DOE/CH/92998-T1

G-5011-3603

FILE COPY
RECORDS MANAGEMENT OFFICE

CONDENSED VERSION

of

DRAFT ACTION DESCRIPTION
MEMORANDUM FOR THE DECONTAMINATION
AND DECOMMISSIONING OF
BATTELLE COLUMBUS FACILITIES

to

DOE CHICAGO OPERATIONS OFFICE

July 12, 1988

by

BATTELLE
Columbus Division
505 King Avenue
Columbus, Ohio 43201-2693

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

MASTER

This report is a work prepared for the United States by Battelle. In no event shall either the United States or Battelle have any responsibility or liability for any consequences of any use, misuse, inability to use, or reliance upon the information contained herein, nor does either warrant or otherwise represent in any way the accuracy, adequacy, efficacy, or applicability of the contents hereof.

1.0 DESCRIPTION OF PROPOSED ACTION

1.1 INTRODUCTION

Under provisions of the Surplus Facilities Management Program (SFMP), the U.S. Department of Energy, Chicago Operations Office, proposes to provide funding for Surveillance and Maintenance (S&M) and subsequent Decontamination and Decommissioning (D&D) of fifteen facilities and associated premises belonging to Battelle Columbus Division. Nine of these facilities are located at Battelle's King Avenue Site, Columbus, Ohio and the remaining six are located at Battelle's West Jefferson Site, West Jefferson, Ohio (see Figure 1-1).

The fifteen facilities are contaminated as a result of nuclear research and development activities conducted over a period of approximately 43 years under Basic Contract W-7405-ENG-92 for DOE and its predecessor agencies--the Energy Research and Development Administration (ERDA), the Atomic Energy Commission (AEC) and the Manhattan Engineer District (MED). The purpose of the D&D program is to remove the contamination so that the facilities may be returned to unrestricted use.

In all but one of the fifteen facilities the contamination is present as low level, fixed contamination which presents no hazard to workers, the general population, or the environment. The exception is the Hot Cell Laboratory, where considerable loose contamination is present in the hot cells themselves. However, the hot cells are closed systems designed for work with highly radioactive materials and, in their present state, also present no hazard to workers, the general population, or the environment.

1.2 PROPOSED ACTION

The proposed action includes continuation of ongoing S&M as well as a D&D of the facilities. The S&M activities include a continued environmental monitoring program to maintain assurance that radioactive contamination has not escaped to the surrounding environment; regularly scheduled inspection and maintenance of health, safety, and radiation protection equipment and instrumentation; a program of health physics surveillance monitoring, personnel dosimetry, and equipment and instrumentation maintenance and calibration; and emergency planning, training and drills. All S&M activities are conducted under an established nuclear quality assurance program.

The so-called dismantlement D&D mode is the proposed alternative for D&D of these facilities. The SFMP program defines the dismantlement mode as actions taken to disassemble and remove sufficient radioactive or contaminated equipment/materials from the facility or site to permit reuse of the property (U.S. DOE, 1985a). For the facilities in question this will generally involve dismantlement and/or removal of equipment; decontamination of building structures; and restoration of the buildings. The decontamination will reduce contamination to levels consistent with unrestricted use of the facilities.

FIGURE 1-1. REGIONAL MAP FOR KING AVENUE AND WEST JEFFERSON SITES

1.2.1 Decontamination

The general decontamination approach will be the same for all fifteen facilities. However, the facilities fall into three categories according to the extent and level of contamination, and some special actions are required for each category. Section 1.2.1.1 describes the general decontamination plan, and Section 1.2.1.2 describes actions or features unique to each category.

The proposed decontamination operations are similar to activities undertaken as part of nuclear research and development at the Battelle facilities over the past 45 years. When carried out as planned they present no significant environmental impact.

1.2.1.1 GENERAL DECONTAMINATION PLAN

The general decontamination plan for all facilities involves the following sequence of operations:

- Relocate non-nuclear operations and staff (as required).
- Isolate the area to be decontaminated and install access control (including installation of change rooms and showers for D&D workers).
- Survey and remove uncontaminated equipment and package for disposal.
- Survey and remove contaminated equipment and package for disposal.
- Cap all floor drains.
- Perform comprehensive radiological survey to establish type, extent and location of contamination.
- Remove pipes, ducts and drains; survey and package for disposal.
- Decontaminate floors, walls and ceilings.
- Survey for residual contamination and continue the decontamination as necessary.

In all operations the area being decontaminated will be isolated and maintained as a closed system to prevent the spread of contamination outside the isolated area. All wastes will be collected and packaged in approved containers, and the containers decontaminated prior to removal to clean areas. A separate air purification system with appropriate filtration will be maintained for the areas being decontaminated.

This general approach has been used in previous D&D of other facilities at Battelle Columbus, as well as in routine cleanup activities at Battelle's Hot Cell Laboratory. These previous activities have resulted in no significant environmental impact.

1.2.1.2 SPECIAL OPERATIONS

The three categories of facilities differ in their extent and level of contamination. These differences lead to some special actions or features which are unique to each category.

1.2.1.2.1 Category 1

Category 1 includes four facilities which are widely contaminated with low levels of contamination. The internals of these facilities--floors, walls, ceilings, fixtures and most of the equipment--are broadly contaminated at levels above the unrestricted use criteria. The safest and most cost-effective approach to decontamination will involve isolation of the entire facility. In addition, it may be necessary to remove most of the internal, non-load-bearing walls.

1.2.1.2.2 Category 2

Category 2 includes only the Hot Cell Laboratory. The hot cells themselves contain high radiation fields due to extensive contamination, with lower levels of contamination in the operating areas. Decontamination operations for the hot cells will employ remote operations as well as extensive radiation protection provisions for workers. The laboratory also includes a storage and transfer pool which contains approximately 125,000 gallons of slightly contaminated water. Accordingly, operations in this facility will include the decontamination and disposal of the pool water.

1.2.1.2.3 Category 3

Category 3 includes facilities which contain isolated areas of low level contamination. The ten facilities in this category are currently used for non-nuclear research activities in areas adjacent to the contaminated areas. Decontamination operations will include isolation of a part of the facility while it is being decontaminated. Depending on the nature and extent of contamination, it may be appropriate in some cases to relocate adjacent laboratories during decontamination.

1.2.2 Confirmatory Survey and Restoration

Following the decontamination of each facility a confirmatory radiation survey will be performed to assure that the facility has been decontaminated to levels consistent with unrestricted use criteria. Results of this survey will be reviewed by DOE to determine that the facility is suitable for unrestricted use. DOE will coordinate review of the confirmatory survey results with the Nuclear Regulatory Commission (NRC).

After notification from DOE and NRC that the facility is suitable for release for unrestricted use, facility restoration activities will be initiated.

1.2.3 Radiation Safety

Major attention will be given to radiation protection for both decontamination workers and the general public. All workers will receive radiation safety training, including biological effects of radiation, protective clothing requirements, use of respirators, and exposure control methods specific to the activity being performed. Health physics staff will be assigned to each work crew to review procedures and proposed activities, monitor activities to enforce ALARA principles, and monitor radiation levels and personnel exposures. Health physics staff will have authority to stop any operations which they believe may be unsafe from the viewpoint of radiation exposure. Maximum radiation exposure to workers is expected to be less than 60 percent of the occupational guideline of 5 rem/year whole body (U.S. DOE, 1981).

Areas being decontaminated will be isolated and maintained as closed systems to prevent the spread of contamination to the public during decontamination operations. All wastes generated will be collected and packaged in approved containers and the containers will be decontaminated prior to removal to clean areas. A separate air purification system with appropriate filters will be maintained for areas being decontaminated. In addition, an environmental monitoring program will continue throughout the decontamination operations to assure early detection of possible release of contamination. Maximum exposure to the public is expected to be several orders of magnitude below the general population guideline of 25 rem/year whole body (U.S. DOE, 1985b).

1.2.4 Waste Disposal

Approximately 172,000 cu. ft. of low level radioactive waste is expected to be generated, including approximately 27,000 cu. ft. of transuranic waste. The types of wastes generated are expected to be less hazardous than those generated during decommissioning of the Shippingport Station (U.S. DOE, 1983).

All radioactive waste will be characterized and classified in detail, and will be packaged in containers approved for the specific classification. Packaging will also conform to the specific waste site disposal criteria. A transuranic (TRU) waste certification plan will be prepared and submitted for approval to ensure that TRU waste acceptance criteria are met.

Disposal of non-TRU waste is expected to be at the DOE-Hanford burial site. TRU waste is expected to be at the DOE-Idaho site for storage until DOE's Waste Isolation Pilot Plant (WIPP) in New Mexico is ready to accept waste. The packaged waste will be transported to the burial site by a transportation company licensed for transportation of radioactive material. Approximately 51 shipments of TRU waste and 279 shipments of non-TRU waste are anticipated.

1.2.5 Schedule and Cost

The proposed action is scheduled over 8 years beginning in 1990. The estimated cost is \$77 million in 1988 dollars.

2.0 ENVIRONMENTAL CONSEQUENCES AND MITIGATION

Potential environmental consequences and mitigation measures associated with the proposed action are briefly discussed in this section. Potential impacts are divided under the major headings of Radiological Impacts (Section 2.1) or Non-Radiological Impacts (Section 2.2). Under both major headings, the impacts are considered for the following three types of activities: D&D, transportation, and disposal.

2.1 RADIOLOGICAL IMPACTS

There are 15 buildings at the King Avenue and West Jefferson sites planned for D&D, which contain varying amounts of residual radioactive contamination. The radioactive substances which have been processed in these facilities include: mixed fission products, activation products, uranium (natural, enriched, and depleted), thorium, cobalt-60, carbon-14, and a few other individual nuclides. Uranium is the predominant residual in most of the facilities except for three of the buildings at the north end of the West Jefferson site.

Existing monitoring data indicates the general locations and types of surface contamination and contaminated systems. Historical records indicate the types of activities carried out in these facilities. This information provides a preliminary basis for estimating exposures that may be expected during decontamination operations. Estimates of radiological exposure and conclusions about potential impacts are based on this preliminary site characterization.

This section on Radiological Impacts is divided into the following four subsections: D&D Activities - Normal Operations, Transportation of Waste - Normal Operations, Disposal of Waste - Normal Operations, and Maximum Credible Upset Conditions. Potential radiological impacts on human health from these activities is of greatest concern and, therefore, receives the greatest attention.

2.1.1 D&D Activities - Normal Operations

Potential radiological impacts of normal operations from D&D activities associated with the proposed action (immediate dismantlement, including S&M) are divided into impacts on human health and impacts on biota. Estimates of potential radiological doses were made for both D&D workers and the general public.

2.1.1.1 HUMAN HEALTH

D&D workers will perform D&D activities and will be in direct contact with contaminated equipment and demolition materials, and radioactive aerosols. It has been estimated that D&D in Category 1 and 3 facilities will require a work force of approximately 50 persons and approximately 15 workers will be required for the Category 2 facility. D&D activities in these facilities may take only 12 months in many instances, but some operations may occur over an 8-year period.

The general public has been divided into two sub-groups: Battelle staff not involved in D&D work, and the general public in areas around the Battelle sites. Non-involved Battelle staff include staff working in offices, laboratories, or shops near the facilities where decontamination will take place. At the King Avenue site, nearly all buildings are connected by hallways or service tunnels. Thus, there are credible indoor transfer pathways from contaminated sites to locations where Battelle staff will be present. However, these passageways will be temporarily blocked with appropriate barriers as necessary to prevent contamination transfer. There are approximately 1,000 Battelle staff assigned to the nine buildings at the King Avenue site that are scheduled for D&D. There are about 40 Battelle staff assigned to the six buildings at the West Jefferson that are scheduled for D&D. These figures represent upper limits for the number of Battelle staff who will be located in close proximity to D&D operations, since many staff will be relocated out of the building (Category 1) or away from the contaminated areas (Category 3) during these activities. The primary exposure route for non-involved Battelle staff is expected to be by the respiratory route. External irradiation is considered to be minimal.

The other sub-group of the general public who could be exposed to low levels of radiation are persons residing or working near the King Avenue or West Jefferson sites. There are approximately 31,000 persons residing within 1 mile of the King Avenue site and 1,700,000 persons located within 50 miles. Approximately 1,200 persons reside within 1 mile of the West Jefferson facilities and 1,700,000 persons located within 50 miles. The general population could conceivably be exposed to D&D contaminants by atmospheric transport and possibly from locally produced food.

2.1.1.1.1 D&D Workers

For the D&D workers, the external and internal doses were separately estimated and then summed to determine the total dose. The total dose was then compared to the DOE guidelines.

Estimation of external dose to D&D workers is based on limited monitoring data. Some of the previous monitoring surveys of the contaminated facilities included exposure rate measurements taken at 1 m above the floor in the vicinity of contaminated areas. The estimated external dose to D&D workers based on this limited radioactive contaminant inventory ranged from indistinguishable from background to 30.0 person-rem for each of the

buildings planned for D&D except the Hot Cell Laboratory. Based on prior operating experience, the total external and internal dose to D&D workers decontaminating the Hot Cell Laboratory is estimated to be 350 person-rem.

The uptake mode for internal dose to D&D workers is considered to be principally through inhalation. The fundamental parameters that determine internal dose from inhalation are: particle size distribution of aerosols, radionuclides in the aerosols, chemical and other physical properties of the aerosols, and the quantity of aerosol inhaled. These parameters are determined by several factors which can be monitored and controlled within certain limits.

The factors which determine internal dose were identified and assumptions were made as follows to serve as the basis for making internal dose estimates:

- (1) Potential Airborne Inventory. Estimates of the portion of the total contaminant inventory which must be removed by methods which may generate aerosols were made by best professional judgement.
- (2) Release Fraction. The release fraction which may become airborne was assumed to be 5% for this evaluation, based on use of special scabbling devices (Funakawa, et al., 1987), wet blasting, fixative coatings, or wetting sprays, as appropriate to reduce the release fraction.
- (3) Local Pickup Fraction. The capture efficiency of the local exhaust or vacuum pickup system at the point of aerosol generation is assumed to be 90% (Battelle Pacific Northwest Laboratories, 1977) of the released aerosol. The filter transmission fraction of the roughing/HEPA filter system is assumed to be 3×10^{-4} .
- (4) Room Exhaust Collection Fraction. The enclosed decontamination work area will be provided with a filtered-exhaust ventilation system that is assumed to capture 75% of the aerosol that escapes the local vacuum pickup. The overall transmission fraction of the roughing filter/2 HEPA filter series of this system is assumed to be 8×10^{-8} .
- (5) Dilution of Ventilation Effluent in Surrounding Area. The effluent from the work area ventilation system is discharged into the larger volume of surrounding areas, which is assumed to dilute the aerosol concentration by a factor of 30.
- (6) Respirability Fraction. Based on particle size data for use of a milling cutter on concrete (Funakawa et al., 1978) and lung deposition data for different particle sizes (ICRP, 1978), a respirability fraction of 0.10 is assumed.
- (7) Respirator Protection Factor. For the internal dose estimates, a respiratory protection factor of 2000 is assumed (NRC, 1987; ANSI, 1980; and Pritchard, 1977).

The above seven factors were incorporated into formulas for estimating the internal dose to D&D workers. Estimated internal doses for D&D workers range

from 1.5×10^{-5} to 103 person-rem in D&D building Categories 1 and 3. As stated previously, the combined internal and external dose estimated for D&D workers in building Category 2 (Hot Cell Laboratory) is estimated to be 350 person-rem based on prior operating experience. These values are predicted for worst case scenarios.

The sum of the estimated internal and external doses to D&D workers in all buildings, as discussed above, is substantially below the occupational exposure guidelines of 5 rem/year set by U.S. DOE (1981). The estimated total individual doses for D&D workers vary from 3.8×10^{-6} up to 2.9 rem/year for the different buildings planned for D&D. Even the highest value, which is for the Hot Cell Laboratory is less than 60% of the guideline. The average annual whole body dose per person for all D&D workers combined is 0.918 rem, which is less than 20% of the guideline. Although dose calculations are preliminary, the estimated levels are well below the guidelines and, thus, no human health impacts are expected for D&D workers.

2.1.1.1.2 General Public (Including Non-involved Battelle Staff)

Estimated radiological doses for non-involved Battelle staff were evaluated separately from the remainder of the general public, because they work in closer proximity to the planned D&D operations than the rest of the general public. In some cases, non-involved Battelle staff will be relocated out of buildings planned for D&D. In other cases, non-involved Battelle staff will be located in the same buildings where D&D is planned or in buildings connected to the buildings where D&D is planned.

External doses to non-involved Battelle staff were not calculated, because the external doses to these staff are expected to be either well below the DOE exposure guidelines or indistinguishable from background for the following reasons:

- (1) The external doses to non-involved staff who remain in or adjacent to 10 of the 15 buildings planned for D&D are expected to be substantially lower than the doses to workers. The external dose to workers, in buildings where non-involved staff will remain during D&D, is expected to be indistinguishable from the general background, except for three locations where worker exposures will be above background, but well below the DOE exposure guidelines.
- (2) For the heavily contaminated areas, staff in adjacent areas will be relocated while decontamination activities are on-going. Relocating may also be necessary for non-radiological reasons, such as noise, clutter, access, etc.
- (3) Exposure rates will be monitored at the periphery of areas undergoing decontamination and in the adjacent areas where staff may remain during decontamination. D&D operations or occupation of adjacent areas, or both, will be modified as necessary to maintain exposures and doses as low as practical within the guidelines.

Estimated internal doses to non-involved Battelle staff range from 3.4×10^{-9} to 2.4×10^{-3} person-rem for the 10 buildings where non-involved staff will be located during D&D operations. These values apply to worst case scenarios. The estimates are based on the same factors discussed for evaluating internal dose to D&D workers, except that the respiratory protection factor of 2,000 to account for the protection of a respirator was removed. Also, the amount of contaminant inhaled by non-involved staff was reduced by a dilution factor based on the volume of the work enclosure, the volume of the larger surrounding area occupied by non-involved staff, and the leakage factor of the exhaust filters from the work enclosure. During D&D operations, aerosol concentrations will be determined by sampling or monitoring in adjacent areas. Decontamination operations or occupation of adjacent areas or both will be modified as necessary to maintain aerosol concentrations well below the DOE guidelines and keep internal exposures as low as possible below the guidelines.

Although the external dose was not calculated, it is expected that the internal dose to non-involved Battelle staff will be the majority of the total dose to these persons during normal operations. Non-involved Battelle staff will not be allowed into the decontamination work areas, except possibly observers who will be present for only short periods of time and will be provided appropriate protective gear. Thus, the internal dose estimates for non-involved Battelle staff discussed above are reasonable approximations of the total dose to these persons. Using these approximations, the estimated total dose to non-involved staff ranges from 1.3×10^{-8} up to 4.3×10^{-2} rem/year, which is far below the U.S. DOE (1985b) guidelines of: (1) 100 rem/year for prolonged (>5 years) whole body exposure to the general population and (2) 25 rem/year for air pathway only, whole body exposure to the general population. Additional work would be required to improve the accuracy of these estimates. However, these estimates suggest that no human health impacts are expected for non-involved Battelle staff as a result of normal D&D operations.

External doses to the public not employed by Battelle are expected to be negligible, because they have only limited access with an escort to some Battelle buildings and security arrangements will prevent access to any of the areas planned for D&D. Internal exposure of public persons during normal decontamination activities can only result from the very small amount of radionuclides which may escape from containment or be released in exhaust air streams. Every reasonable preventive and protective measure will be taken to ensure these releases are as low as feasible. This concern is demonstrated by the fact that environmental monitoring data (Battelle, 1987) indicate that no significant releases of radionuclides have occurred in the past from either of the two Battelle sites planned for D&D. The small inventory of radionuclides which may be subject to release during decontamination of the King Avenue facilities will limit emissions and the distance of the West Jefferson site from major population centers tends to reduce exposures to the public. Sampling of aerosol concentrations in areas peripheral to areas being decontaminated, in exhaust streams, and other potential release pathways will provide data feedback which will allow positive control of emissions.

Estimates of the internal dose to the general public were calculated separately for the King Avenue and West Jefferson sites as 70-year committed doses using the AIRDOS-EPA/RAD RISK model (U.S. DOE, 1985b). Since the model assumes that the release rates are constant over the 70-year period, but the potential release period is only 7 years for the King Avenue site and 9 years for the West Jefferson site, the resulting estimates are very conservative. The following assumptions were made for the King Avenue site:

- (1) The initial source term is the sum of the inventories subject to release.
- (2) The release fraction is assumed to be 0.05 of the total inventory.
- (3) The fraction picked up at the point of origin by the local exhaust or vacuum is assumed to be 0.90. The filters on the pickup equipment are assumed to have a transmission factor of 3×10^{-4} to the general room exhaust ventilation system.
- (4) The capture fraction for the room general exhaust ventilation system is 0.75 of the aerosol released in the decontamination room. The filters on the decontamination room are assumed to have a transmission factor of 8×10^{-8} .
- (5) The activity is expected to be released from the center of the King Avenue campus, at an average height of 12 meters, over a period of seven years, and at the following rates: U-238 = 5.6×10^{-9} Ci./yr, MFP (Sr-90) = 6.1×10^{-10} Ci./yr, and Th-232 = 2.6×10^{-10} Ci./yr.

The following predicted internal doses to the public for the King Avenue site were calculated as 70-year committed doses with the AIRDOS model using the above assumptions:

- (1) The weighted sum, effective dose equivalent for the individual receiving the maximum dose (individual within 250 meters of the release point in the downwind, northeasterly direction), is 1.22×10^{-5} rem/yr.
- (2) The weighted sum, effective dose equivalent for the mean individual, within a 45-mile radius, is 1.23×10^{-7} rem/yr.
- (3) The collective population dose for 1×10^6 persons is 1.88×10^{-4} person-rem/yr.

In all cases the public doses estimated for the King Avenue site are far below the U.S. DOE (1985b) guideline of 25 rem/yr for air pathway only, whole body dose equivalent exposure to the general population.

Predicted internal doses to the public from the West Jefferson facilities using the AIRDOS model are based on stack release data from the Hot Cell Laboratory, because the radionuclide inventories from the other West Jefferson facilities are so small they would make no real contribution to the

public dose in addition to that from the Hot Cell Laboratory. Also, it is estimated that the overall time to decontaminate all West Jefferson facilities is about 9 years. The following predicted internal doses to the public for the West Jefferson site were calculated as 70-year committed doses with the AIRDOS model:

- (1) The weighted sum, effective dose equivalent for the individual receiving the maximum dose (individual within 250 meters of the release point in the predominantly downwind, northeasterly direction), is 1.09×10^{-3} rem/yr.
- (2) The weighted sum, effective dose equivalent for the mean individual, within a 45-mile radius, is 3.13×10^{-6} rem/yr.
- (3) The collective population dose for 1.48×10^6 persons is 4.64×10^{-3} person-rem/yr.

In all cases the public doses estimated for the West Jefferson site are far below the U.S. DOE (1985b) guideline of 25 rem/yr for air pathway only, whole body dose equivalent exposure to the general population.

2.1.1.2 BIOTA

Under normal D&D operating conditions, no significant impacts of radionuclides from D&D of the King Avenue and West Jefferson sites are expected on the terrestrial and aquatic biota in the area. Air, water, and soil are the media which act as pathways for transport of radionuclides. However, monitoring of air, water, and soil around the facilities planned for D&D have not indicated any radioactive contamination from past nuclear research (Battelle, 1987). Furthermore, extensive mitigative measures are planned to avoid significant release during the planned D&D. All decontamination will be done in enclosed work areas within the buildings planned for D&D. Air releases will be prevented by a system of air locks at entrances; a negative pressure work area; HEPA filtration systems on equipment exhaust pickups and the room exhaust; use of water sprays where feasible to reduce dust; and closure of ducts, vents, and passages. Water releases will be prevented by sealing all drain pipes and effluent outlets from the indoor, enclosed work areas.

Extremely small air releases during normal operation are possible despite use of extensive mitigative measures, but these are not expected to have any significant effect on biota, based on the extremely low doses predicted for humans. Estimates of the potential radiological doses to the general public due to air releases from the two Battelle sites planned for D&D have been discussed in Section 2.1.1.1.2, and are far below the DOE guidelines of 25 rem/yr for whole body, air pathway only exposure. However, predicted doses to biota other than humans that are known to occur in the area need to be calculated and compared to doses known to cause effects in the species selected. This additional evaluation is more important for the West Jefferson site, because diverse communities of terrestrial and aquatic biota

occur in the immediate vicinity. Although no threatened or endangered species occur on the West Jefferson site, a few threatened and endangered (T&E) animal species have been reported in Big Darby Creek that flows along one side of the site boundaries. These T&E species are not expected to be affected by the normal D&D activities.

2.1.2 Transportation of Waste - Normal Operations

In view of the large number of facilities involved in the D&D activities, a significant quantity of radioactive waste is expected to be generated. It is estimated that 26,600 cu. ft. (3,547 55-gal. drums) of TRU waste and 145,605 cu. ft. (19,414 55-gal. drums) of non-TRU will be generated. This waste will be characterized and packaged to conform to the specific waste disposal site criteria. In addition, a TRU waste certification plan will be prepared and submitted for approval to ensure that these wastes meet TRU waste acceptance criteria.

The packaged waste will be transported to the disposal site by a transportation company licensed for transportation of radioactive material. Based on the estimated volume of waste, it is estimated that approximately 330 shipments will be required. This assumes that each shipment will include 70 drums of 55-gal. capacity. It is expected that the low level, non-TRU waste will be shipped to the DOE-Hanford site for burial. TRU waste may be shipped to the DOE-Idaho site for storage until DOE's Waste Isolation Pilot Plant (WIPP) in New Mexico is ready to accept the waste. Based on these assumptions, potential radiation exposure to truck drivers (2 per shipment, 40 hours driving time, and a maximum of 2 rem/hr radiation field in the cab) is estimated to be 52.8 man-rem. On the assumption that no individual driver participates in more than half the shipments (a conservative assumption), the maximum exposure to any individual driver is less than 2.0 rem/yr (less than 40 percent of the DOE occupational guideline of 5 rem/yr).

2.1.3 Disposal of Waste - Normal Operations

No significant impacts are expected at the Hanford, Idaho, or WIPP sites as a result of disposal of radioactive waste from D&D operations. These approved sites are fully qualified to accept and dispose of the wastes from D&D. The disposal sites are located in relatively arid areas where solute migration through soil to groundwater is minimized due to sparse precipitation and depths to groundwater of 180 to 750 ft. (ERDA, 1975 and 1977; U.S. DOE, 1980).

2.1.4 Maximum Credible Upset Conditions

Credible upset conditions that could result in potentially higher radiation doses to humans and biota than those described above for normal operations include tornado, earthquake, fire, and transportation accidents. The worst of these upset conditions involves a large volume of packaged radioactive waste primarily of small particles that can become airborne that is involved in a transportation accident where all of the barrels break open. Since it is planned to remove waste as soon as a truck load is generated, there would never be more than one truck load in a given location at one time.

Although no calculations have been made regarding a potential accident involving radioactive waste from Battelle facilities, calculations for a similar type of truck accident were made for radioactive waste from the Shippingport Atomic Power Station (U.S. DOE, 1983). In this hypothetical accident, a truck accident involving a shipment of spent ion exchange resin in high integrity containers (HICs) was evaluated for dose to the public. For this accident, the maximum exposed individual receives a whole-body radiation dose of 5.5 rem (approximately 3.2% of the natural annual background exposure). This is far below the U.S. DOE (1985b) requirement not to exceed 500 rem/yr. for occasional (i.e., <5 yr.) exposures to the public. Additionally, except at the Hot Cell Laboratory, most of the Battelle wastes are only a mild radiological hazard compared to the Shippingport waste.

2.2 NON-RADIOLOGICAL IMPACTS

Non-radiological environmental impacts of the proposed action are expected to be very minor. Potential impacts are discussed as they relate to D&D activities or transportation of waste. No non-radiological impacts are predicted for disposal of waste at the three DOE waste sites.

2.2.1 D&D Activities

Non-radiological impacts associated with D&D activities could be due to the presence of toxic or hazardous substances, noise from D&D equipment, and socioeconomic changes. No mixed wastes are known or expected in the areas of proposed D&D activities. The only toxic or hazardous substance currently known to occur in the facilities planned for decontamination is beryllium. However, the level of beryllium contamination is extremely low due to past cleanup efforts, and it is not of sufficiently small particle size to be classified as hazardous waste. In addition, there is no evidence available that suggests commingled contamination of radioactive materials and beryllium. A pre-D&D survey of the area will be conducted and the decontamination procedures will be appropriately modified to prevent any potential commingling of the waste.

Only beryllium dust is considered hazardous, but generation of beryllium dust during D&D is considered highly unlikely due to the low levels of contamination. The recommended Threshold Limit Value-Time Weighted Average (TLV-TWA) for beryllium dust is 2 ug/m^3 (American Conference of Governmental and Industrial Hygienists, 1986). Use of dust pickups on D&D equipment and other containment/protective methods (respirators, ventilation systems) to be utilized in the D&D activities are expected to be sufficient to prevent undue exposures to any worker or Battelle staff.

Many of the D&D activities will result in noise levels that could adversely affect workers and staff without the use of mitigative measures to reduce impacts. Mitigative measures will include providing ear protection for workers and relocation of staff to areas away from the D&D activities. Noise from jack hammers, drills, and scabbling and spalling equipment will be transmitted throughout the building structures and may result in stress and reduced work efficiency in Battelle staff in the affected area. The public is located far enough from Battelle facilities that noise inside the buildings is not expected to cause any impacts.

The proposed action will result in a small net increase in employment and economic activity. Most of the D&D activity will be performed by 120 staff over a period of six to eight years. In addition to staff labor directly involved in the D&D project, an additional \$15,000,000 (1988 dollars) will be utilized over six to eight years for the purchase of equipment, materials and transportation services.

Property values may be impacted by the proposed action. If the program is viewed negatively by the public and the news media, there could be some short term negative impact on the value of nearby property. However, the long term impact on surrounding property values is expected to be negligible or slightly higher.

2.2.2 Transportation of Waste

As for any type of transport operation, there is a certain potential for non-radiological injury or death as a result of a truck accident. The overall accident rate for truck transport is 1.06×10^{-6} per kilometer, and there are 0.51 injuries and 0.03 fatalities per truck accident (U.S. DOE, 1983). Based on these rates, it is estimated that waste shipments would lead to 1.26 accidents, 0.6 injuries, and 0.04 fatalities.

The number of trucks used to transport waste is not expected to have any significant impact on traffic at either site. During maximum transport activity, it is estimated that a total of 6 truck shipments will originate during 1993 from the King Avenue site and 40 truck shipments during 1996 from the West Jefferson site. This maximum transport activity would be equivalent to a common 18-wheel, tractor-trailer rig leaving the King Avenue site every 2 months and slightly less than once a week from the West Jefferson site.

3.0 REFERENCES

American Conference of Governmental Industrial Hygienists (ACGIH). 1986. Threshold Limit Values and Biological Exposure Indices for 1986-87. ACGIH, Cincinnati, Ohio.

American National Standards Institute, Inc. (ANSI). 1980. American National Standard Practices for Respiratory Protection. 288.2-1980.

Battelle Columbus Division. 1987. Environmental Report for Calendar Year 1986 on Radiological and Nonradiological Parameters. Prepared for the U.S. Department of Energy.

Battelle Pacific Northwest Laboratories. 1977. Technology, Safety and Costs of Decommissioning a Reference Nuclear Fuel Reprocessing Plant. Vol. 2. Prepared for Nuclear Regulatory Commission, Washington, D.C.

Energy Research and Development Administration (ERDA). 1975. Final Environmental Statement: Waste Management Operations, Hanford Reservation, Richland, Washington, December, 1975.

Energy Research and Development Administration (ERDA). 1977. Final Environmental Impact Statement: Waste Management Operations, Idaho National Engineering Laboratory, Idaho, September, 1977.

Funakawa, N., Kinoshita, T., and T. Tanaka. 1987. New Method for Decontamination of Concrete with Milling Cutter. International Decommissioning Symposium, Oct. 4-8, 1987, Conf.-871018, Vol. 2.

International Commission on Radiological Protection (ICRP). 1978. Limits for Intakes of Radionuclides by Workers. ICRP Publication 30, Part 1, Pergamon Press. New York, NY.

Nuclear Regulatory Commission (NRC). 1987. Protection Factors for Respirators. Code of Federal Regulations, Title 10, Part 20, Standards for Protection Against Radiation, Appendix A. pp 272 and 273. National Archives and Records Administration, Office of the Federal Register, Washington, D.C.

Pritchard, J. A. 1977. A Guide to Industrial Respiratory Protection. LA-6671-M, UC-41, Los Alamos Scientific Laboratory of the University of California, Los Alamos, New Mexico.

U.S. Department of Energy (U.S. DOE). 1980. Final Environmental Impact Statement: Waste Isolation Pilot Plant, Los Medanos, New Mexico, October, 1980.

U.S. Department of Energy (U.S. DOE). 1981. Requirements for Radiation Protection (Order 5480.1, Chapter XI), April 29, 1981.

U.S. Department of Energy (U.S. DOE). 1983. Decommissioning Plan for the Shippingport Station Decommissioning Project. DOE NO RL/SFM-83-4, September, 1983.

U.S. Department of Energy (U.S. DOE). 1985a. Surplus Facilities Management Program, Program Plan UNI-3560. October 1, 1985.

U.S. Department of Energy (U.S. DOE). 1985b. Radiation Standards for Protection of the Public in the Vicinity of DOE Facilities. August 5, 1985 Memorandum, Vaughn to Distribution.