ENV- NEPA
25577

United States Government **Department of Energy**

memorandum

Ohio Field Office

DATE:

REPLY TO ATTN OF: OH:GRANDFIELD OH-0407-02

SUBJECT: **COLUMBUS ENVIRONMENTAL MANAGEMENT PROJECT (CEMP) ENVIRONMENTAL ASSESSMENT (EA)**

TO: Thomas A. Baillieul, Director, CEMP, OH

Based upon a thorough review of National Environmental Policy Act (NEPA) documentation for the Columbus Environmental Management Project (CEMP), I have determined the updated Environmental Assessment (EA) to be appropriate and adequate. The approved Categorical Exclusion for the Well Injection Depth Extraction (WIDE™) system completes the comprehensive coverage of your Project activities. I have further determined the 1990 Finding of No Significant Impact (FONSI) to be valid for the updated EA.

Susan R. Brechbill
Manager

cc:
C. Borgstrom, EH-42, HQ

United States Government **Department of Energy**

memorandum

Ohio Field Office
Columbus Environmental Management Project

DATE: September 25, 2001 C01-038

REPLY TO ATTN OF: CEMP: Baillieul

SUBJECT: **RE-EVALUATION OF 1990 ENVIRONMENTAL ASSESSMENT FOR THE COLUMBUS ENVIRONMENTAL MANAGEMENT PROJECT (CEMP)**

TO: Robert Grandfield, NEPA Compliance Officer, Ohio Field Office

The Columbus Environmental Management Project (CEMP) has completed a re-evaluation of the project's Environmental Assessment and Finding of No Significant Impact (FONSI) which were originally issued in 1990. At this point, the project has completed all planned work at Battelle's King Avenue site, and is in the final stages of approval for a revised project baseline focused on the completion of the West Jefferson site. All sections of the Environmental Assessment were examined to see if updated site information, or changes in technical approach in any way change the conclusion in the FONSI. Also the DOE checklist for Environmental Assessments was utilized to assure that all current DOE expectations have been addressed. The two attachments to this memorandum provide the results of the review. While more extensive information is available concerning both the West Jefferson site and the site end state, the impacts associated with the clean-up are still bounded by the 1990 assessment.

Given the age of the original FONSI, it is probably appropriate to have the Manager confirm that the original decision is still valid.

If you have any questions regarding this re-evaluation , please do not hesitate to call me at (614) 760-7372.

Thomas A. Baillieul

Thomas A. Baillieul, Director
Columbus Environmental Management Project

TAB/psr

Attachments:
1. DOE-CEMP review of EA chapters 1 and 2.
2. Battelle review of EA chapters 3-6 and Attachment A

ATTACHMENT 1

PERIODIC RE-EVALUATION OF THE ENVIRONMENTAL ASSESSMENT FOR THE BCL DECOMMISSIONING PROJECT - SEPTEMBER, 2001

EA Section		Evaluation Comments
1.0	Introduction	N/A
1.1	Description of Proposed Action	The Columbus Environmental Management Project is no longer part of the DOE Surplus Facilities Management Program (SFMP). That program was merged with the Environmental Management (EM) program in the early 1990s. The overall action remains unchanged although the technical approach has been modified.
1.2	Need for Action	No change required. The project is more than 75% complete, and is included in the current EM strategy for site closure.
1.3	Environmental Setting	Enhanced and updated information on the environmental setting is given in the re-evaluation for chapters 3 and 4. Also see the Annual Site Environmental Reports for the BCL Decommissioning Project published for the past 10 years - they contain a wealth of site information.
2.0	Current Status	The planned decontamination and release of buildings at Battelle's King Avenue site has been completed. All project activities are now focused on the former West Jefferson North Nuclear Sciences Area. No continued work with radioactive materials is anticipated at this site, and the goal is to demolish the three major buildings, leaving the site available for re-use without radiological restrictions.
2.1	Building Contamination	The radioactive inventory in the JN-1 Hot Cell building was re-estimated in 1995 as 60,000 Curies, not 6,000 Curies as originally reported in the 1990 EA. Much of this inventory has already been removed and packaged as TRU waste, or shipped off site as low-level waste. In 1996, the fuel transfer pool was drained and the water evaporated. The pool has been lined and is currently used to store packaged drums of remote-handled TRU waste. Removal of the reactor bioshield in building JN-3 has reduced the original radioactive inventory of that building by 95%.

2.2	Soil Contamination	In 1995, contamination discovered at two storm sewer outfalls into Battelle Lake was remediated, including the area of soil contamination nearest the dam. A settling pond has been constructed in conjunction with the active JN-1 storm drain. Additionally, a water filtration/ion exchange system has been installed to remove soluble cesium from the effluent. In 1999, an abandoned outfall pipe into Big Darby Creek west of the filter bed area was found to be leaching low levels of cesium contamination which was then being concentrated in the stream bottom sediments. The pipe was removed following coordination with all cognizant regulatory authorities. Soil sampling on a 10-meter grid across the entire West Jefferson North site has not detected contamination above release levels, even beneath the asphalt pad east of JN-1. Soil sampling around the active and abandoned filter beds has detected cesium-137 contamination above release levels down to 3 meters depth. Total contaminated soil volume in this area is less than 7,000 ft^3.

ATTACHMENT 2

ENV-NEPH/CERCLA
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TB

Battelle
505 King Avenue
Columbus, Ohio 43201-2693
Telephone (614) 424-6424
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August 31, 2001

Mr. Thomas A. Baillieul, Director
U.S. Department of Energy
Columbus Environmental Management Project
555 Metro Place North, Suite 415
Dublin, OH 43017

Dear Mr. Baillieul:

Evaluation of 1990 Environmental Assessment

Enclosed for your review are Chapters 3 through 6 and Attachment A of the subject evaluation, prepared under approved change proposal OH-006-01 (Battelle # 01-018). The enclosed document was prepared in consideration of your March 5, 2001, guidance to the CEMP/BCLDP Environmental Assessment Review Team and has received an internal review by Battelle. Responsibility for preparation of the remaining chapters (Chapters 1 and 2) was taken by the DOE/CEMP.

Please advise of any comments you may have on the evaluation report.

Sincerely,

N. Joseph Gantos, Manager
Decontamination & Decommissioning Operations

NJG/MEJ
Enclosure

EVALUATION OF THE ENVIRONMENTAL ASSESSMENT

0.0 INTRODUCTION

The Battelle Columbus Laboratories Decommissioning Project (BCLDP) Environmental Assessment (EA) was issued in 1990. Over the past 11 years, a number of site conditions have changed (e.g., the Big Darby Creek has been named a Federal and State Scenic River, and several animal and plant species occurring at the West Jefferson North site have been added to the threatened or endangered lists), a significant amount of decontamination and decommissioning (D&D) work has been completed, and plans for completion of the remaining work have been revised. In consideration of these facts, it was decided to revisit the 1990 EA to assure that BCLDP activities continue not to have significant adverse environmental impacts. This report documents the results of that review and provides updated information for use with the 1990 EA.

The initial scope of work that was authorized for the Battelle King Avenue site (described in the 1990 EA) has been completed. Information presented in the EA that is associated with that site no longer has relevance. Work to be performed until the end of the project will concentrate on the West Jefferson North site and the information presented in this report pertains to that site. Certain rooms and locations at the King Avenue site that were not in the initial project baseline have recently been identified as candidate areas for additional detailed surveys and, if necessary, spot decontamination, based on their historical use. The low levels of contamination, and the relatively small areas involved, will ensure that any work performed will have no significant environmental impact. To ensure this result, decontamination work performed will use engineering controls, as required, to control releases to the environment. Such work is anticipated to be conducted in parallel with the West Jefferson North site clean-up but may take longer to complete.

This report follows the outline of the 1990 EA. It is a look into the future beginning October 1, 2001 (FY 2002).

3.0 DISCUSSION OF ALTERNATIVES

No changes are required to the original EA.

3.1 DISPOSITION OF RADIOACTIVE AND NON-RADIOACTIVE CONTAMINATION

No changes are required to the original EA.

3.1.1 No Action

The current quality specification for BCLDP is DOE Order 414.1A, Quality Assurance, and ASME/ANSI Standard NQA-1, Quality Assurance Program Requirement for Nuclear Facilities. Title 10 CFR Part 50, Appendix B, is no longer a contractual requirement for the BCLDP, although use of NQA-1 provides similar coverage for BCLDP activities.

Battelle's NRC license was divided into two licenses: one for decommissioning radioactively contaminated facilities and one for continued research using by-product material. The by-product materials license is under the jurisdiction of the Ohio Department of Health. The decommissioning license, which is currently under the NRC, will be terminated upon completion of D&D activities and verification by NRC or the Ohio Department of Health, depending on which agency has jurisdiction at the time, that license termination criteria have been met. The license for continued research has no relevance to the D&D effort.

Neither of the above factors causes a change to the conclusion in the EA that the no-action option, perpetual surveillance and maintenance, is not a viable option.

3.1.2 Decommissioning of the Facilities

The objective of decommissioning the buildings designated as JN-1, JN-2, JN-3, and surrounding grounds is to return this area back to a condition without radiological restrictions. This will involve the deconstruction of the structures and infrastructures and cleanup of the building footprints and exterior areas. This action involves removal of all the building fluids. The removal of water from the JN-1spent fuel pool has been completed. In JN-2 and JN-3, the decontamination will reduce contamination to levels consistent with use of the facilities without radiological restrictions prior to demolition. This should minimize overall D&D costs (labor, material, and waste costs). For example, the most effective demolition of JN-1 will be to treat it as a low-level waste (LLW) facility, with most surfaces fixated and only the major and highly contaminated structures and equipment removed. Buildings JN-2 and JN-3 will be decontaminated, as required, to meet approved release criteria and disposed of as clean construction waste.

3.1.2.1 Approach to Decommissioning

The approach for decommissioning these facilities is to decontaminate and remove radioactive or contaminated (PCB or asbestos) equipment/materials/soil from the facilities on site to permit uncontaminated demolition, except in JN-1 where highly contaminated materials will be removed allowing the building to be demolished safely as LLW. In general, the decontamination approach is the same as was used at the King Avenue, West Jefferson South, and West Jefferson

Middle sites. However, the remaining decontamination of the facilities at the West Jefferson North site (WJN) entails a spent fuel profile that has greater potential for exposure to personnel and the environment. As such, the specific sequence of operations and particular activities may change.

3.1.2.2 General Building Decommissioning Plan

The general decommissioning plan for JN-2, JN-3, and surrounding structures at WJN is to release these structures, but instead of decontaminating for reuse, the structures are being released for demolition. Concerning JN-1 decommissioning, the building will be decontaminated to a level that can safely be demolished as a LLW facility. Therefore, the decontamination is not as rigorous, but the need to fixate potential contamination before demolition is high. As opposed to normal industrial demolition activities, some demolition activities will actually be altered to assure containment and control during this radioactive demolition, thus minimizing the potential exposure to personnel and the environment. These activities include, as necessary, the use of diamond wire sawing, the use of remote backhoe type work inside local enclosures, and the use of HEPA ventilation (some with monitors and alarms and some without these features).

The general pattern of conducting a comprehensive radiological survey, isolating the area, removing equipment and some utilities, cleaning the area, surveying, releasing, and demolishing (rather than re-use) is still the decommissioning plan. However, the process may utilize the buildings' drain systems, as long as such drains remain within the buildings or terminate in closed sumps or tanks. Therefore, the drains in the buildings will not necessarily be capped as indicated in the EA. The remaining operations identified in the EA will be performed, but not necessarily in the indicated sequence. The sequence will be determined based on the radiological and physical conditions. In JN-1, there will be less cleaning, and releasing the building will be replaced with fixating contamination in the building, then de-constructing it and removing building materials. All the decontamination and decommissioning operations will utilize suitable technical and administrative controls.

3.1.2.3 Decontamination Methods for Building Decommissioning

The decontamination methods described below will be used at the three WJN buildings; the approved scope for the King Avenue buildings has already been completed.

Several additional methods for decontamination and removal that were not used in the 1990 EA are being used by Battelle, in accordance with the NRC-approved Decommissioning Plan. The operations are described in DOE G 420.1-1 (Guide, 3/28/2000), *Nonreactor Nuclear Safety Design Criteria and Explosive Safety Criteria Guide for Use with DOE O 420.1 Facility Safety*, the replacement for

DOE Order 6430.1A. The NRC does not have design criteria per se but has issued NUREG 1727 as a guide if the decommissioning plan were to be revised.

High Pressure Water Washing and Scarification – This process will be used in the decontamination process. The water from this process, as well as other processes, is filtered and evaporated. The sludge and/or filters from these processes are dried and packed in absorbent for disposal. Other water processes to be used are the TRU Mop Head and Rags Decontamination System, water and Spray-Nine solutions manually applied, and water baths/water sprays, etc. utilized in various dismantling and removal operations. It is now estimated that approximately 100-150 cubic feet of LLW could be disposed of in the form of sludge and/or filters with absorbent as identified above.

Dry Mechanical Scabbling and Ultrasonic Cleaning – These processes will be used as currently described in the EA.

Electropolishing – This process will probably not be used at the West Jefferson site. Set-up is expensive, and the waste generated is suspect. Water and mechanical methods are expected to be sufficient.

Concrete Cutting – This process will be utilized in a variety of ways. Not only will it be used as described but diamond wire saw cutting will be used to remove the very dense hot cells with the liners attached. The diamond wire saw process will generate up to 1000 gallons of water per week but methods have been developed to re-cycle most of the water. The excess will be disposed of as discussed above. The diamond wire saw may also be used to remove the slightly radioactive spent pool liner from the high bay of JN-1 if chemical decontamination is not feasible.

Vacuum Grit Blasting – This process was not discussed in the original EA but will be used in the decontamination of the buildings. It involves the grit blasting of a surface in conjunction with a powerful vacuum. The vacuum collects the grit and the removed surface material in 55-gallon drums to minimize cross-contamination in this very aggressive material-removal mode of operation.

Chemical Etching and Decontamination – This process may be used on surfaces that are extremely difficult to remove from the site, such as the spent fuel pool liner. It utilizes strong, slow-acting agents to penetrate radioactive surfaces and remove layers of material that contain the radioactivity. The object of chemical decontamination will be to leave the surface, or portions of the surface, in place as free-releasable material.

Transuranic (TRU) waste generated by the decontamination methods described above may be stored at Hanford or at another DOE site until it can be shipped to the WIPP site for permanent disposal. The waste methods, processes, and estimated volumes generated in each building using the above decontamination

methods are discussed in Section 3.2 (see Table 3-1). They have, however, changed since the EA was written. The TRU contaminated materials from the Hot Cells will be packaged in approved containers for temporary storage, pending shipment, that involve several options. Packaged TRU level waste is presently being stored in the JN-1 Spent Fuel Pool and the High Bay. Other on-site storage options include the JN-3 High Bay or a new temporary on-site storage facility. The waste may be shipped to DOE-approved offsite TRU waste receiver sites, e.g., Oak Ridge, Hanford, or directly to WIPP, depending on the availability of those sites. The DOE Waste Management Programmatic EIS strongly influences future decisions concerning the storage of RH-TRU waste. The potential sites were also narrowed down by DOE/EM/REP/6450-001, "Evaluation of Selected Small Quantity Sites TRU Waste Disposition Alternatives."

There are 18 sumps and underground, sludge-containing structures associated with BCDLP efforts at the WJN site. Twelve of the sumps and structures are not expected to contain radioactive or hazardous sludge and, therefore, will require no decontamination action. Less than 10 cubic feet of hazardous waste sludge is anticipated to be found in one sump based on process knowledge. The remaining five sumps and structures may have a total of 45 cubic feet (2 cubic yards) of sludge. The above numbers are current estimates; variations encountered will have no significant affect on operations or waste management/disposal.

3.1.2.4 Decontamination Methods for Hot Cell Pool Water

This water has been treated and disposed of through evaporation. The pool is presently being used for temporary RH-TRU storage. The decontamination of the pool liner was discussed earlier. Any additional water found in JN-1 will be treated, if necessary, and evaporated or otherwise disposed of in accordance with applicable regulations.

3.1.2.5 Disposition of Contaminated Soils

Any remedial action taken with contaminated soils at the West Jefferson site will be based on release criteria established in the NRC approved D&D plan[33]. The release criteria are based on remediating the WJN site to a condition free of radiological restrictions. There are four possible approaches for handling the radiologically contaminated soil that is above the release criteria.

The first approach, no action, requires continued surveillance and maintenance and is discussed in Section 3.1.1 for the contaminated buildings. This approach does not meet the NRC approved D&D plan nor the stated criterion of releasing the site from future radiological restriction.

The second approach described in the EA, leaving the soil in place and adding institutional controls, remains applicable with the following clarification. That

approach does not meet the NRC-approved D&D plan or the stated objective of releasing the site from future radiological restriction.

The third approach is the removal and disposal of the soil as low-level radioactive waste. The soil is not a TRU waste because the quantity of TRU elements present has been measured to date at an average concentration of less than 10 picocuries per gram, which is four orders of magnitude below the 100 nanocuries per gram TRU waste criterion. Any contaminated soil found beneath Building JN-1 is expected to be well below the TRU waste concentration and will be handled as low-level waste. Should such soil meet the TRU waste criterion, it will be of a small amount and highly localized, and will be handled as TRU waste. If soil removal is selected, on the order of 68,000 cubic feet of soil is expected to be removed from the storm sewer discharge and sanitary drain line areas and 195,000 cubic feet of soil will be removed from the filter bed areas. Implementation steps for this approach remain as in the EA, except the fourth bullet is revised as follows:

- Excavate contaminated soils and properly package in certified LSA boxes for shipment to a DOE-approved low-level waste disposal site such as Envirocare of Utah[39], the Nevada Test Site, or the Hanford facility.

The fourth approach is to extract the contamination from the soil using a soil washing technique. A suitable solvent for the identified radionuclides would be flushed through the soil and then recovered. The contamination could then be removed from the solvent using an ion exchange resin and the solvent reused. The removed contamination would then be disposed of as low-level waste. The implementation steps are generally as follows:

1. Perform a radiological survey to establish the type and extent of contamination for purposes of planning the effort
2. Conduct laboratory testing to identify the appropriate solvent to be used
3. Conduct field testing to optimize the extraction process
4. Implement administrative controls (i.e., radiation work permit) to minimize the risks of inadvertent exposure and contamination
5. Perform extraction process on contaminated areas
6. Perform verification survey (by Independent Verification Contractor) to determine if the process was effective
7. Dispose of contamination and used solvent
8. Prepare certification docket.

The fourth approach may require an amendment to the NRC Decommissioning License.

The balance of information in this section remains the same as it appears in the EA, except the reference to four approaches rather than three approaches.

3.2 WASTE MANAGEMENT

First Paragraph: Approximately 492,000 cubic feet of low-level radioactive waste, including soil, 2,400 cubic feet of low-level radioactive mixed waste, 900 cubic feet of TRU waste (95% remote handled, 5% contact handled) in the form of decontamination debris contaminated with TRU, and non-TRU isotopes is expected to be generated from the buildings. This includes approximately 263,000 cubic feet of low-level radioactive contaminated soil that may be generated.

The remainder of the first paragraph remains unchanged.

Second Paragraph: Delete "1540.1, 1540.2, 5480.3, and 5820.2A." Replace with "435.1." Replace the last sentence with "Operational plans and procedures for low-level waste and TRU waste will be prepared and implemented to ensure that disposal facility acceptance criteria are met."

Third Paragraph: Disposal of low-level waste will be at a Department of Energy approved disposal site such as Envirocare of Utah[39], the Nevada Test Site, or the Hanford facility. TRU waste will be stored at the West Jefferson site until it can be shipped either directly to the Department of Energy's Waste Isolation Pilot Plant (WIPP), or to an interim storage facility such as the Hanford facility or the Department of Energy's Oak Ridge Site. A Department of Energy approved transporter will transport the packaged waste[37]. Approximately 12 shipments of TRU waste and 1446 shipments of low-level waste, including soil and mixed low-level waste, are anticipated.

Fourth Paragraph: Wastes that are not radioactively contaminated will be so certified by the Health Physics staff prior to final disposition. Approximately 81,000 cubic feet of primarily construction rubble (12,000 cubic feet for the JN-1 office area, 41,000 cubic feet for Building JN-2, and 28,000 cubic feet for Building JN-3) are expected to be generated. The estimated volume will result in approximately 150 shipments (assuming use of 20 roll-off boxes) leaving the site. Numerous construction landfills are available in the area to handle the waste.

TABLE 3-1. Estimated Radioactive Waste Volumes (cubic feet)

Building or Location	TRU Waste	Low-Level Waste
JN-1	900	221,000
JN-2	0	9,000
JN-3	0	4,000
Out fall area	0	62,000
Filter beds area	0	196,000

*Outfall area in table refers to inside fence but outside building footprints.

Fifth Paragraph: Replace with: Radioactive mixed waste will be generated during the decommissioning of the West Jefferson site. Approximately 2,411 cubic feet of mixed radioactive waste is expected to be generated. This waste will be managed according to RCRA as outlined in the BCLDP Site Treatment Plan[35] and disposed of at a Department of Energy approved disposal facility such as the Hanford Site, Envirocare of Utah[39], or the Nevada Test Site.

3.3 RADIATION SAFETY

Decontamination activities will be performed using negative pressure ventilation systems and with HEPA filtration in most cases. Continuous air monitors are not routinely used by Health Physics operations during decontamination activities. Job-specific air samples, both general area and personnel, are collected to monitor airborne contamination.

As a matter of policy, all BCDLP workers and staff have stop-work authority when they observe conditions that pose an imminent hazard to the health and safety of workers or the public[32].

The DOE has withdrawn Order 5480.1 as applicable to the BCLDP, in deference to NRC regulatory authority. Environmental monitoring is conducted in accordance with the BCLDP Radiation Protection Program for BCLDP, DD-90-02, which is incorporated in Battelle's NRC Decommissioning License, SNM-7. Specific information relative to the program is included in the BCLDP West Jefferson site Environmental Monitoring Plan (DD-98-01). BCLDP environmental monitoring is no longer conducted at the King Avenue site since the approved D&D work has been completed there.

3.4 CONFIRMATORY SURVEY AND RESTORATION

Confirmatory surveys will be conducted as described in the NRC license and approved Decommissioning Plan. Release limits are set forth in the Decommissioning Plan for the Battelle Memorial Institute Columbus Operations[33] (DD-93-19), which is approved and endorsed by the NRC in Battelle's Decommissioning License, SNM-7[34]. The release criteria are contained in Attachments 1 and 2 of the Decommissioning Plan.

3.5 SCHEDULE AND COST

The decommissioning and demolition of the West Jefferson facilities is scheduled to take 5 years beginning in October 2001. The estimated cost is $129.4 million in escalated dollars including a contingency of 20%, assuming sufficient funding is made available by the DOE.

4.0 ENVIRONMENTAL CONSEQUENCES AND MITIGATION

No changes are required to the original EA.

4.1 RADIOLOGICAL IMPACTS

Occupational and public radiological exposures are now evaluated against NRC exposure limits as set forth in 10 CFR Part 20. Estimates of exposures are discussed in the following sections.

4.1.1 Human Health

Baseline data for the no-action option remain as stated in the EA. Updated exposure data for workers and the general public are presented in the following sections and Attachment A.

4.1.1.1 Decommissioning Workers

Regulatory dose limits for the BCLDP are set forth in 10 CFR Part 20.

The highest estimated individual exposure for decommissioning workers is 1.5 rem, which is 30 percent of the occupational limit. The estimated mean exposure is 0.5 rem, 10 percent of the occupational limit. The estimated collective total effective dose equivalent (TEDE) for BCLDP workers for the remainder of D&D activities at West Jefferson is 134 person-rem (see Attachment A). Attachment A also contains actual doses received by workers in the past several years.

Table 4-2
Estimated Exposures for BCLDP Workers

	TEDE
Individual	(Rem/yr)
Maximum	1.5
Mean	0.5
Occupational Dose Limit (NRC)	5.0
Collective	(Person-rem)
Total	134

4.1.1.2 General Public

Estimated radiation exposures to the general public, including non-involved Battelle staff, are expected to be negligible. Data from thermoluminescent dosimters (TLDs) placed in JN-4, around the site fence, and off-site show that no additional radiation exposure has occured as the result of D&D operations at West Jefferson (see Attachment A).

In EA Table 4-3 and the paragraph following it, the guideline for exposures to members of the public is now set for the BCLDP by NRC regulations, 10 CFR 20.1301. The current guideline is 0.1 rem (100 mrem) per year. As noted above, measured exposures have indicated that no additional radiation exposure to members of the public has occurred as a result of D&D operations at West Jefferson.

4.1.2 Biota

Big Darby Creek was designated as a state scenic river in 1984 and as an outstanding national water resource by the State of Ohio in 1999. It was designated as part of the national scenic rivers system in 1994. The Darby Creek watershed covers an area of 557 square miles and is home to 86 species of fish, 5 of which are endangered in Ohio including the federally endangered *Scioto Madtom*. In addition, 41 species of freshwater mollusks live in these waters. Eight of these mollusks species are on the Ohio endangered list, including the federally endangered *Clubshell* and *Northern Riffleshell*.

ENDANGERED FISH:

Etheostoma maculatum – Spotted Darter
Hiodon alosoides – Goldeye
Ichthyomyzon fossor – Northern Brook Lamprey
Noturus stigmosus – Northern Madtom
Noturus trautmani – Scioto Madtom *(also federal endangered specie)*

ENDANGERED MOLLUSKS:

Elliptio crassidens – Elephant-ear
Epioblasma rangiana – Northern Riffleshell *(also federal endangered specie)*
Epioblasma triquetra – Snuffbox
Lampsilis ovata – Pocketbook
Megalonaias nervosa – Washboard
Pleurobema clava – Clubshell *(also federal endangered specie)*
Quadrula cylindrice cylindrica – Rabbitsfoot
Villosa fabalis – Rayed Bean

Data as of 3/27/98 – Provided for Big Darby Creek by the Ohio Department of Natural Resources (ODNR)

Due to the high diversity of aquatic biota in Darby Creek, the Ohio Environmental Protection Agency (OEPA) classes it as an Exceptional Warm Water Habitat. This classification enables the OEPA to require more stringent chemical standards on effluents discharged into the creek.

The ODNR maintains a rare plant species list for the State of Ohio. There are two endangered and five threatened species listed for Madison County.

ENDANGERED PLANT SPECIES:

Iris brevicaulis – Leafy Blue Flag
Viola Pedatifida – Prairie Violet

THREATENED PLANT SPECIES:

Armoracia lacustris – Lake Cress
Carex Bicknelli – Bicknell's Edge
Melanthium Virginicum – Bunchflower
Panicum Leibergii – Leiberg's Panic-Grass
Sporobolus Heterolepis – Prairie Dropseed

Rare Plant Species (2000-20001 Status List) provided for Madison County by ODNR

One terrestrial animal, the *Indiana bat* (Myotis sodalis), which is on both the federal and Ohio endangered species lists is believed to be present in the region. However, ODNR does not have any records for the Indiana bat in the vicinity of Battelle's West Jefferson site.

The Ohio endangered species list includes two species of birds that may nest in the region. These are the *American bittern* (Botarus lentiginous) and the *loggerhead shrike* (Lanius ludovicianus). Several other Ohio endangered species including the *northern harrier* (Cirus cyaneus), *magnolia warbler* (Dendroica magnolia) and *dark-eyed junco* (Junco hyemalis) may occasionally occur on the site as transients or winter residents and others may occur from time to time.

Future work performed by the BCLDP at the West Jefferson facility is not expected to have any negative effect on threatened or endangered species in the area. Refer to Section 4.3, under Floodplain Management, for details on remediation activities performed and to be performed in the Big Darby floodplain.

4.1.3 Transportation of Waste and Radioactive Materials

First Paragraph: Based on the estimated volume of waste (see Section 3.2), it is anticipated that approximately 1,458 shipments will be required, which will consist of 1,446 low-level waste shipments and 12 TRU waste shipments. This assumes that each low-level waste shipment consists of eight boxes per truck with a capacity of 72 cubic feet per box. Each TRU waste shipment is assumed to consist of ten 55-gallon drums.

Second Paragraph: Using the same assumptions as reported in the EA, but allowing for additional number of shipments, the worst case cumulative estimated exposure to truck drivers would be 280 person-rem. A change in trucking practices now makes it more likely that a single driver using a sleeper cab will transport waste shipments (as opposed to a two-person crew). This factor doubles the exposure time of individual drivers since they will spend 48 hours driving and approximately the same amount of time sleeping/resting in the cab. Worst case assumptions (a single driver making 24 trips/year, dose rate at the rear of the cab being 2 mrem/hour) yield\ a total worst-case exposure to a single driver of approximately 4.6 rem/year. Actual experience has shown that having the same driver more than four to six times per year is unusual, and dose rates at the rear of the cab for most shipments are near 0 mrem/hour. In cases where the dose rate approaches the 2 mrem/hour limit, rearrangement of the load is performed in order to minimize the dose rate. It should be noted, therefore, that the estimated values presented above are theoretical maximums; actual exposures are expected to be a small fraction of the estimates.

4.1.4 Disposal of Waste

First Paragraph: Each of the Department of Energy approved disposal sites used for disposal of low-level waste is fully approved and qualified to accept and dispose of wastes from decommissioning activities at the West Jefferson site. The volume of low-level waste sent to each disposal facility per year is expected to be less than 1% of the total volume received at the site, an insignificant percentage of the total volume for the site. It is expected that all TRU waste will be disposed of at the Waste Isolation Pilot Plant once it is authorized to accept the waste. In the interim, the TRU waste will be stored temporarily at the West Jefferson site until it can be sent to an interim storage site (the Hanford Facility or the Oak Ridge Facility). The BCLDP TRU waste is expected to be less than 0.06% of the total waste received at the WIPP. Radioactive mixed waste will be managed according to RCRA as outlined in the BCLDP Site Treatment Plan[35] and disposed of at a DOE-approved disposal facility such as the Hanford Site, Envirocare of Utah[39], or the Nevada Test Site.

4.2 Non-Radiological Impacts

No adverse non-radiological environmental impacts from no-action are expected as supported by annual Site Environmental Reports on non-radiological parameters based on a range of samples including air, soil, vegetation, food crops drinking water, groundwater, and wastewater.

Battelle's West Jefferson site holds a National Pollutant Discharge Elimination System (NPDES) permit issued by the Ohio Environmental Protection Agency. This permit (#4IN00004*GD) authorizes discharges into the Big Darby Creek and Battelle (Silver Creek) Lake through its monitored outfalls. The permit is in compliance with the provisions of the *Federal Water Pollution Control Act* and

the *Ohio Water Pollution Control Act*, and was renewed effective March 1, 2000, and expires February 28, 2005.

No adverse non-radiological environmental impacts from the proposed action are expected. Potential impacts are discussed as they relate to decommissioning activities or transportation of waste. No non-radiological impacts are expected for disposal of waste at the Department of Energy waste sites.

It can be anticipated that asbestos **may** be encountered either with or without radioactive contamination. Appropriate disposal shall occur in both cases using certified contractors.

Refer to Section 4.3 for information on RCRA and RCRA-mixed waste generated by the BCLDP.

As noted in Section 1.3 of the EA, the West Jefferson North site buildings were constructed in the mid-1950s and are now approaching 50 years in age. The likelihood of facility failures and failures of critical systems within them increases each year, requiring increasing expenditures on maintenance. The BCLDP is working to reduce the radiological source term within the buildings and any other hazards presented by these facilities to minimize risk to workers, the public, and the environment.

4.2.1 Decommissioning Activities

The present EA has accurately identified and discussed three non-radiological hazards associated with decommissioning activities. A fourth hazard could be nuisance dust generated during the demolition process of the two radiologically cleaned facilities, JN-2 and JN-3. Normal industrial methods will be incorporated in the demolition of these facilities, and as such, large amounts of local dust may be generated. However, personnel will not be allowed in the dust prone area due to the large equipment operations (i.e., wrecking balls, grapples, etc.). Therefore, dust hazards to personnel appear to be low. Appropriate use of dust collectors/HEPA vacuums, fans, respirators, etc. will be made as necessary. Levels of dust blown off site are expected to be minimal, due to the relatively small sizes of the demolition projects and the distance from the site to the nearest residences. Dust would be expected to settle and/or disperse before reaching nearby residents. Should dust levels ever become high enough to be noticeable off site, mitigating measures, such as wetting, will be employed.

The industrial safety hazards associated with the BCLDP are evaluated on each activity, work instruction, and contract through hazards identifications, procedures, safety check lists, hazards analysis and, in the case of demolitions, the hazards analysis of the detailed design. Health and safety issues are not only integrated into the planning and design functions, but are also integrated into the personnel training given and the methodology of how the work is performed. The

job is analyzed through safety reviews, hazards analysis, etc., and is monitored by safety inspections and walkdowns, and is performed by personnel trained in hazards recognition.

4.2.2 Transportation of Waste

There is a potential for non-radiological injury or death as a result of a truck accident. Based on 1999 accident statistics for large trucks[38], 0.0253×10^{-6} fatality would be expected per mile driven and 0.454×10^{-6} injuries would be expected per mile driven. Based on the estimated 19 shipments to Hanford, Washington; 1,390 shipments to the Nevada Test Site and Envirocare in Clive, Utah; 26 shipments to NNSI near Houston, Texas; 11 shipments to Alaron in Wampum, Pennsylvania; and 12 round-trip shipments to WIPP near Carlsbad, New Mexico; total shipping mileage is expected to be on the order of 2.76×10^{6} miles for TRU and low-level waste. Local shipments of clean rubble to disposal sites are insignificant in adding to total mileage. Based on the mileage estimate and the accident statistics reported above, 1.25 injuries and 0.070 fatalities could occur due to shipping activities.

The number of trucks used to transport waste will not have a significant impact on traffic at the West Jefferson site. During maximum transportation activity (FY 2005), it is estimated that a total of 348 shipments will originate from the West Jefferson site. This maximum transportation activity would be equivalent to a common 18-wheel tractor-trailer rig leaving the West Jefferson site 6.7 times per week, on average. The number of trucks leaving the site in other years will be considerably less.

Use of intermodal containers to ship large volumes of soil via rail is under consideration. Soil/rubble may be loaded into 20 cubic yard IP1 containers and transported via flatbed truck 20 to 100 miles to an approved railroad spur. Four to six intermodal containers may be loaded onto a railroad flatcar and shipped to Envirocare where they would be dumped and returned. Should this option be used, the number of truck shipment miles would be substantially reduced, with a corresponding reduction in estimated driver injuries and fatalities.

Shipments of BCLDP radioactive waste turn north from the exit of the West Jefferson site onto Ohio Rt. 142, travel less than 1 mile, and turn west onto I-70. DOT regulations require radioactive materials to be shipped on the interstate highway system as much as possible unless states designate other routes.

4.3 Environmental Consultations and Permits

The BCLDP continues to maintain a state of compliance with applicable environmental statutes and regulations. No fines, penalties, or administrative orders have been imposed on the BCLDP. No lawsuits by regulatory agencies or citizens have been brought against Battelle. No United States Environmental

Protection Agency (USEPA) or Ohio Environmental Protection Agency compliance issues have been attributable to BCLDP operations.

Listed below are changes to specific regulatory areas, previously addressed in Table 4-5 of the EA.

- **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)**

  No violations have occurred and no enforcement actions taken in connection with BCLDP. There have been no releases of hazardous substances that required notification under CERCLA.

- **Resource Conservation and Recovery Act (RCRA)**

  The BCLDP is responsible for radioactive wastes, including those hazardous wastes that have collateral radioactivity. BCLDP uses Battelle's 90-day generator storage facilities as necessary to maintain cost-effective packaging and shipping operations. Battelle currently conducts hazardous waste operations under OEPA generator regulations. Battelle is not operating as a hazardous waste treatment, storage, or disposal facility (TSDF).

- **Federal Facility Compliance Act (FFCA)**

  The amended proposed BCLDP Site Treatment Plan (STP) was submitted to the OEPA in October 1995. This STP fulfills the requirements in the FFCA of 1992 and RCRA Section 3021. The OEPA Director's Findings and Orders, effective October 4, 1995, covers implementation of the STP. The BCLDP provides OEPA with an annual update of the STP in compliance with the Director's Findings and Orders. The 1999 and 2000 updates included new information on low-level and transuranic (TRU) mixed waste identified by the BCLDP. Refer to the December 2000 STP update for detailed information on mixed waste streams and volumes.

- **National Environmental Policy Act (NEPA)**

  Activities performed by the BCLDP are consistent with the existing BCLDP Environmental Assessment[5] and Finding of No Significant Impact (FONSI).

- **Clean Air Act (CAA)**

  The NRC regulates Battelle through the SNM-7 license. Current requirements are to limit release to less than 10 mrem/yr (constraint level of NRC/USEPA) of dose from facility operations. Battelle currently meets the constraint level.

In a letter from the director received on August 9, 1996, the OEPA exempted the BCLDP from the requirements to obtain a permit to install under Ohio Administrative Code (OAC) 3745-31-03 (A)(3)(g) and a permit to operate under OAC 3745-35. The exemption expires on August 31, 2002.

- **Clean Water Act (CWA)**

  This Act is administered in Ohio by the OEPA. Battelle has received no Notice of Violation (NOV) attributable to BCLDP.

- **Safe Drinking Water Act (SDWA)**

  This Act is administered in Ohio by the OEPA. Battelle has received no NOV attributable to BCLDP.

- **Toxic Substances Control Act (TSCA)**

  No violations have been cited by USEPA Region 5 and no enforcement actions were taken in connection with the BCLDP. Polychlorinated biphenyl (PCB) wastes were stored in compliance with 40 CFR 761.65 with the exception of accumulation time specified in 761.65(a). At the end of 1999, 2,703 kg of low-level radioactive PCB solid waste remaining on-site exceeded the 1-year storage limitations due to insufficient capacity of TSDFs. In 1996, DOE and USEPA signed the National Compliance Agreement on the Storage of PCBs. An annual status summary was provided to USEPA on radioactive PCB waste exceeding the 1-year storage limitations. The BCLDP provided pertinent waste inventory information for this report for CY 1996 and 1997 until it was deemed legally unnecessary by DOE in 1998. The BCLDP provided pertinent waste inventory information to Battelle Columbus Operations Environment, Safety and Health (BCOES&H) to be included in the site TSCA inventory. The mixed PCB wastes were shipped to Envirocare for disposal in October 2000.

- **Superfund Amendments and Reauthorization Act (SARA) Title III**

  Battelle is not required to report under Emergency Planning and Community Right-to-Know Act (EPCRA) 302-303: Planning Notification; EPCRA 304: EHS Release Notification; or EPCRA 313: TRI Reporting. Battelle reports under EPCRA 311-312; Material Safety Data Sheet (MSDS)/Chemical Inventory, which applies to storage of chlorine in cylinders used for water disinfection and above ground and underground tank storage of #2 fuel oil, gasoline, and kerosene for backup fuel for boilers and emergency generators. Battelle is voluntarily participating in the group locally responsible for implementing SARA Title III.

- **Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)**

This Act is not applicable to BCLDP. Pesticides used in BCLDP areas are USEPA registered and purchased from a registered establishment.

- **Endangered Species Act (ESA)**

  For information on endangered species, see Section 4.1.2, Biota.

- **Federal Wild and Scenic Rivers Act**

  The Big Darby Creek has been designated as a component of the National Wild and Scenic Rivers System. At the present time, BCLDP activities are not subject to the requirements under this act, because the activities do not affect the free flowing nature of the Big Darby Creek. Additional state or local requirements may be implemented in the future.

- **National Historic Preservation Act (NHPA)**

  The Resource Protection and Review Department of the Ohio Historic Preservation Office has determined that the West Jefferson nuclear facilities are not eligible for the National Register of Historic Places[36]. Therefore, demolition of the facilities will have no effect on the properties listed in or eligible for the National Register.

- **Executive Order 11988 "Floodplain Management"**

  Although portions of the West Jefferson site are located in the 100-year floodplain for the Big Darby Creek, the JN-1, JN-2, and JN-3 buildings are not located in the floodplain.

  The remediated filter bed area, however, does lie in the 100-year floodplain. While some remediation efforts have occurred in this area (Reference BCLDP/CEMP Fact Sheet 031901 "Cesium Remediation"), the BCLDP continues to investigate non-invasive technologies to facilitate remediation. If successful, non-invasive remediation methods will eliminate or greatly reduce the need for excavation and backfill in this area.

- **Executive Order 11990 "Protection of Wetlands"**

  BCLDP operations have had no adverse impact on these areas.

List of Environmental Permits

The following is a list of active environmental permits for Battelle Columbus Operations that are associated with the BCLDP.

Type	Description	Number
Air	BCLDP D&D Project	Exemption
Air	Boiler Building JN-1 Registration	0149000074/B001
Air	Boiler Building JN-2 Registration	0149000077/B002
Air	Boiler Building JN-3 Registration	0149000074/B003
Air	Underground Storage Tank Building JN-1 Registration	0149000077/T001
Air	Emergency Generator Building JN-6 Registration	0149000077/B012
Water	NPDES Permit	4IN00004*FD
Water	License to Operate or Maintain a Public Water System	99-4930212
Waste	Permit to Install – Sewage Holding Tanks	01-7110
Waste	Hazardous Waste Generator Registration	OHT400013892
Transportation	Tennessee Radioactive Waste Delivery License – BCLDP	T-OH007-L99
Transportation	US DOT Hazardous Materials Registration	061499010002H
Radioactive Materials	US NRC Materials License	SNM-7

The "BCLDP Public Information Plan" has been renamed the "Annual Public Involvement Plan & Assessment." Updated annually, the purposes of this document are:

- Describe the sites being remediated, and information provided to the public and key stakeholders
- Discuss the feedback received from stakeholders about the BCLDP/CEMP and assess the current status of their interests
- Describe public involvement plans for the 2001 fiscal year
- Identify those responsible for implementing the plan.

4.4 ACCIDENT RISKS

The BCLDP recognizes that a formal process is warranted in identifying, characterizing, and analyzing hazards likely to be encountered during the remaining life of the project. Therefore two hundred and fifty-nine (259) work packages were examined and ninety-three initially identified as possibly needing formal Job Hazard Analyses (JHAs). That number was reduced to a final total of eighteen (18), partly due to grouping similar activities together. The review and evaluation of baseline activities was performed in accordance with the guiding principle to maximize safety and minimize risk.

Accident risks that will be evaluated by multidisciplinary review and sign-off are present by the following situations/conditions:

Personnel Working from Heights

- Personnel fall hazards from roofs, elevated work platforms (scaffolding), ladders, scissor lifts and/or powered platforms, man lifts, or vehicle-mounted platforms during building demolition activities, removing roofs, structural members, etc.
- Situations where standard body harnesses, lanyards, lifelines and fall protection equipment are not practical.

Material Handling

- Dropping loads, damaging equipment and/or injuring workers while lifting and/or handling large, odd-shaped objects/materials, or unusually heavy objects; examples: (1) chiller unit from JN-1 requiring close coordination of roof crew/ground crew, (2) crane trolley, rails and structure from high-bay areas of JN-1, JN-2 or JN-3
- Any material handling representing unusual conditions.

Confined Space Work

- Health and safety hazards in restricted work locations, entrapment, immediately dangerous to life or health (IDLH) atmospheres, non-routine work areas
- Highly unusual situations, deep and/or large excavations such as those where the only access to large sump/storage vault type areas is through a manhole.

Lockout/Tagout

- Electrical, mechanical, pneumatic and other sources of stored energy
- Activities involving main natural gas and other main utility lines
- Unusual situations of potential stored energy.

Trenching and Excavation

- Health and safety hazards in trenches where cave-ins and/or entrapment could occur
- Activities involving deep trenching and excavation in limited space areas where sloping, step-up construction, or a trench box cannot be used.

Hoisting and Rigging

- Preparing loads (rigging), operating the equipment used to make the lifts, locating the lift, moving material from elevated and congested locations, etc.
- Lifting and/or handling large, odd-shaped objects/materials.

4.4.1 Process for hazard analysis, risk assessment, and work planning

Accident risks will be evaluated by a multidisciplinary review and sign-off as illustrated in Figure 4-1.

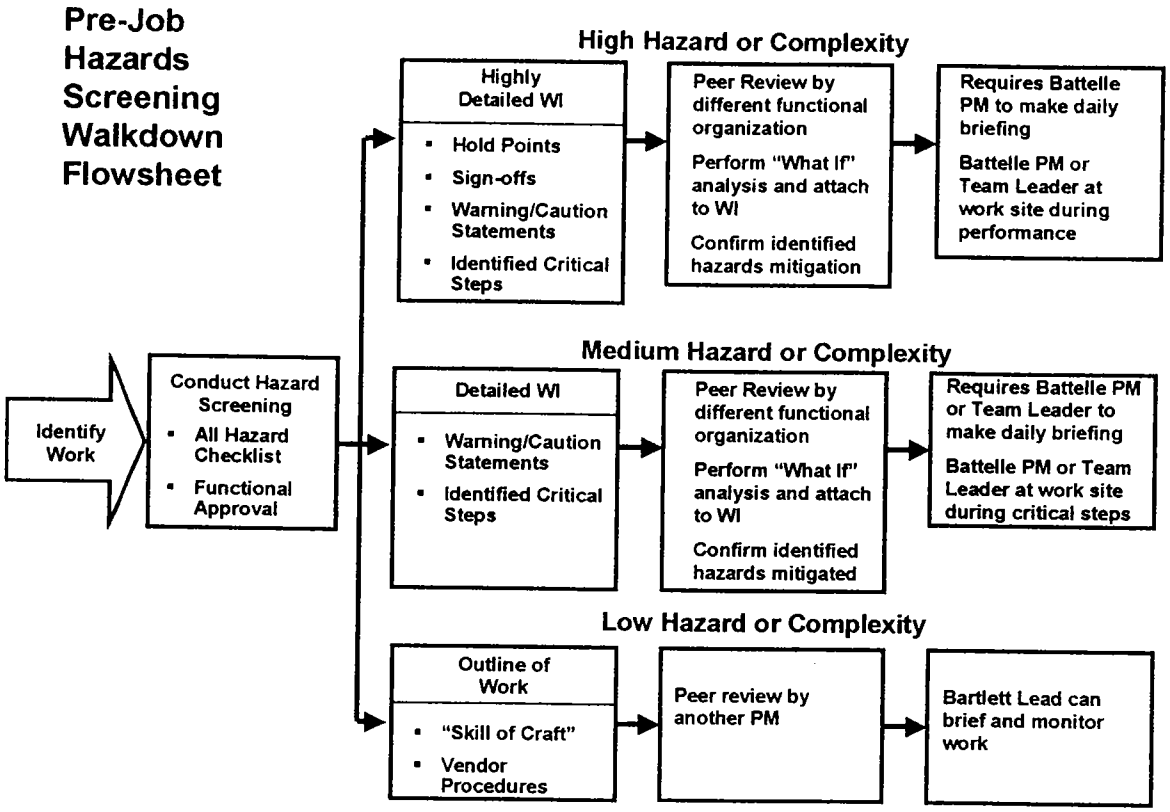

Figure 4-1. Pre-Job Hazards Screening Walkdown Flowsheet

4.4.2 Emergency Management and Response Capability

To address response to accidents the BCLDP has implemented a comprehensive and community integrated emergency management program that combines adherence to regulatory requirements with public sector emergency response partnering. Governing documents are the BCLDP Emergency Management Plan, DD-93-07 and associated implementing procedures and the West Jefferson site Spill Prevention, Containment and Control Plan, EP-PP-06. Response capabilities are structured based on the Incident Command System that promotes the timely combining of resources and integration of activities along functional lines at all levels, and to the extent possible, across all hazards. A preplanned unified command agreement that combines decision-making authorities at three levels:

(1) incident command, (2) safety, and (3) medical is maintained between Battelle and the Jefferson Township Fire Department.

If a release of hazardous material does occur, response will be initiated and emergency operations conducted according to BCLDP emergency plan implementing procedures. Credible scenarios involving the release of hazardous materials will be classified using conservative judgment in the absence of confirmed data. Emergency response monitoring equipment is maintained in a state of readiness at the West Jefferson North site and backup equipment is maintained ready at the Battelle King Avenue location. A group of Health Physics technicians and hazardous waste handling technicians are trained on emergency response procedures including environmental monitoring, personnel decontamination, and first aid. Responders are assigned on-call responsibilities on a rotating basis to address response needs beyond routine working hours.

The Battelle capability is structured to address situations such as the following.

Failure of Work Area Containment Systems/Release of Airborne Contaminants

- All work areas where concentrations of airborne radiological contaminants may be generated in excess of administrative limits will be equipped with HEPA filtration. In the event of failure, consequences are anticipated to be minimal because all such work areas are maintained under negative atmospheric pressure. However, the use of double HEPA filtration will be evaluated and a determination made on a case-by-case basis considering the complexity of the situation.

Loss of Negative Atmospheric Pressure in JN-1 and/or JN-3

- Loss of negative atmospheric pressure of a BCLDP building or container could occur as the result of severe weather, a malevolent act or as the result of an aircraft crash.

Rupture/Loss of Integrity of Waste Containers

- Rupture or loss of integrity of waste containers is most likely to occur while handling and moving.

Off-Site Transportation

- Recognizing that accidents could occur during off site transportation, the BCLDP assigns on-call response to staff knowledgeable of materials being transported. Copies of transportation paperwork are maintained by the primary shipper, emergency management personnel and Security Operations staff while materials are en route. An emergency response telephone is manned 24 hours a day, 7 days a week, throughout the year.

Severe Weather Events

- Emergency management and Security Operations personnel monitor weather radios to track impending severe weather. The West Jefferson site is equipped with a global emergency public address system to warn personnel and provide emergency response information.

Personnel Injury

- Injury to personnel could occur at any time but a higher probability of occurrence is associated with demolition activities. Therefore, all BCLDP emergency responders are trained in administering emergency first aid and in performing cardiopulmonary resuscitation. A Battelle registered nurse is located at the West Jefferson site and maintains general knowledge of BCLDP operations. Public sector emergency medical personnel are located within 5 miles of the site and are integrated into the BCLDP response capability.

5.0 CONCLUSIONS

The conclusions of the EA remain in effect, subject to the following change. Currently, BCLDP baseline planning for the West Jefferson site projects an end state consisting of:

- Building demolition and waste removal
- Remediation to levels of residual contamination that allow future site use without radiological restrictions[31].

6.0 SUPPLEMENTAL REFERENCES

7. Deleted.

8. Deleted.

10. BCLDP Site Environmental Report for Calendar Year 2000 on Radiological and Non-Radiological Parameters, BCLDP-100101, Battelle Columbus Laboratories Decommissioning Project.

18. Final Annual Public Involvement Plan & Assessment, Battelle, September 2000.

22. Deleted.

23. Deleted.

24. Deleted.

25. Deleted.

29. Deleted.

31. End State Definition for Baseline Planning. Letter to N. Joseph Gantos from Thomas A. Baillieul, Columbus Environmental Management Project, dated February 29, 2000.

32. Decontamination and Decommissioning Operations Quality Manual, Section 2.6.1.

33. Decommissioning Plan for the Battelle Memorial Institute Columbus Operations to U.S. Nuclear Regulatory Commission, DD-93-19, Revision 3, August 8, 2000.

34. NRC Material License SNM-7, Amendment 23, August 25, 2000.

35. Battelle Columbus Laboratories Decommissioning Project, Federal Facilities Compliance Act, Amended Site Treatment Plan FY 00 Annual Report, December 2000.

36. Ohio Historic Preservation Office, National Register, Madison County, Ohio.

37. DOE National Transportation Program, Carrier Evaluation Database.

38. U.S. Department of Transporation, National Highway Traffic Safety Administration homepage, Traffic Safety Facts 1999.

39. Memorandum from Thomas P. Grumbly, Assistant Secretary for Environmental Restoration and Waste Management, DOE, to Manager, DOE Ohio Operations Office, Exemption from Department of Energy Order 5820.2A for Radioactive Waste from the Battelle Columbus, Site A/Plot M, and RMI Titanium Facilities, dated October 12, 1993.

Attachment A

Information presented in EA Attachment A is replaced with the following information.

Dose Considerations – Normal Operations

Estimates of total effective dose equivalent (TEDE) expected to be received by BCLDP staff (Battelle and non-Battelle), non-involved Battelle staff, and the public are based on historical dose information collected since active D&D work resumed at the West Jefferson site in 1998. Total effective dose equivalent is the sum of the deep dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures). Estimated TEDE to decommissioning workers is described below. Doses (TEDE) to both non-involved Battelle staff and the public are expected to continue to be negligible.

Decommissioning Workers

BCLDP worker doses are extrapolated using the project dose numbers for calendar years 1997 through 2000. Based on the annual cumulative TEDE received during this period and projected work schedule, worker doses are predicted through the completion of BCLDP work at the West Jefferson site. The estimated cumulative TEDE for calendar years 2001 through 2007 is 134,000 mrem. These projected doses are given in Table A.1.

Table A.1
Estimated Cumulative Dose to All BCLDP Workers

Calendar Year	Total Effective Dose Equivalent (mrem)	Comments
1997	1,083	Actual; JN-1 pool drained
1998	24,082	Actual; resumed active D&D at West Jefferson
1999	31,532	Actual
2000	31,784	Actual
2001	35,000	Projected
2002	40,000	Projected based on earlier years; expected peak of hot work
2003	30,000	Projected based on earlier years and declining source term
2004	25,000	Projected based on earlier years and declining source term
2005	3,000	External grounds/underground pipe systems
2006	1,000	Completion of external grounds
2007	Negligible	Final Status
Total 1997-2007	222,481	
Total 2001-2007	**134,000**	

Building JN-4 staff

Since D&D operations began at WJN in 1998, JN-4 staff have not received appreciable radiation exposure. JN-4 is the only WJN facility that houses non-BCLDP staff. Data from area thermoluminescent dosimeters (TLDs) located inside the building on the southeast wall (closest to JN-1) demonstrate negligible external exposure for even a worst-case scenario. BCLDP Health Physics performs periodic dose rate surveys of the area between JN-1 and JN-4 to ensure radiation levels are maintained below the threshold that would require personnel monitoring for staff working inside JN-4. Table A.2 summarizes the JN-4 TLD data from 1997 through 2000.

Table A.2
Thermoluminescent Dosimeter Data for Inside Building JN-4

Calendar Year	Average Annual External Dose[a] (mrem)
1997	10
1998	6
1999	8
2000	8

[a] Above-background dose for working year (2000 exposure hours).

Public

External doses to the public are estimated to be negligible throughout remaining D&D operations at the West Jefferson site. This estimate is based on data from environmental monitoring TLDs that demonstrate exposures from 1997 to 2000 were within the normal range of background. Radiation dose rate surveys are also performed periodically by BCLDP Health Physics to ensure that fence line radiation levels are maintained. Table A.3 summarizes the environmental TLD data from 1997 through 2000. External doses to the public are expected to remain negligible due to programmatic controls. Limited site access, substantial distance to the nearest public receptor, and decreasing radioactive material inventory further reduce the potential for exposure.

Table A.3
Environmental Thermoluminescent Dosimeter Data – Property Boundary

Calendar Year	Average Annual External Dose[a] (mrem)
1997	17
1998	6
1999	5
2000	22

[a] Above-background dose, measured 24 hours per day, 7 days per week, 52 weeks per year

Internal Dose Consideration – Normal Operations

Inhalation remains the primary mode of intake of radioactive material from D&D operations. Internal doses (CEDE) to BCLDP workers are a comparatively small component of the total dose (TEDE). Since 1998 the percent CEDE to TEDE was less than 1 percent. Estimated CEDE for BCLDP workers is not expected to exceed 1 percent of the TEDE through completion of the project. Table A.4 lists the past and projected CEDE for BCLDP workers. Based on historical operations and current programmatic controls, it is not expected that JN-4 staff or the public will receive any CEDE due to BCLDP operations.

Table A.4
Estimated Committed Effective Dose Equivalent (CEDE) to BCLDP Workers

Calendar Year	CEDE (mrem)	Percent TEDE	
1998	62	0.26	Actual
1999	122	0.39	Actual
2000	142	0.45	Actual
2001	175	0.50	Projected
2002	400	1.00	Projected; expected peak of radiological work
2003	150	0.50	Projected
2004	125	0.50	Projected
2005	10	0.33	Grounds/underground pipe systems
2006	Negligible	Negligible	Completion of external grounds
2007	Negligible	N/A	Final Status
Total 1997-2007	1186		
Total 2001-2007	**860**		