems and asphalt, as per Attachment 8.5.

5.5.1 This section will provide the instructions for:

1. The rerouting of the BGRR elev. 143' equipment room drains,
2. Rerouting of the Building 701 south side roof drains,
3. Rerouting of the Building 701 Machine Room floor drain and equipment drain,
4. Isolation of the floor drain under the Building 701 east Control Rod Drive Mechanism area,
5. Rerouting of the storm drain line currently going north from the south storm drain manway of Building 709, to the east end storm drain system outfall,
6. Removing associated contaminated soils.

5.5.2 A RWP has been issued for section 5.5.

RWP No: _____

FE Initial: _____ Date: _____

5.5.3 The JSA has been reviewed to verify that no additional hazards may exist due to changing field conditions or configuration.

FE Initial: _____ Date: _____

IH/IS Representative: _____ Date: _____

5.5.4 Verify that waste container(s) available to accept material.

WMR Initial: _____ Date: _____

5.5.5 Verify that all piping isolations have been made in accordance with Section 5.1, Piping Isolation.

FE Initial: _____ Date: _____

5.6 Surface Soil Remediation

BNL PE is preparing the detailed instructions for the above items, 1 and 2. They will be incorporated into this package when they are available in accordance with ERD-OPM 1.0.

Throughout the implementation of this section 5.6, collect and/or obtain samples for each waste stream, i.e., concrete, soil, piping systems and asphalt, as per Attachment 8.5.

5.6.1 This section will provide the instructions for:

1. Removal of the layers of asphalt and concrete in the east parking area, approximately 120 feet east of Building 701 column 7 and 160 feet south from the south wall of Building 703,
2. Removal of surface contaminated soils,

5.6.2 A RWP has been issued for section 5.6.

RWP No: _____ FE Initial: _____ Date: _____

5.6.3 The JSA has been reviewed to verify that no additional hazards may exist due to changing field conditions of configuration.

FE Initial: _____ Date: _____

IH/IS Representative: _____ Date: _____

5.6.4 Verify that waste container(s) available to accept materials.

WMR Initial: _____ Date: _____

5.7 Remediation Area Restoration

This section will provide instructions for installing the permanent barrier between the Canal at Building 701 column 7, removing the temporary containment over the Canal area, installing the permanent cover over the Canal area, backfilling and grading the area for drainage control, and application of asphalt to the area to maintain the grading.

The Independent Verification Contractor (IVC) shall have completed surveying and sampling of the areas, sample analysis, and will have submitted their draft report that the area has been satisfactorily remediated before backfilling to complete the remediation of the area.

5.7.1 IVC draft report has been submitted.

FE Initial: _____ Date: _____

5.7.2 The barrier in the Canal will be made of aluminum sheeting and anchored into the Canal slotted place that was used for segregating the Canal during normal operations. Aluminum angle will be used with wall anchors to hold the aluminum plate in place. See **Sketch 10.**

5.7.3 Have Plant Engineering sheet metal workers take the necessary measurements and manufacture the aluminum plate and angle pieces for installation in the Canal.

5.7.4 The Plant Engineering sheet metal workers should install the aluminum barrier in the Canal.

5.7.5 The permanent barrier has been satisfactorily installed in the Canal.

FE Initial: _____ Date: _____

5.7.6 The temporary weather tight cover over the Canal area shall be replaced with a permanent cover capable of supporting normal roadway traffic. The cover shall also be watertight to prevent rainwater intrusion into the Canal area**.**

5.7.7 Plant Engineering support will be used to design and install the permanent cover over the Canal area.

5.7.8 Install the watertight cover over the Canal area.

5.7.9 The permanent watertight cover has been satisfactorily installed over the Canal area.

FE Initial: _____ Date: _____

5.7.10 The Canal area and the east side of Building 701 where the remediation has been completed, 160 feet by 120 feet, will be backfilled and graded to provide drainage control to prevent water intrusion into the Canal area. Following the grading, a layer of asphalt will be applied to maintain the grading.

5.7.11 Backfill the area on the east side of Building 701 and grade to provide water intrusion drainage control for the Canal area. The soil compaction criteria for the backfill will be decided by Plant Engineering. This requirement will be incorporated to the work package in accordance with ERD-OPM 1.0.

5.7.12 Prepare the graded area for application of the asphalt.

FE Initial: _____ Date: _____

5.7.13 Apply a covering of asphalt of sufficient depth to accept typical roadway traffic and to maintain the drainage control grading. The asphalt thickness will be decided by Plant Engineering. This requirement will be incorporated to the work package in accordance with ERD-OPM 1.0.

FE Initial: _____ Date: _____

5.8 Final Inspection at Completion of Work

5.8.1 The FE and the IH/IS Coordinator shall inspect all areas of work to ensure no personnel safety hazards exist.

FE Initial: _____ Date: _____

IH/IS Representative: _____ Date: _____

5.8.2 Perform a radiological survey of the completed work area to ensure no radiological hazards exist. This document will become the base survey document for surveillance and monitoring of this area.

FE Initial: _____ Date: _____

FS Initial: _____ Date: _____

6.0 RECORDS

File the work package and all supporting data and documentation in accordance with Reference 7.2, ERD-OPM-4.5, Implementation, Control, and Configuration Management For BGRR Decommissioning Project Work Activities.

7.0 REFERENCES

7.1 ERD-OPM-1.0, Procedure Development Requirements.

7.2 ERD-OPM-4.5, Implementation, Control, and Configuration Management For BGRR Decommissioning Project Work Activities

7.3 ERD-OPM-4.6, Hazardous Materials Assessment, Analysis, and Mitigation for BGRR Decommissioning Activities

7.4 BNL Radiological Control Manual

7.5 USID/SE No. BGRR-SE-01-02, "Lower Canal and Water Treatment House, Equipment, and Associated Soil Removal."

7.6 ERD-BGRR-TP-01-05, "Soil Sample Screening for Excavations."

7.7 EP-ES&H-801A, “Plant Engineering Digging Permit and Daily Trench & Excavation Inspection Guide”

7.8 Suffolk County Department of Health Services- Suffolk County Sanitary Code Article 12, Toxic and Hazardous Materials Storage and Handling Controls.

7.9 ES&H - 1.18.0 "Excavation Safety"

7.10 ES&H - 2.2.4 "Confined Spaces"

7.11 29CFR1926, SUBPART P

7.12 REFERENCE DRAWINGS

1. M-1, Sheet 3 of 5, Job 3252-A, Mechanical Work, Decontamination Facility – 709, 3-25-54
2. M-811-5-A, Plot Plan Radioactive Waste Disposal System, 9-17-48
3. M-811-15-A, Radioactive Waste System, Profile of Trenches, 1-10-49
4. C-709-1A, Canal – East of Line 7 of BLDG. 701, Sections & Details, 11-8-48
5. C-709-2A, Canal – East of Line 7 of BLDG. 709, Plans, Sections, & Elev’s, 11-8-48
6. M-3, Job # 3686-A -BLDG 709 Instruction Drawing No. 2, 7-25--/57
7. M-709-5A, Canal & Material Handling Equipment Exterior Pile Building, 9-23-48

8. BLDG 709, A3841 – S1, sheet 1 of 4, Concrete Paving, Curbing, & Drainage, 10-10-57
9. M-607-30-A, Composite Layout of Yard Piping All Services Canal Area – East of BLDG. 701, 2-8-49
10. M-701-4-A, Pile BLDG No 701 Main Floor Floor-Roof-Semi-Hot-& Hot Drains, 1-15-48
11. M-703-50-A, Pile Laboratory Pneumatic Tube System Arrangement and Details, 7-21-48
12. M-801-4A, Hot Laboratory Pneumatic Tube System Arrangement and Details, 11-24-48
13. A3841-S1, Sheet 1 of 4, Concrete Paving, Curbing and Drainage, 10-10-57
14. S-1 3686 , Sheet 1 of 2, Structural, 9-16-55
15. S-2 3686, Sheet 2 of 2, Trench Pit & Pump FDTNS, Plans, Sections & Details, 12-6-55
16. BGRR Piping Outline For Removal

8.0 ATTACHMENTS

8.1 Bill of Materials
8.2 Removed pipe listing
8.3 Section 5.1 Piping Isolation Sketches
8.4 Support Sketches
8.5 Samples Needed from the Lower Canal, Piping Systems, and Soil Excavations

9.0 DEFINITIONS/ACRONYMS

ACM	Asbestos Containing Material
BGRR-DP	Brookhaven Graphite Research Reactor Decommissioning Project
CI	Cast Iron
CMU	Concrete Masonry Unit (concrete block)
CSB	Canal Service Building
EM	Environmental Management
ES&H	Environment, Safety and Health
EYS	East Yard Sump
FE	Field Engineer
FS	Facility Support
IH/IS	Industrial Hygiene/Industrial Safety
IVC	Independent Verification Contractor
JSA	Job Safety Analysis
PCG	Preliminary Cleanup Goal
PE	Plant Engineering
RWP	Radiological Work Permit
USID/SE	Unreviewed Safety Issue Determination / Safety Evaluation
VT	Vitrified Tile
WMR	Waste Management Representative

Attachment 8.1

Bill of Materials

Section	Item No.	Description	Quantity
5.1			
	1	1 1/2" Stainless Steel, Socket Weld Cap, 3000 lb	1
	2	2" CS, Threaded cap, 150 lb	1
	3	2" x 6" CS, Sch. 40 nipple - threaded both ends	1
	4	2" Dresser type coupling	1
	5	2" Fernco type rubber cap with clamp	10
	6	4" Fernco type rubber cap with clamp	2
	7	6" Fernco type rubber cap with clamp	1
	8	6" Roust-about type pipe cap	1
	9	Cans of foam	6
	10	1/4" HSS drill bit	6
	11	2" plastic pipe cap	20
	12	1 1/2" plastic pipe cap	6
	13	4" plastic pipe cap	12
	14	ISOCS	1
	15	Beta Scint	1
	16	Sample Bottles	LOT
	17	Hydraulic Cement	5Cu. Ft
5.2			
	1	Shaving Heads	3
	2	Shaving Machine	1
	3	Needle Scabblers	3
	4	PPE	LOT
	5	ISOCS	1
	6	Beta Scint	1
	7	Sample Bottles	LOT
	8	HEPA Vacuum	2
	9	Worker Respirators	LOT
	10	Hydraulic Cement	5Cu. Ft.
	11	Cans of Foam	20
	12	3/8” Drill	1
	13	¼” drill bits	5
	14	Saws-All Pipe cutting blades	50
	15	Pipe cutter	1
	16	ID cutting tool for 4" line	1
	17	Super Sacks, 10-yard capacity each	50
	18	Herculite Material Roll	3
	19	Crane for East Yard Sump, vaults, and structure removal	1

Section	Item No.	Description	Quantity
	20	B-52 Boxes, 312 cu. ft. capacity	10
	21	B-25 Boxes, 96 cu. ft. capacity	15
	22	14' W x 19' L x 6' H Manufactured cover	1
	23	1 1/2" plastic pipe cap	50
	24	2" plastic pipe cap	100
	25	4" plastic pipe cap	50
	26	6" plastic pipe cap	50
5.3			
	1	PPE	LOT
	2	ISOCS	1
	3	Beta Scint	1
	4	Sample Bottles	LOT
	5	HEPA Vacuum	2
	6	Worker Respirators	LOT
	7	Concrete Mix	10 Cu. Ft.
	8	Cans of Foam	20
	9	3/8” Drill	1
	10	¼” drill bits	5
	11	Saws-All Pipe cutting blades	50
	12	Pipe cutter	1
	13	Super Sacks, 10-yard capacity each	20
	14	Herculite Material Roll	3
	15	Crane for trench box removal	1
	16	B-52 Boxes, 312 cu. ft. capacity each	10
	17	B-25 Boxes, 96 cu. ft. capacity each	15
	18	Hydraulic Cement	2 Cu. Ft
5.4			
	1	PPE	LOT
	2	ISOCS	1
	3	Beta Scint	1
	4	Sample Bottles	LOT
	5	HEPA Vacuum	2
	6	Worker Respirators	LOT
	7	Concrete mix	10 Cu. Ft.
	8	Cans of Foam	20
	9	3/8” Drill	1
	10	¼” drill bits	5
	11	Saws-All Pipe cutting blades	50
	12	Super Sacks, 10-yard capacity each	20
	13	Herculite Material Roll	3
	14	Crane for trench box removal	1

Section	Item No.	Description	Quantity
	15	B-52 Boxes, 312 cu. ft. capacity each	10
	16	2" Plastic pipe cap	100
	17	1 1/2" Plastic pipe cap	50
	18	B-25 Boxes, 96 cu. ft. capacity each	15
	19	Hydraulic Cement	2 Cu. Ft
5.5			
	1	PPE	LOT
	2	ISOCS	1
	3	Beta Scint	1
	4	Sample Bottles	LOT
	5	HEPA Vacuum	2
	6	Worker Respirators	LOT
	7	Concrete mix	10 Cu. Ft.
	8	Cans of Foam	20
	9	3/8” Drill	1
	10	¼” drill bits	5
	11	Saws-All Pipe cutting blades	50
	12	Super Sacks 10 yard capacity each	50
	13	Herculite Material Roll	3
	14	Crane or front end loader for pipe removal	1
	15	B-52 Boxes, 312 cu. ft. capacity each	10
	16	B-25 Boxes, 96 cu. ft. capacity each	15
5.6			
	1	PPE	LOT
	2	ISOCS	1
	3	Beta Scint	1
	4	Sample Bottles	LOT
	5	HEPA Vacuum	2
	6	Worker Respirators	LOT
	7	Super Sacks 10 yard capacity each	200
	8	B-52 Boxes, 312 cu. ft. capacity each	10
	9	B-25 Boxes, 96 cu. ft. capacity each	15
5.7			
	1	¼” Aluminum Plate ~ 6’x 8’	1
	2	¼” Aluminum angle ~ 28’ of 2” angle	1
	3	Hilti Gun	1
	4	Hilti Loads 1 bolt per foot	22
	5	Hilti Bolts	28
	6	RTV sealant tube	3

Section	Item No.	Description	Quantity
	7	Pan large enough to go over Canal	PE
	8	Reinforcing bars	PE
	9	Concrete	PE
	10	Grading equipment	
	11	Backfill material for 120’ x 160’ = 19,200 Sq. Ft. x 2 ft	40,000 cu.ft
	12	Asphalt 120’ x 160’ = 19,200 Sq. Ft. x 6” =	10,000 cu.ft.
	13	Sample containers	LOT

Attachment 8.2

List of Pipe Quantities to be Removed

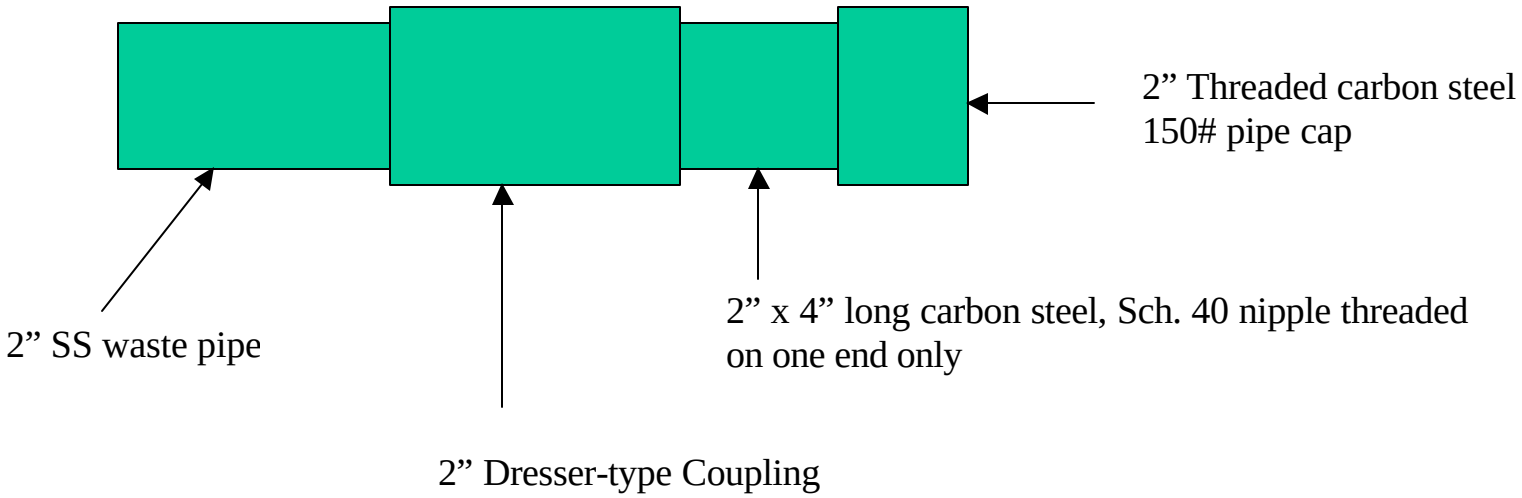
Pipe Name/Material	*Size*	*Length (ft)*
Pneumatic tubes, aluminum, copper, brass	2"	1000
703 Lab Drain, SS	2"	200
F Waste line, CI	6"	200
North Pad drain, CI	4"	100
	6"	25
South Pad drain, CI	4"	75
Canal Discharge, Black steel welded	4"	225
EYS vent, pump suction, SS	2"	40
EYS, Canal walkway sump discharge, SS	1 1/2"	250
Cooling water, steel	12"	80
Compressed Air, steel	3"	40
Water Treatment house drains, duriron	2"	10
SS	3"	50
	4"	6

Attachment 8.3

Section 5.1 Piping Isolation Sketches

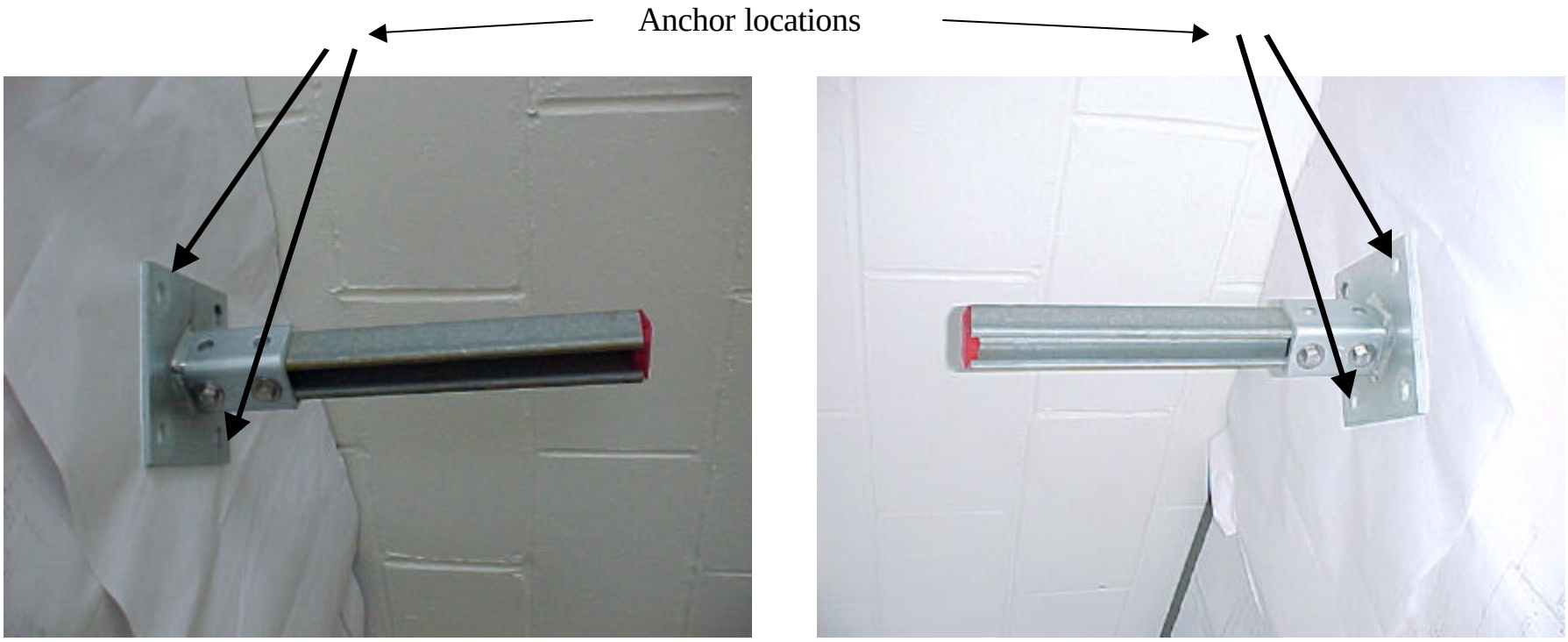
SKETCH 1

Typical isolation utilizing Dresser-type coupling



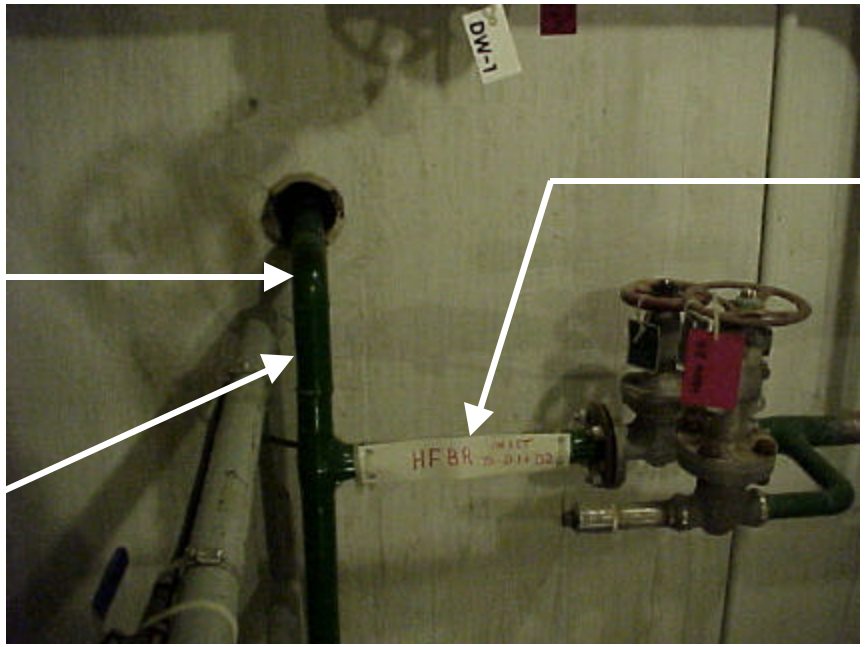
SKETCH 2

Typical hanger for 1 1/2" SS discharge line to be anchored on the wall with 2- 1/2"x5 1/2" long Hilti Quick Bolt II. The anchors should be installed at locations as depicted below. Anchor support above line between tee and valve HOV-25. Use 3/8" threaded rod with a 1 1/2" clevis hanger.



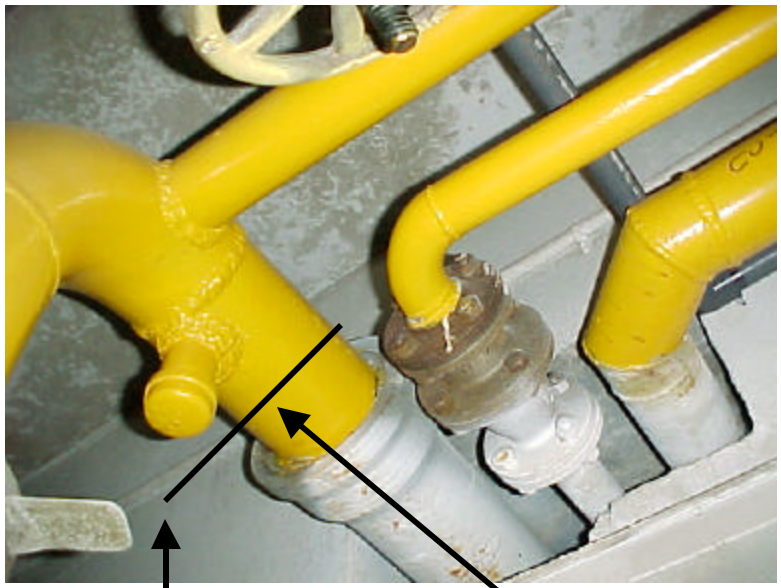
SKETCH 3

Isolation of 1 1/2” SS line at “D” Tank room in Building 801



SKETCH 4

6” discharge line at “F” Tank room in Building 801



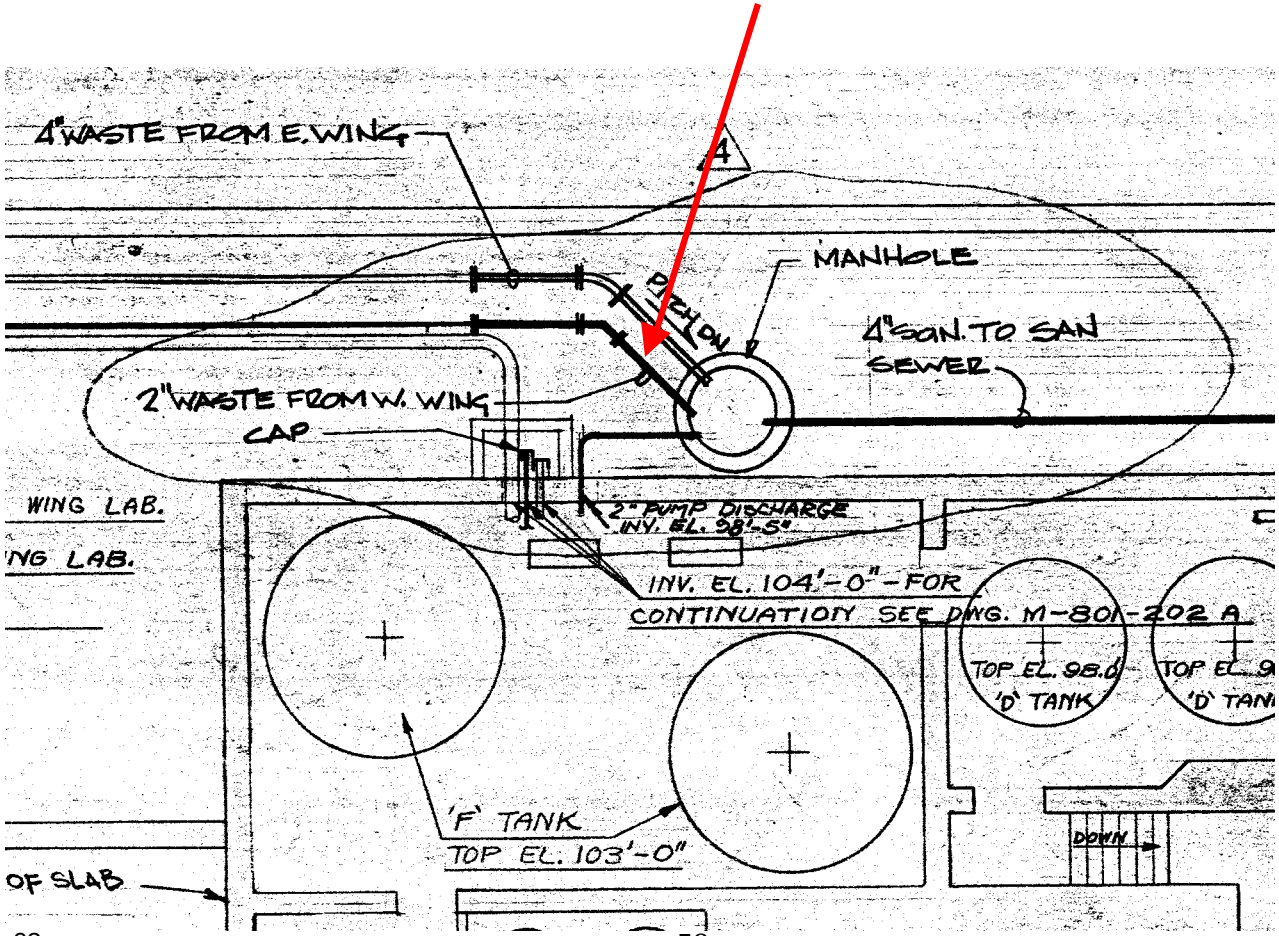
Cut line

Cut within this area, and install plastic cap

SKETCH 5

2” Stainless Steel Waste Line from Building 701

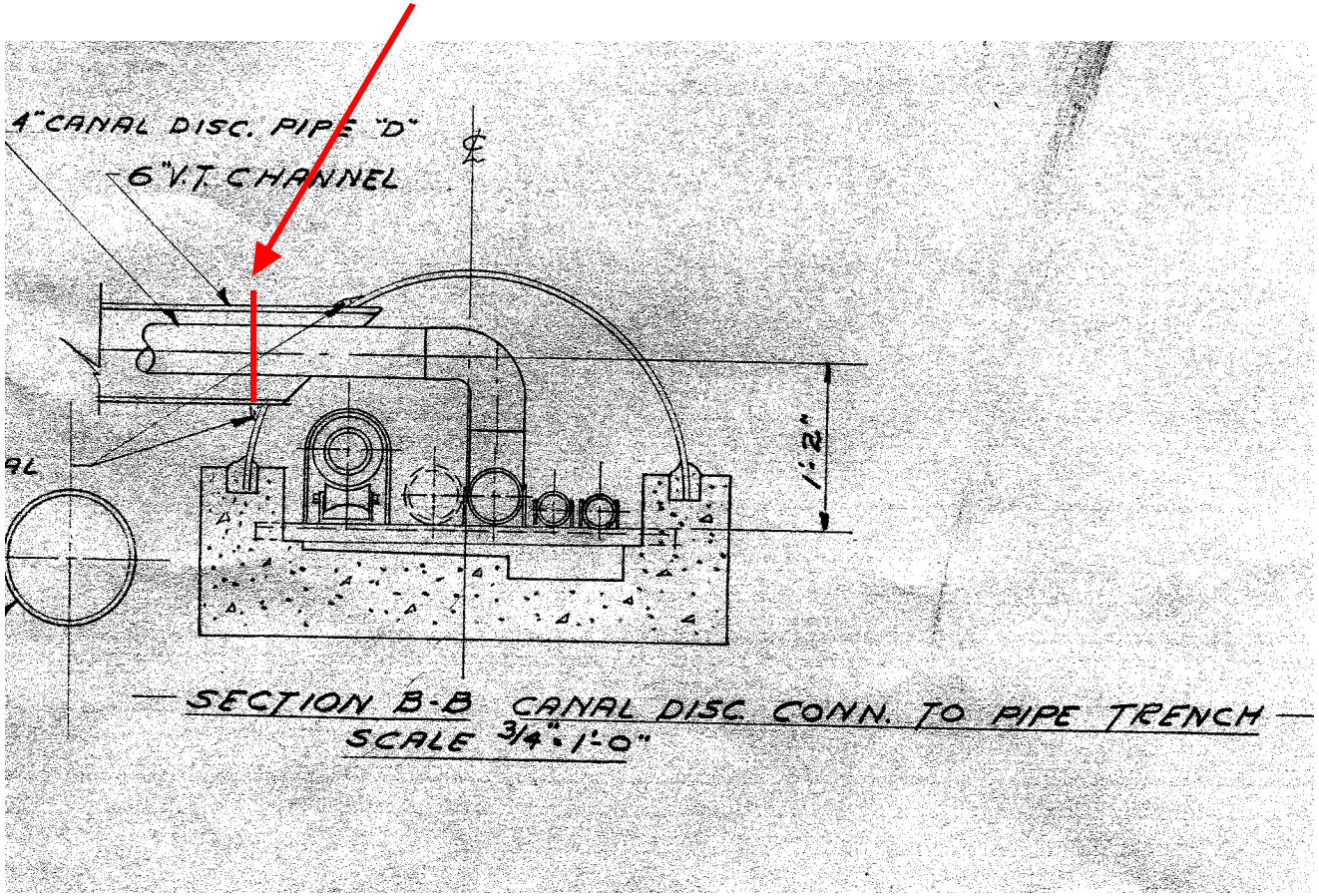
Excavate, cut and remove 2” line from the manhole



SKETCH 6

4” Canal Discharge pipe to Building 811

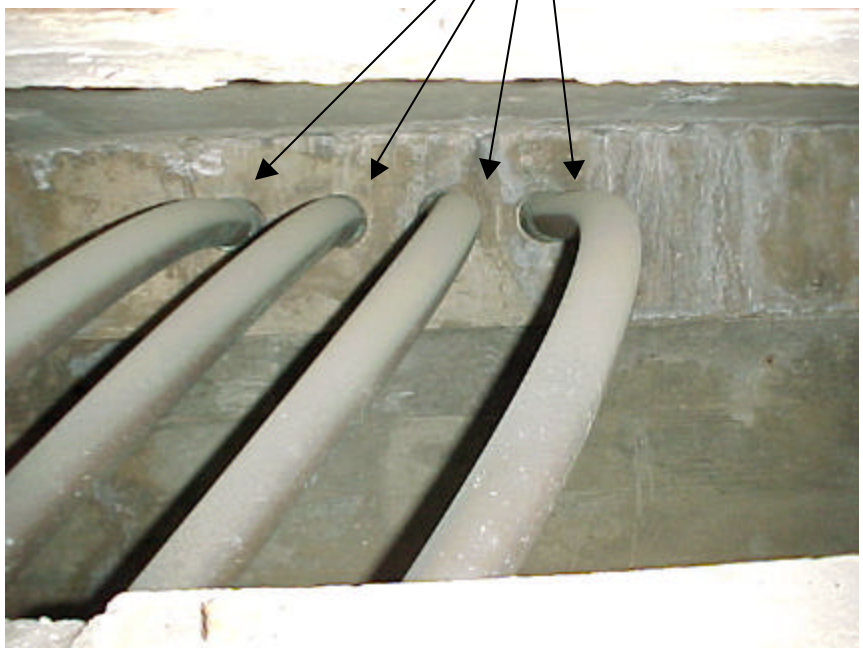
Excavate, cut tile and pipe outside of trench and seal



SKETCH 7

2” Pneumatic tubes at Building 801

Cut all four lines minimum 2” maximum 6” south of the coupling

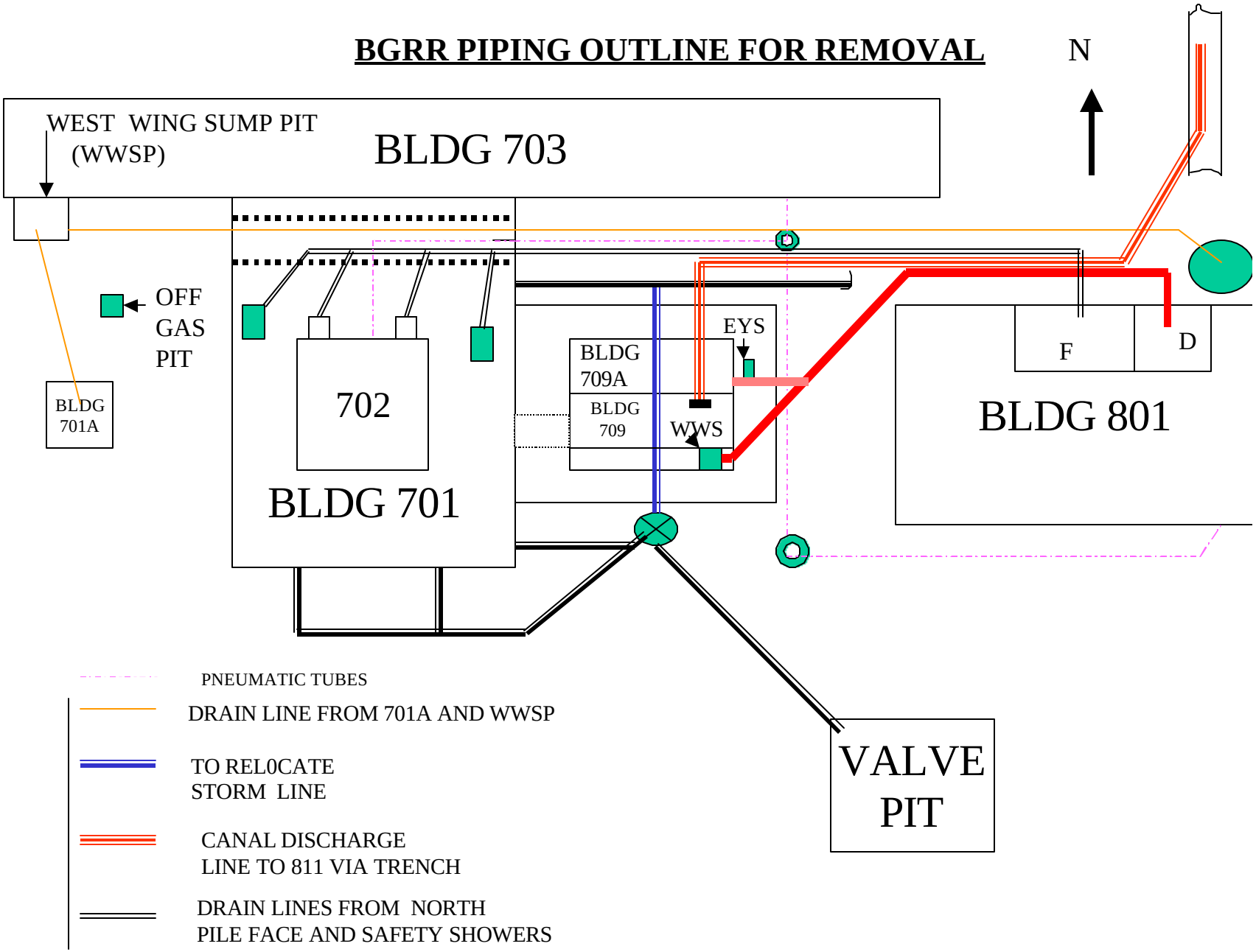


Approximate cut line

Attachment 8.4

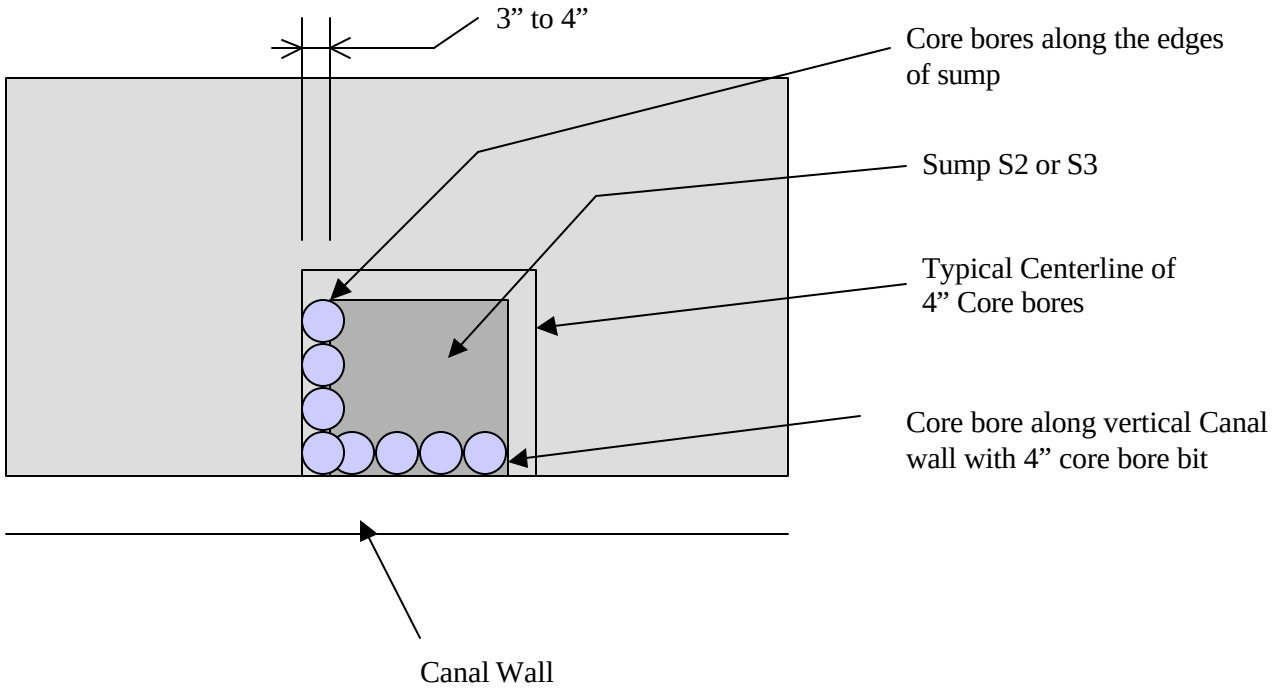
Support Sketches

BGRR PIPING OUTLINE FOR REMOVAL



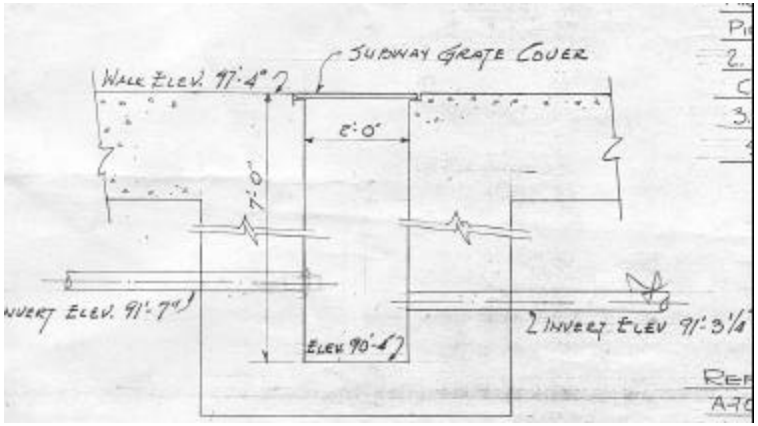
SKETCH 8

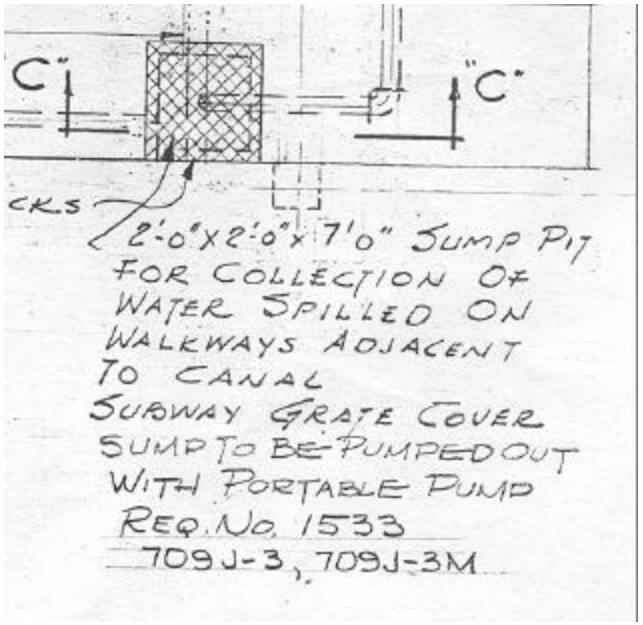
Canal Sumps S-2 and S-3
Typical core bore detail
(Not to scale)

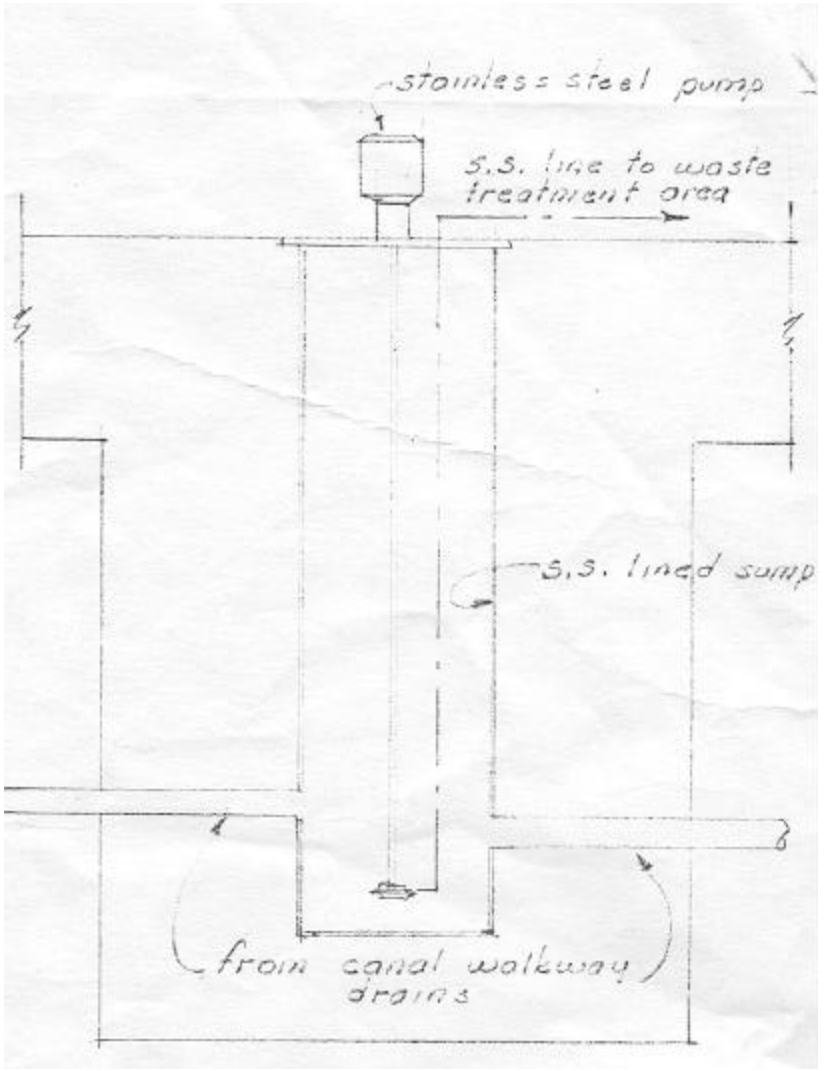


SKETCH 9

Canal Walkway Sump Details

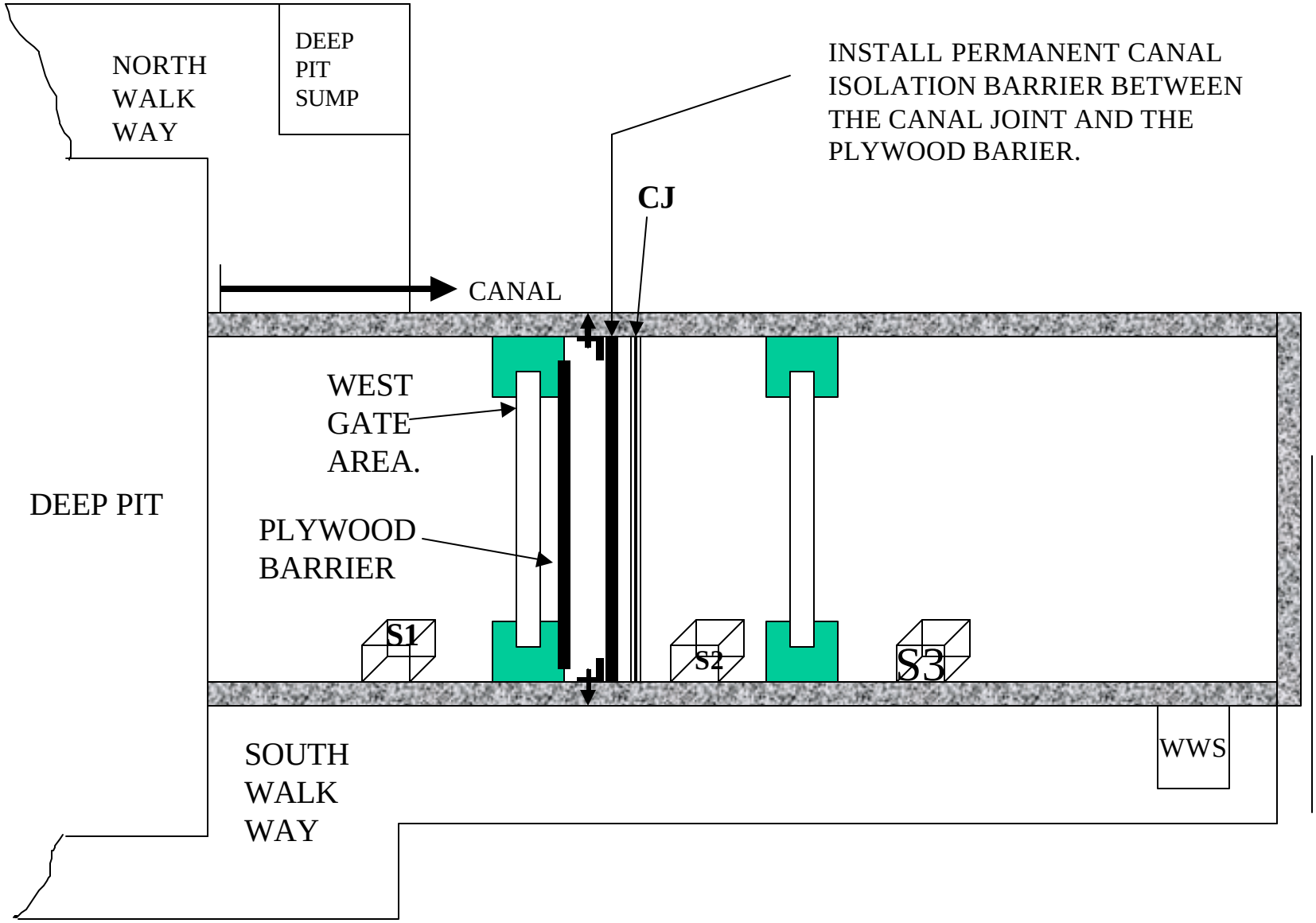






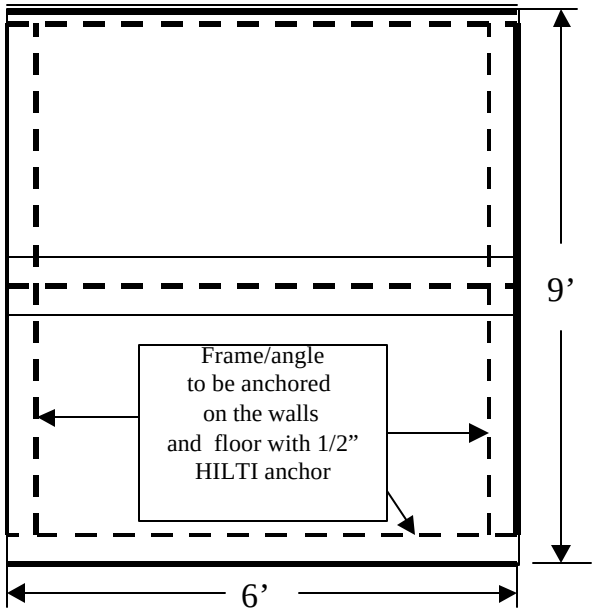
SKETCH 10

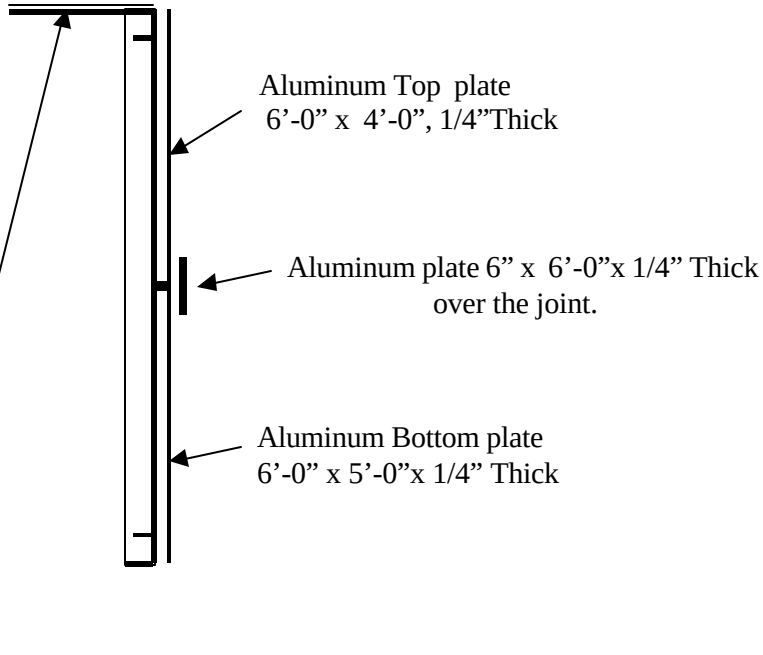
Permanent Canal Isolation



SKETCH 11

ISOLATION DETAILS FOR THE
CANAL WEST BOUDARY



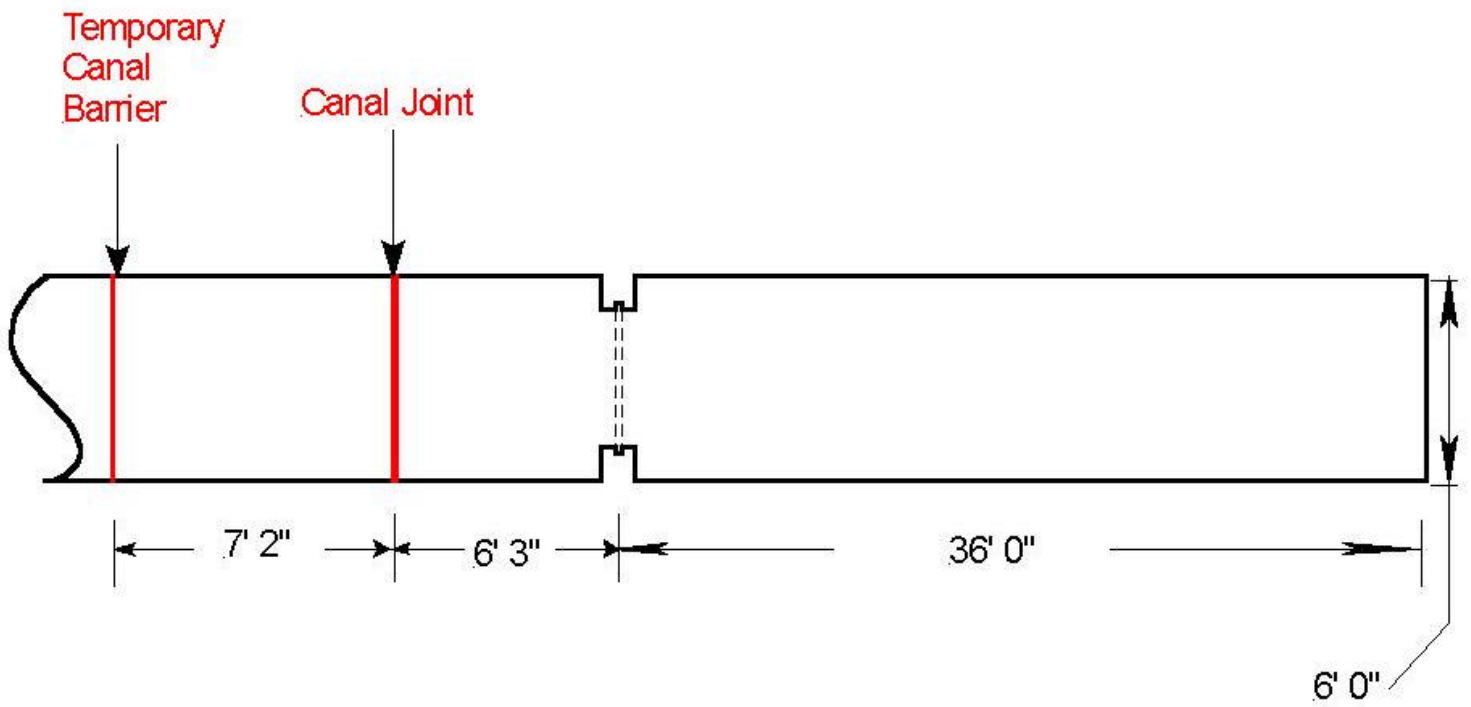


Top plate to seal the space from the vertical plates up to the cement planks. Apply 50 year sealant on the sealing surfaces.

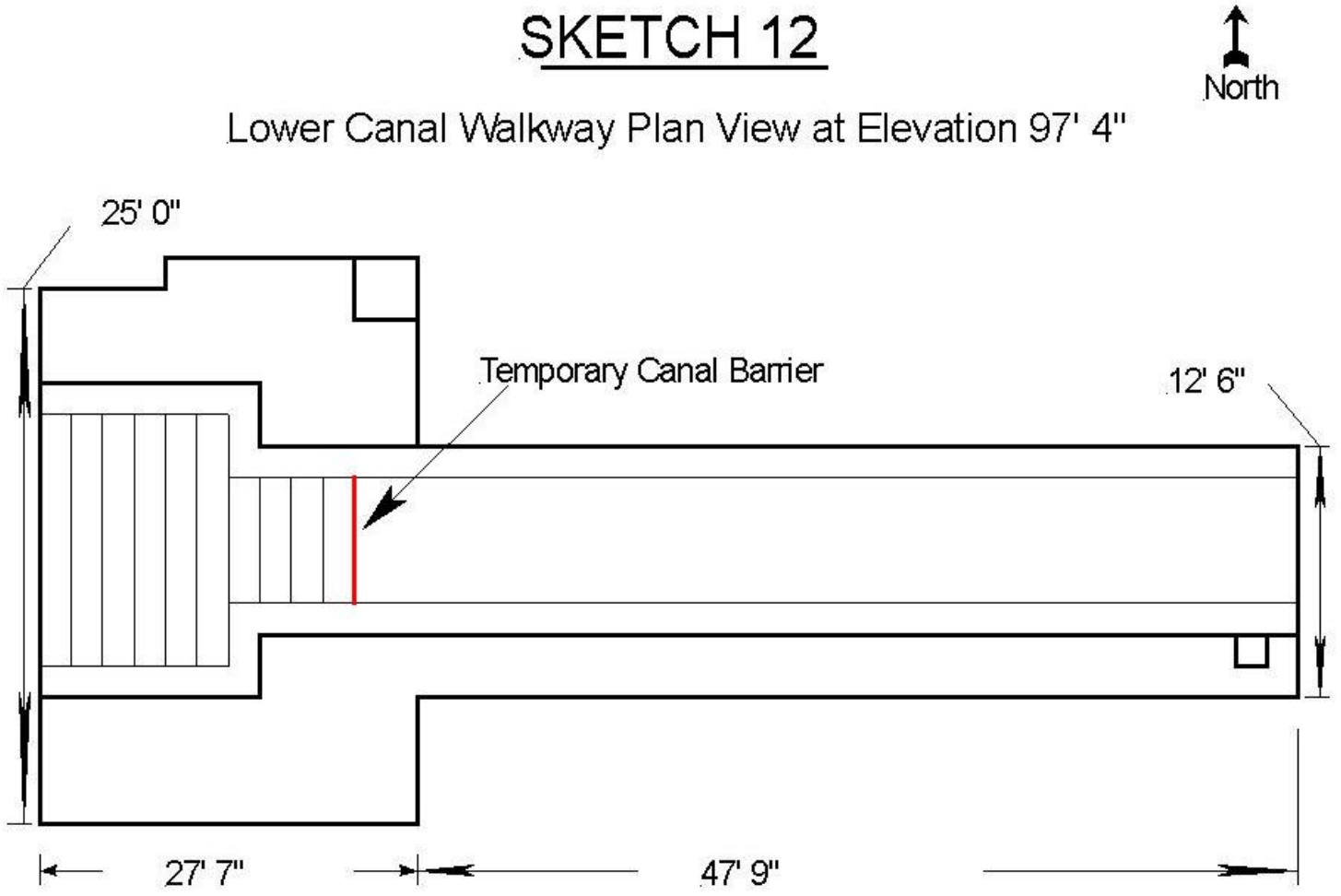
SKETCH 11

Lower Canal Plan View at Elevation 91' 4"

North



SKETCH 12


North
Lower Canal Walkway Plan View at Elevation 97' 4"
25' 0"
Temporary Canal Barrier
12' 6"
27' 7"
47' 9"

Attachment 8.5

Samples Needed from the Lower Canal, Piping Systems and Soil Excavations

Lower Canal:

Radiological Characterization:

- Three 1-liter bottles of concrete rubble and dust.

Hazardous Characterization:

- Two 250-gram samples of concrete rubble and dust.

Envirocare pre-shipment samples:

- Two 1-liter bottles of concrete rubble and dust.

Piping Systems:

Radiological Characterization:

- Two 1-liter bottles or cans of piping and sludge **OR**
- 150 grams of sludge.

Hazardous Characterization:

- 150 grams of sludge.

Envirocare pre-shipment samples.

- Two 1-liter bottles or cans of piping and sludge.

Soil:

Radiological Characterization:

- One 1-liter bottle for every ten yard sack designated as waste.

Hazardous Characterization:

- Two 1-liter bottles.

Envirocare pre-shipment samples:

- Five 1-liter bottles of composite samples.

Asphalt:

Radiological Characterization:

- One 1-liter bottle for every 10-yard sack designated as waste.

Hazardous Characterization:

- Two 1-liter bottles.

Envirocare pre-shipment samples:

- Five 1-liter bottles of composite samples.