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SR 655

The Decommissioning of DRES Building 12

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July 1997

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SUFFIELD REPORT No. 655

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ABSTRACT

DRES Building 12, an obsolete structure containing underground lead-lined concrete vaults and a chemical laboratory facility, had been used since World War II for a variety of purposes, including the storage of radioactive and pesticide wastes, the synthesis of radioactive chemical warfare agents for research purposes, and as a site for training Canadian Forces personnel in nuclear, biological and chemical defence. A systematic approach was taken to remove chemical hazards and residual radiological contamination during the decommissioning of this building. This Report describes the decontamination and decommissioning activities undertaken to ensure Building 12 could be safely demolished.

EXECUTIVE SUMMARY

JM McAndless and D. Cole, "The Decommissioning of DRES Building 12", DRES Suffield Report No. 655, July 1997.

Canadian Forces Base Suffield is carrying out a modernization program which includes the decommissioning and demolition of obsolete buildings, including those operated by the Defence Research Establishment Suffield (DRES). Building 12, a World War II-vintage structure containing five lead-lined underground concrete vaults, qualified for this program. This building had been used by DRES for a variety of purposes including the synthesis of radioactive chemical warfare agents, storage of radiological and other hazardous chemical wastes, and as a site for training Canadian Forces personnel in nuclear, biological and chemical defence.

A systematic approach was developed by DRES for decommissioning Building 12. Decommissioning activities were undertaken over a period of several years with the ultimate goal of completing the work in a safe, environmentally-acceptable manner. These activities, which were carried out primarily through contracts and with direct DRES support, included:

- removal and disposal of stockpiles of radiological waste;
- removal and disposal of stockpiles of pesticides and other hazardous chemicals;
- radiological decontamination of the laboratory facility used for the synthesis and storage of radioactive chemical warfare agents;
- removal of lead sheet lining from the concrete vaults;
- radiological and chemical surveys of Building 12 to ensure the building met regulatory requirements for release for demolition.

The decommissioning work was funded through the Chief of Research and Development Incremental Environmental Program. Work involving radiological surveys and decontamination was sponsored and monitored by the Department of National Defence Director General Nuclear Safety (DGNS). Contracts with a total value exceeding $0.5M were awarded for the Building 12 project. A unique feature was the use of the vault lead linings to offset costs. In this case, the sale of the lead to a scrap mill yielded a residual profit after accounting for contractors profit and removal costs. This residual profit was returned to DRES in the form of services of equivalent value provided by the contractor.

The final radiological decontamination of Building 12 was carried out by SAIC Canada under contract and involved the removal of fixed and loose contamination associated with Strontium-90 in concrete structures and fume hood ducting within and around the chemical warfare agent synthesis laboratory. A comprehensive survey conducted upon completion of the decontamination work confirmed that the decontamination was successful and that loose and fixed radiological contamination had been reduced to background levels. Building 12 has now been rendered safe and is ready for demolition.

TABLE OF CONTENTS

INTRODUCTION

At Canadian Forces Base (CFB) Suffield, the buildings, facilities and associated infrastructure are currently undergoing modernization in accordance with the Base Development Plan. For example, a new water treatment plant, sewage lagoon, and a Base Supply hazardous materials storage facility have recently been constructed and commissioned. The modernization program also involves the removal of buildings and structures which no longer meet requirements; for example, the Central Heating Plant (Building 303), old Water Storage Tower and an abandoned greenhouse located near the main Base have been demolished. The removal of such obsolete facilities typically provides CFB Suffield with annual savings in energy and maintenance costs.

CFB Suffield also provides support for the operation and maintenance of all Defence Research Establishment Suffield (DRES) buildings. DRES is a Department of National Defence (DND) research and development laboratory which conducts programs in chemical-biological defence and military engineering technologies. In keeping with the Base Development Plan, DRES conducts an annual review of its buildings and facilities and upgrades those which are required to support the Establishment research and development programs or removes those which are no longer required.

DRES Building 12 was an example of an obsolete building which qualified for decommissioning and removal. This World War II-vintage building was used for a variety of purposes in support of DRES research and development programs. For example, the building was used for:

- producing radioactively-labelled chemical warfare agents;
- storing radioactive waste, hazardous materials, equipment items and archived classified documents, and
- conducting small training exercises in chemical-biological defence.

This report describes a project which was undertaken to decontaminate and decommission Building 12 in preparation for its demolition.

BUILDING 12 DESCRIPTION

Building 12 was located within a secure, fenced compound in the CFB Suffield Magazine Area, approximately 1 km north of the main Base Administration Area along Jenner Road (see Figure 1). The building, shown in Figure 2, was of wood-frame construction with dimensions 50 m x 10 m x 4 m. The building was erected during World War II to provide cover for five concrete vaults located partially below ground (see Figure 3). Each vault had dimensions 9 m x 6 m x 4 m with a wall thickness of 25 - 35 cm. As shown by the example in Figure 4, the vaults were fully lined internally with lead sheet, approximately 6.5 mm thick. Two vaults were combined to provide space for the operation of a laboratory facility (R/A Laboratory), as shown in Figures 5 and 6. All vaults, except one central vault, were modified to allow access by stairway from ground level. The building was supplied with electrical, water and natural gas utilities.

BUILDING 12 HISTORY

Building 12 was originally built for the purpose of storing bulk mustard chemical warfare agent in the lead-lined concrete vaults. However, the vaults were never used in this manner; instead, the building was used in a variety of other ways as described below.

R/A Laboratory

In the early 1950s, a laboratory was constructed within the southernmost two vaults (Vaults #4 and #5) of Building 12. This facility, known as the Radioactive Synthesis and Analysis (R/A) Laboratory, was equipped with fume hoods (14 total) as well as sinks, storage shelves and personnel decontamination areas. The laboratory was divided into three main areas, *viz*: a radioactive agent synthesis area, a central 'dry box' sample preparation and work area, and an agent simulant preparation area. A schematic of the laboratory is shown in Figure 7.

Within the R/A Laboratory, various chemical warfare agents labelled with Phosphorus-32 (P^{32}, $t_{1/2}$=14 days) or Sulphur-35 (S^{35}, $t_{1/2}$=87 days), were synthesized in pilot scale (kg) quantities for use in various toxicity studies. This activity was carried out on a regular basis from 1955 until the mid-1970s. Following this, portions of the laboratory were used intermittently for studies using chemical agent simulants, training exercises in support of the chemical-biological defence program and for the storage of small quantities of hazardous chemicals. The laboratory remained inactive after 1992.

Radioactive Waste Storage

Starting in 1967, low-level radioactive waste from Department of National Defence facilities and Canadian Forces bases was shipped to DRES for disposal. Waste received between 1967 and 1 July 1971 was land filled at a designated site on the DRES Experimental Proving Grounds (Radioactive Waste Burial Site). Waste received from 2 July 1971 to 1 July 1975 was placed in the northernmost vault in Building 12 (Vault #1, Radioactive Waste Storage Vault); after this time, DRES ceased to accept radioactive waste from external agencies. Ultimately, 97 drums (205 L capacity), with a waste volume of approximately 20 m^3 , were stored in this vault. The drums contained a variety of identified, sealed radioactive sources [1], mainly radium-containing dials. The Radioactive Waste Storage Vault was operated and maintained over the years by DRES in accordance with Atomic Energy Control Board (AECB) regulations under a series of Waste Management Facility Operating Licences which were periodically renewed (e.g. AECB-WFOL-307-6). The Vault was inspected annually by AECB officials as part of the licence renewal process.

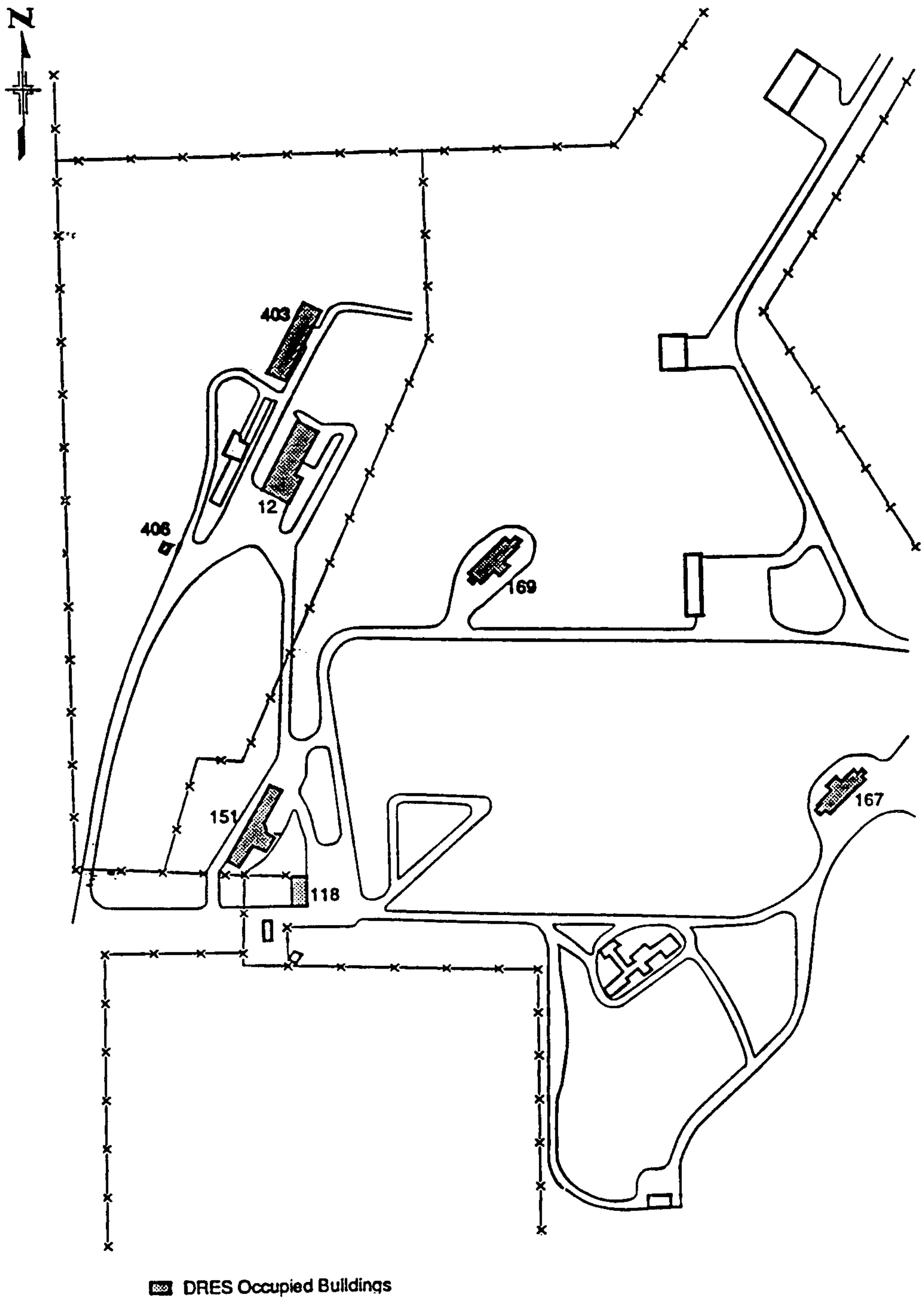

Figure 1. Magazine Area Site Schematic

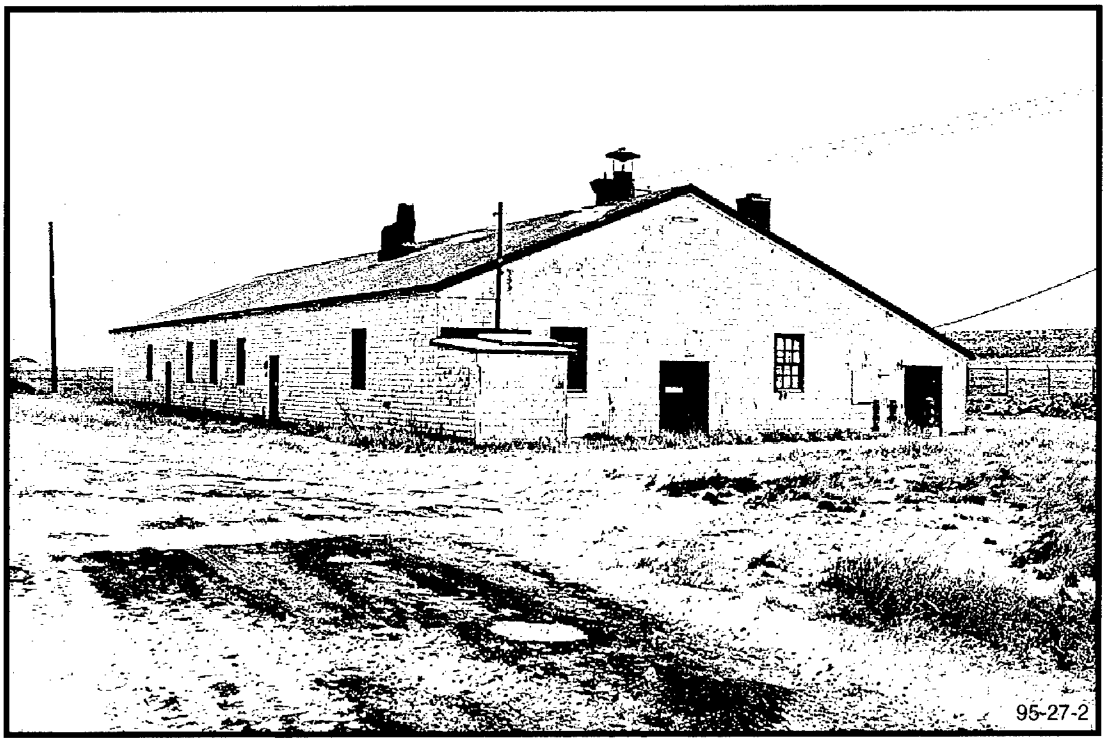

Figure 2. Building 12 Exterior View

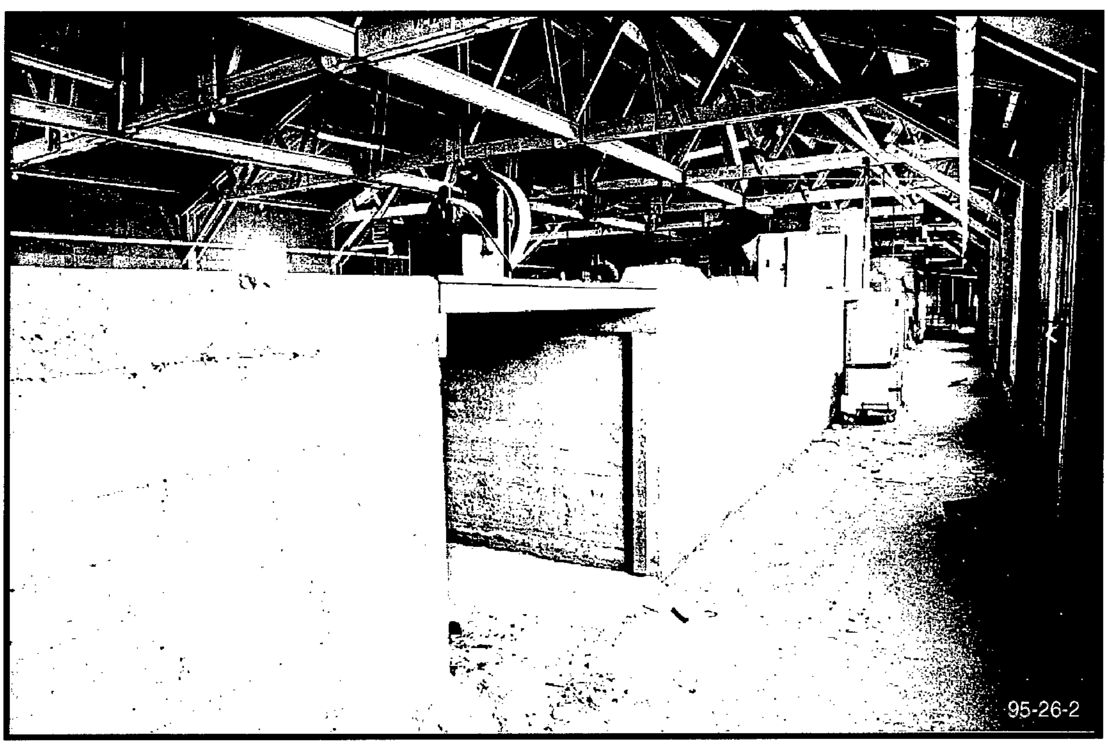

Figure 3. Building 12 Interior View

Figure 4. Interior View of Lead-Lined Concrete Vault

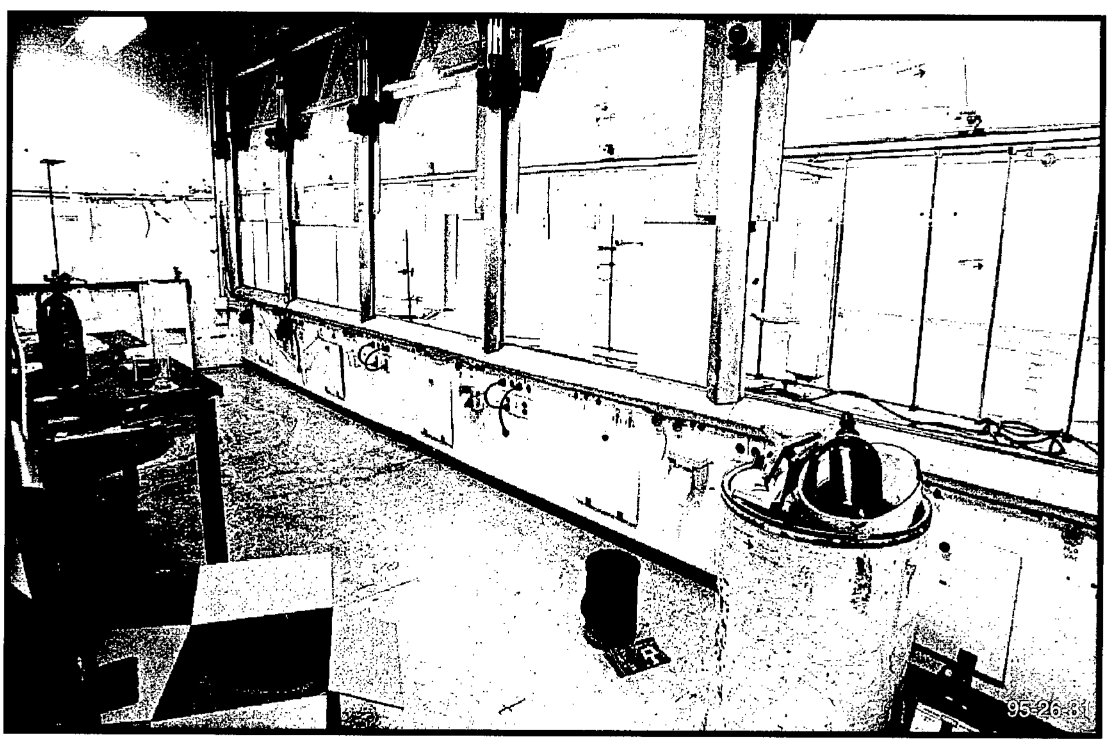

Figure 5. Interior View of Building 12 Laboratory Showing North Side Fume Hoods

Figure 6. Building 12 Laboratory Entrance Way

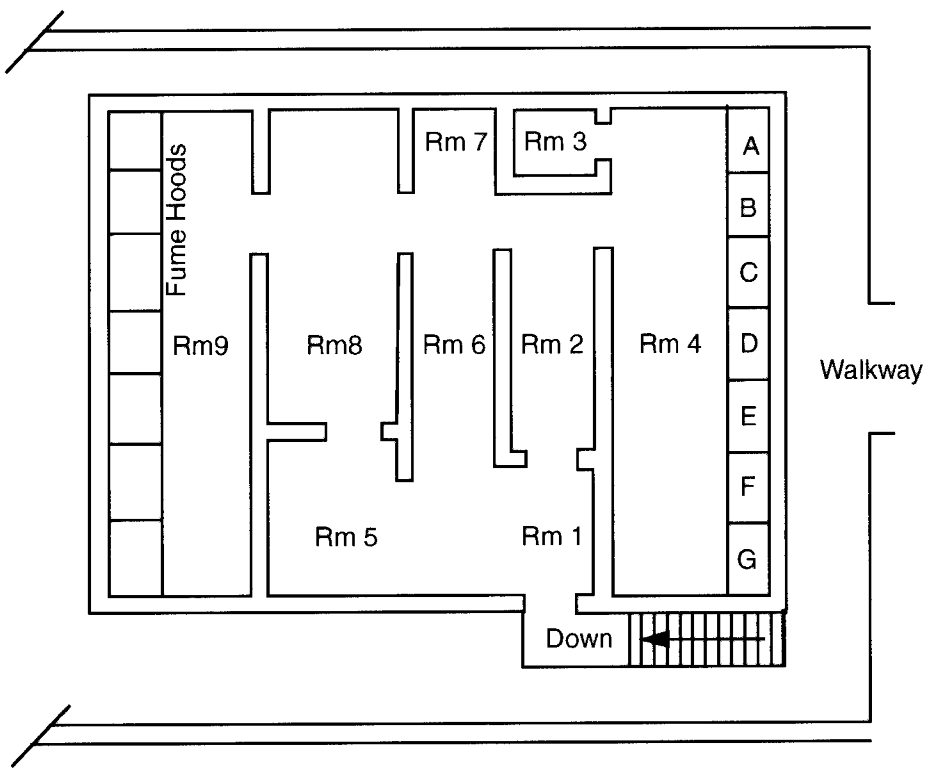

Figure 7. R/A Laboratory Schematic

Hazardous Waste Storage

At ground level, Building 12 had some open space around the outside of and in between the vaults, as well as storage space on top of the vaults. The top of the vaults formed a continuous area above ground level.

Over the years, a variety of hazardous products, including stockpiles of pesticides, aerosol spray cans, petroleum organic liquid (POL) products and laboratory solvents were stored in this open space. For example, several tonnes of the banned insecticide DDT were stored by DRES on behalf of Agriculture Canada; this stockpile represented an emergency reserve in the event other insecticides proved ineffective in combatting outbreaks of mosquito-borne diseases such as western equine encephalitis.

As noted previously, the R/A Laboratory was used also to store hazardous materials. These including small quantities of chemical warfare agents, decontaminants, agent simulants, compressed gases and fluorinated compounds.

General Purpose Storage

From the 1980s onward, archived classified documents from the DRES library were stored in one vault (Vault #3). This vault was equipped with a large door which incorporated a combination locking mechanism, similar to a bank vault door.

The open space outside of and on top of the vaults was also used for general equipment storage. Typical items stored in Building 12 included prototype devices, glassware, tubing, air sampling pumps, laboratory ovens, wind tunnels, animal cages, insecticide sprayers, etc. The equipment was typically surplus to requirements, was in disrepair, or had been used previously in activities involving toxic materials.

PRE-DECOMMISSIONING ACTIVITIES

Starting in 1990, several projects were undertaken to improve the existing conditions within Building 12. Some of these projects, as described below, were completed before a formal decommissioning plan for the building was developed in 1994. A summary of all Building 12 projects undertaken by contract is given in Table I.

Preliminary Radiation Surveys

As part of a task to identify radioisotopic stores in Building 12, and in Building 406 nearby, technical staff from the Defence Research Establishment Ottawa (DREO) Radiation Effects Section, along with the DRES Radiation Safety Officer, conducted cursory spectroscopic and dosimetric surveys in these buildings to determine the existence of residual radioactivity, if any.

TABLE I
DECOMMISSIONING CONTRACTS FOR BUILDING 12

CONTRACT/COST[1]	CONTRACTOR	DESCRIPTION
W7702-9-R139 1991: $35K	Acres International/AECL	Develop options for decommissioning Radioactive Waste Storage Vault.
W7702-2-0879 1993: $45.6K	Laidlaw Environmental Services Ltd.	Package and remove pesticide waste.
W7702-3-0277[2] 1993: $82.1K	Tri-Waste Reduction Services Ltd.	Package and remove hazardous chemical waste.
W7702-3-0376 1993/94: $254.7K	Canatom Inc.	Package and remove radioactive waste. Building 12 radiation survey (preliminary).
1994: DGNS RISO[3]	SAIC Canada	R/A Laboratory radiation survey.
W7702-5-0329 1995/96: N/A[4]	SAIC Canada/Lambco Industries.	Remove lead lining from vaults. Complete radiological decontamination of R/A Laboratory.

[1] Cost includes tax (GST). K = x 1000.

[2] The cost shown is for a contract to remove waste from various DRES Experimental Proving Ground storage sites. Building 12 chemical waste was removed as part of this contract.

[3] Regional Individual Standing Offer contract for SAIC Canada administered by DND/Director General Nuclear Safety (DGNS).

[4] The cost of lead removal was covered by profits realized from the sale of lead sheet to a smelter. Radiological decontamination costs (approx. $85K) were covered under a DND/DGNS Regional Individual Standing Offer contract.

Two spectral measurements were made within the Building 12 Radioactive Waste Storage Vault, one at the centre of the vault and the other at the top of the entrance stairs. The corresponding dose rates were 0.7 µSv/h and 0.2 µSv/h, respectively, resulting primarily from the Radon-226 (Ra^{226}, $t_{1/2}$= 1600 years) decay chain. For comparison, background radiation is typically in the order of 0.1 µSv/h. The vault was equipped with a fan system to draw off accumulated Radon gas. A subsequent reading at the vault entrance (no line-of-site to vault sources) showed a dose rate of 0.041 µSv/h, indicating the fan system was effective in removing Radon gas from the vault.

Spectral measurements were also conducted within the R/A Laboratory, especially in the agent synthesis fumehoods, in the simulant preparation areas and in a dry box which had been used to store agent precursors containing Phosphorus-32. The total dose rate within the agent synthesis area was about 0.02 μSv/h, indicating no residual radioactive contamination. Some containers stored within the dry box and in fume hoods in the simulant preparation area were found to be contaminated with varying amounts of Cobalt-60 (Co^{60}, $t_{1/2}$= 5.3 years) with one container in the latter area emitting radiation consistent with Strontium-90 (Sr^{90}, $t_{1/2}$= 28.6 years). Surface exposure rates ranged from 5-20 μSv/h. These contaminated containers were not opened nor removed at this time, due to concerns about other possible contents (non-radioactive).

Radioactive Waste Removal

Acres International and Atomic Energy Canada Ltd. (AECL) were awarded a contract in 1991 to develop options and associated costs for the disposal of waste contained in the Radioactive Storage Vault. Following this study [2], DRES decided to have this waste removed to AECL, Chalk River, Ontario, for controlled storage and eventual disposal in the planned Intrusion-Resistant Underground Storage (IRUS) facility. In preparation for waste removal, Acres/AECL sorted, catalogued and labelled waste-containing shipping drums and completed radioactive measurements within the vault.

In March of 1994, Canatom Inc. completed a contract to remove the radioactive waste to AECL, Chalk River, in accordance with AECB regulations. The Vault waste and the containers from the R/A Laboratory, were repackaged to reduce the overall waste volume. After the waste was removed, Canatom completed a survey of the Radioactive Storage Vault, carried out surface decontamination where necessary, and confirmed that the vault met AECB requirements for release from regulatory control. The results of the survey [3] are given in Table II. Based on these results, AECB subsequently removed the Radioactive Waste Storage Vault from AECB licensing, thereby releasing the vault to DRES for unrestricted use [4].

As part of their contract, Canatom also carried out a survey of the R/A Laboratory and immediate surroundings in Building 12. This survey discovered radioactive contamination in fume hood ducting, on sink counter tops, and on concrete surfaces at levels which prevented this facility from being decommissioned without remedial action. For example [3], radioactive contamination was found in all of the ducts leading from the fume hoods on the south side of the laboratory, but not in the north side fume hood ducting, nor at the top of the air exhaust stacks. The surface of the concrete floor outside of the R/A Laboratory at the south end of Building 12 was found to be contaminated in localized areas with a strong beta emitter, probably Strontium-90. In general, the radioisotopes in the contaminated areas emitted beta particles and low energy gamma rays. The ductwork appeared to be contaminated with Strontium-90. This finding was somewhat surprising, given that DRES records did not indicate that compounds containing this radioisotope had ever been synthesized or used within the R/A Laboratory. As noted above, however, a previous survey had encountered a container suspected of holding a Strontium-90 source.

TABLE II
RADIOLOGICAL SURVEY RESULTS FOR BUILDING 12 STORAGE VAULT

PARAMETER	AMBIENT GAMMA RADIATION (μSv/h)	FIXED CONTAMINATION (Bq/cm^2)	
		ALPHA	BETA/GAMMA
No. of Measurements	16	186	850
Mean Value	0.001	0.036	0.123
Standard Deviation	0.003	0.030	0.091
Upper Limit[1] Individual Readings	0.009	0.13	0.409
Highest Value Observed	0.008	0.15	0.50
Mean Standard Error	0.001	0.002	0.003
Upper Limit[1] On Mean	0.003	0.043	0.132
Release Criteria (Acceptable Limit)	0.05	0.2	1.0

[1] Upper limit based on a 99.95% confidence interval.

Canatom personnel removed the radiological contamination from some of the lightly-contaminated surfaces within the R/A Laboratory and included this contaminated material with the other waste shipped to Chalk River.

Hazardous Chemical Removal

In 1992, a detailed inventory was undertaken of the pesticide stocks held in Building 12. These stocks, which were stored primarily in the space between and around the Radioactive Storage Vault, included the following:

- DDT (dichlorodiphenyltrichlorotoluene):- most of the DDT was stored as a 50% powder in 2 kg bags or in 205 L drums . The total weight of DDT-containing material in storage was approximately 5.6 tonnes. The majority of containers were in good condition; a small number of broken bags containing DDT powder were over packed in 205 L drums.

- Baygon (propoxur): This insecticide was contained as a liquid formulation in 20 L drums. The total weight of Baygon in storage was approximately 0.7 tonnes.

- Chlordane (octachlorodihydrocyclopentadiene): Approximately 50 kg of this material were stored either as a 10% powder or as a liquid formulation in 4 L cans.

- Lindane (hexachlorocyclohexane): Approximately 45 kg of Lindane were stored as a 25% powder or as a 10% liquid formulation in small cans or in two 20 L drums.

- MCPA Amine 80 (2-methyl-4-chlorophenoxyacetic acid, dimethylamine salt): This herbicide was stored as a 300 g/L liquid formulation in three 20 L drums, with a total net weight of 60 kg.

- Miscellaneous aerosol spray cans containing commercial insecticides such as pyrethrum, dichlorvos and methoxychlor.

An agreement was reached between DND, DRES, Agriculture Canada, and Environment Canada that the DDT emergency reserve stockpile was no longer required. In early 1993, Laidlaw Environmental Services Ltd. was awarded a contract to re-package and remove the pesticides and associated spray equipment from Building 12. The pesticides were ultimately destroyed by high temperature incineration at the Alberta Special Waste Treatment Facility located at Swan Hills. The DDT was used as a test burn material to verify the destruction and removal efficiency of a new rotary kiln installed at this facility. The Special Waste Treatment Facility issued a Certificate of Destruction to DRES and to Laidlaw Environmental Services following incineration of all the pesticide stocks.

Laboratory waste containers filled with hazardous chemicals were also stored around the outside of the vaults in Building 12. The chemical waste included, for example, ammonia solutions, hydrochloric and nitric acids, various alkyl thiols, benzene and metals such as antimony, tin, zinc, and mercury. These materials were removed by Tri-Waste Reduction Services in 1993 for proper disposal at commercial facilities. Hazardous chemicals which had been stored in the fume hoods or storage shelves within the R/A Laboratory were removed at the same time by DRES staff and properly stored within other facilities or destroyed using appropriate in-house methods.

PROJECT DECOMMISSIONING PLAN

A formal plan (DRES Research Note No. 1450) for decommissioning Building 12 was developed in 1994 following removal of the radioactive waste and hazardous chemical stocks. Amongst the various tasks to be carried out, three key items needed to be addressed in order to ensure the building could be properly decommissioned and safely turned over to the CFB Suffield Base Engineering Branch for demolition, *viz*:

- residual radioactivity within and around the R/A Laboratory needed to be reduced or eliminated before dismantling the laboratory;

- archived documents stored in the centre vault needed to be reviewed with respect to security considerations, removed, and either relocated or disposed of as appropriate, and

- appropriate options for the removal and disposal of the lead lining in the vaults needed to be developed, evaluated and selected.

The lead lining in the vaults normally would be sold as scrap and removed under contract, as arranged by Crown Assets Distribution Centre. However, other options were explored because of the unique nature of this material. For example, the lead was manufactured and installed prior to atmospheric atomic testing and was thus not contaminated by radioactive particulate to the same extent as lead manufactured after 1945. The lead was also in the form of large sheets which could be readily added to existing facilities to provide extra shielding, e.g. for cancer radiotherapy laboratories.

Other tasks which needed to be carried out included the removal and disposal of obsolete equipment and non-hazardous stores and the removal of electrical, heating and plumbing utilities.

General Approach

The plan called for the decommissioning project to be carried out using a combination of in-house and contracted resources. The project was coordinated by the DRES Environmental Officer who was responsible for the following:

- developing and implementing the decommissioning plan;
- managing day-to-day project tasks;
- arranging for and scheduling contracted and DRES resources;
- developing technical solutions to problems, as required;
- ensuring the project was carried out safely and with a high degree of environmental protection, and
- reporting progress to senior management at DRES and CFB Suffield.

Funding for contracts was obtained through the Incremental Environmental Program as allocated to DRES by the Chief of Research and Development (CRAD).

In order to support decommissioning activities within the building, the heating and electrical services were maintained throughout. The water supply was disconnected at an early stage due to constant flooding problems in the utility service room and with pipes freezing during the cold winter months of 1995.

The Building 12 decommissioning plan incorporated the following approaches:

- The R/A Laboratory radiological survey and decontamination would be carried out under contract;

- DRES personnel would carry out such functions as removing equipment items, archived documents and the remaining chemicals stored in Building 12;

- The lead lining in the vaults would be removed under the terms of sale arranged through Crown Assets Distribution Centre. Any profits accrued minus the cost of extraction and contractor profit would be returned to DRES in the form of technical services of equivalent value;

- Building 12 utilities would be maintained until all contract work was completed and the building structure was certified as suitably contamination-free and ready for demolition;

- Non-contaminated R/A Laboratory equipment such as fume hoods would not be salvaged but rather would be disposed of *in-situ* when the laboratory vault was demolished;

- Some decommissioning activities could be carried out concurrently. For example, removal of equipment stores and archived documents could take place during decontamination surveys within the R/A laboratory;

- For safety reasons, the R/A Laboratory decontamination operation and the lead removal operations would be carried out at separate times.

Tasks

The major decommissioning tasks carried out are shown in Table III in approximate sequential order. Stand-alone estimates of the time required to complete each individual task are also given in this Table. In some instances, there were prolonged periods of inactivity between tasks as project personnel devoted efforts to their normal duties under the DRES research and development programs.

Schedule

The schedule for the Building 12 decommissioning project, as proposed in the Decommissioning Plan, is given in Figure 8. This schedule assumed a start date of 1 December 1994 and employed the individual task time-frame estimates given in Table III. Based on the estimates given and the assumption that each task would immediately follow the previous task, the decommissioning project was predicted to be complete by the end of July 1996. As noted above, this did not occur in every case. For example, the final radiological decontamination (task 11) was not completed until October 1996.

ENVIRONMENTAL CONSIDERATIONS

Prior to commencing operations, an environmental impact assessment for the Building 12 Decommissioning project was completed in accordance with the Environmental Assessment Review Process Guidelines Order [5], the predecessor to the Canadian Environmental Assessment Act. The project assessment is given in Annex A.

TABLE III
TASK SUMMARY FOR BUILDING 12 DECOMMISSIONING PROJECT

TASK SERIAL	ACTIVITY	TIME FRAME
1	Prepare proposal for R/A Laboratory survey and decontamination. Submit to CRAD for Environmental Program FY 95/96 approval.	1 month
2	Prepare Statement of Requirement for sale and removal of vault lead. Submit to Crown Assets Distribution Centre.	1 month
3	Remove remaining equipment stores from B12.	2 weeks
4	Remove remaining chemical stores from B12 R/A Laboratory. Conduct chemical agent survey.	2 weeks
5	Remove archived documents from central vault.	2 months
6	Remove benches, non-fixed equipment from B12 R/A Laboratory	3 weeks
7	Review bids, complete site visits and select contractor for vault lead sale and removal	3 weeks
8	Prepare and submit Request For Proposal for R/A Laboratory radiation survey and decontamination contract	1 month
9	Bidders conference, proposals review, contractor selection for R/A Laboratory radiation survey and decontamination	2 months
10	Contract: remove lead lining from B12 vaults	1 month
11	Contract: conduct survey, decontaminate surfaces, remove radioactive residues and certify R/A Laboratory for release (no radioactive hazard)	2 months
12	Remove R/A Lab exterior ducting and components	3 weeks
13	Disconnect B12 utilities (remove reusable components)	1 month
14	Dismantle/demolish B12 superstructure	3 weeks
15	Demolish Vaults and R/A Laboratory	3 weeks
16	Complete site restoration, marking and documentation	3 weeks
17	Prepare Technical Report on B12 Decontamination and Decommissioning project	2 months

The project was assessed as being able to proceed, as any potential adverse environmental impacts could be fully mitigated by known procedures and equipment. Atmospheric emissions (e.g. dust and fumes) occurring during lead removal operations or during demolition of the vaults represented the prime area for potential environmental impacts.

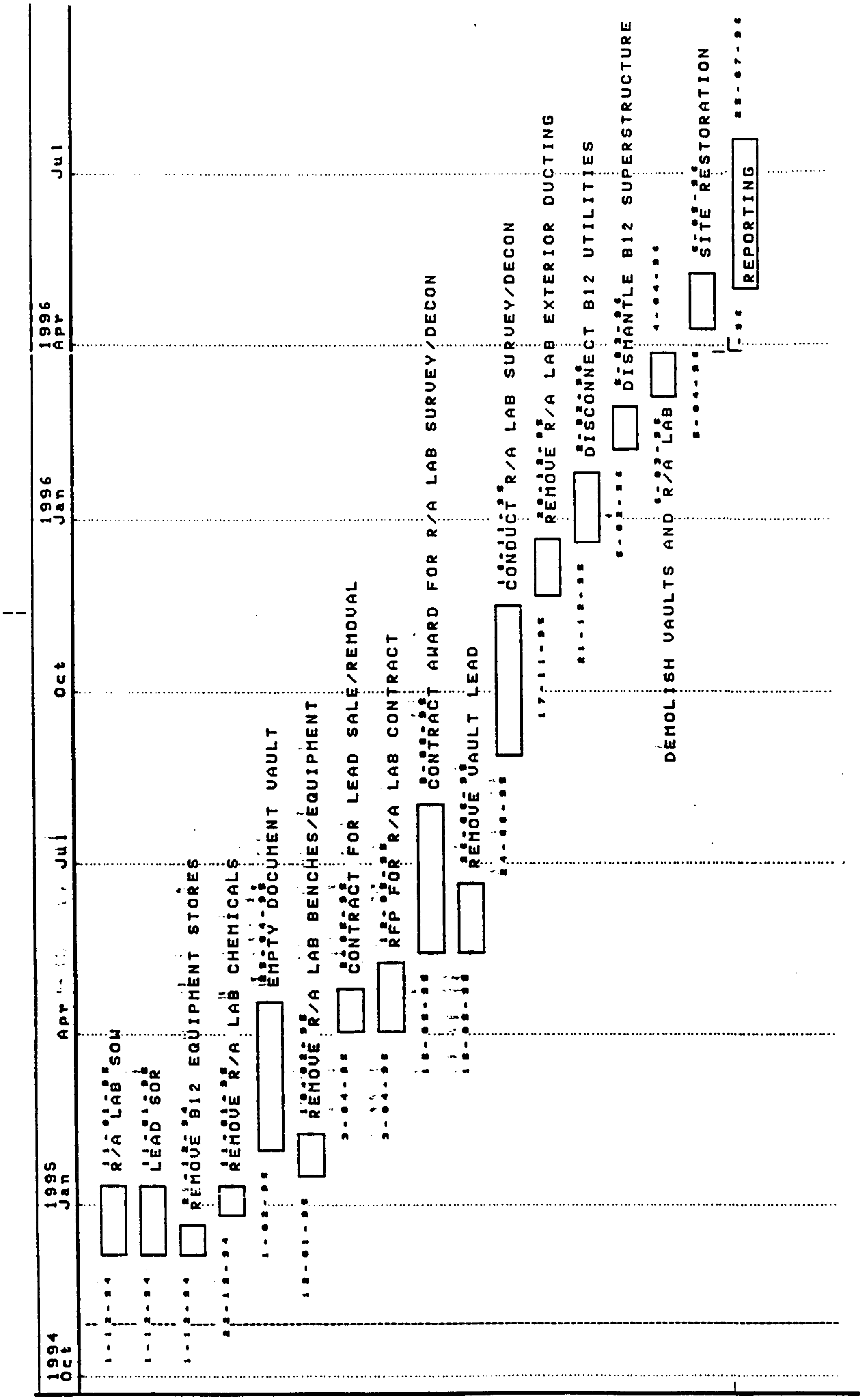

Figure 8. Proposed Schedule For Building 12 Decommissioning

DECOMMISSIONING TASKS

R/A Laboratory Radiological Survey

Under a Regional Individual Standing Offer held by the Director General Nuclear Safety (DGNS), Science Applications International Corporation (SAIC Canada) was retained to conduct a complete radiological survey of the Building 12 R/A Laboratory to quantitatively determine the nature and extent of the contamination. The objectives of this survey were to:

- determine and mark the exact areas of contamination;
- determine whether the contamination was fixed or loose;
- identify the radioactive isotope(s) and estimate the total activity present, and
- develop a plan and recommendations for the decontamination of the R/A Laboratory.

The regulatory limits, as set by DGNS, for decommissioning the R/A Laboratory were as follows:

- Loose contamination:- 0.5 Bq/cm^2 for beta and gamma emitters, 0.05 Bq/cm^2 for other emitters;
- Fixed contamination:- 0.5 μSv/h measured at 50 cm.

The survey of the laboratory was carried out in March 1995 over a 12 day period, using procedures described in the SAIC Canada "Master Plan for Radiological Decommissioning" [6]. The areas surveyed are shown schematically in Figure 9 (interior of laboratory and exterior ductwork). The following equipment was employed:

- Berthold LB 122 beta/gamma counting tube;
- Ludlum 43-89 scintillator;
- FAG Bearings swipe counter.

In addition, all survey personnel were provided with two extremity (ring) ThermoLuminescent Dosimeters (TLDs). One TLD was worn continuously while the other was worn continuously except during radiological surveys. The differences in readings between the two TLDs provided an accurate reading of the dose received by the hands of each person during the surveys. In general, no significant excess dose was received by any of the survey personnel. One member of the survey team wore an SAIC PD-1 gamma radiation dosimeter from which daily recordings were obtained. No measurable radiation dose above normal background levels was detected.

Daily background measurements were taken in accordance with the survey protocol in order to determine the detection rate for the instruments (i.e., the lowest count rate or dose rate which could be measured with 95% confidence).

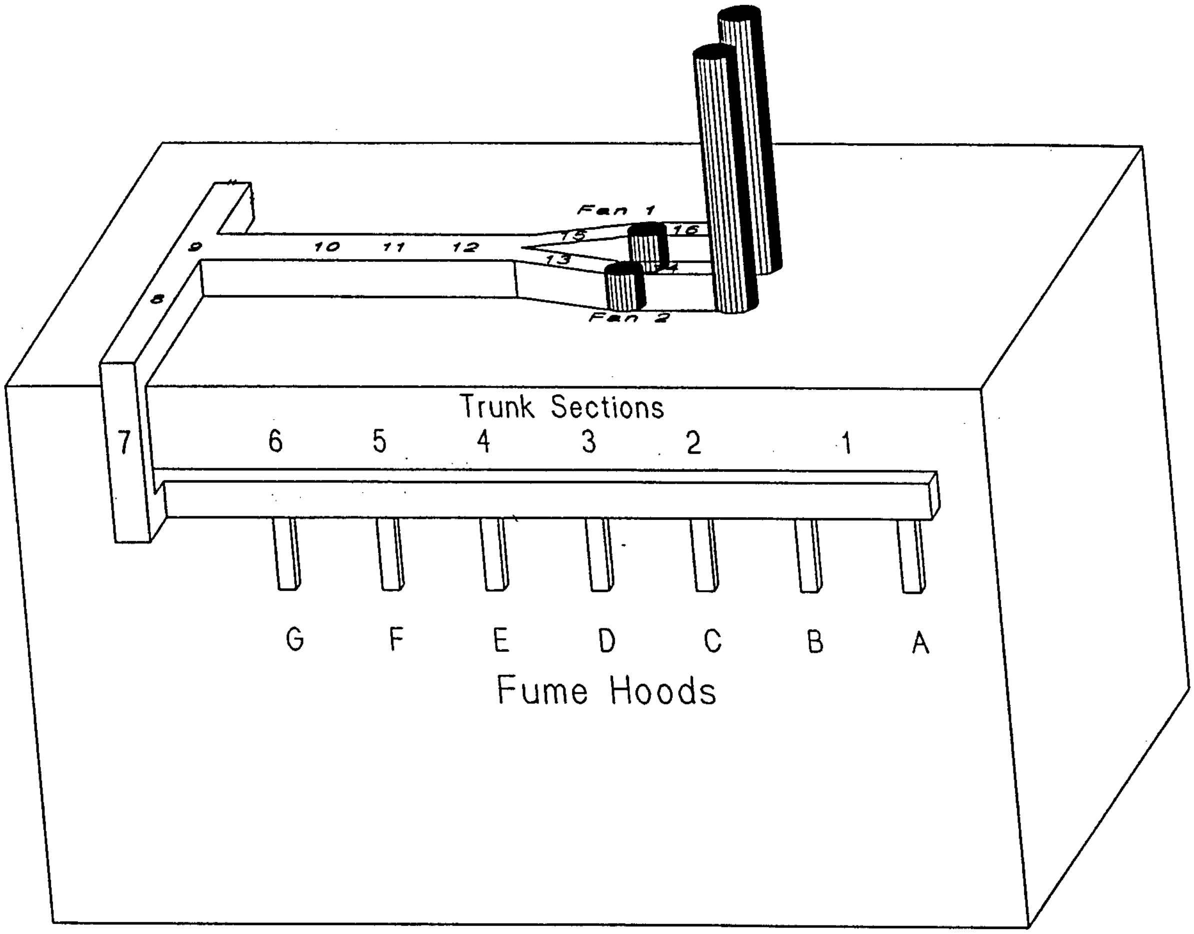

Figure 9. Schematic Of R/A Laboratory Fume Hood Trunking

Loose Contamination In Fume Hood Trunking

Radiological contamination was detected inside the fume hood trunking leading from the fume hoods along the south side of the R/A Laboratory in the agent simulant preparation area [7]. The highest levels (up to 15 Bq/cm^2) were detected in the trunking near fume hood A (see Figure 9) with the level decreasing as the distance from fume hood A increased. No contamination was found on the vertical section of trunking leading from the fan mounted on the roof of Building 12, nor on the roof itself. In total, 18 m of trunking (surface area = 41 m^2) between fume hood A and fan No. 1 was found to be contaminated. The total activity calculated for the contaminated trunking is given [7] in Table IV. The contamination was in the form of a thick layer of dust/dirt (up to 2 cm deep) inside the trunking. Sample analysis in these and other contaminated areas (see below) indicated that Strontium-90 and its daughter product Yttrium-90 (Y^{90}, $t_{1/2}$ = 64 h) were the source of the radiological contamination.

TABLE IV
CONTAMINATED R/A LABORATORY FUME HOOD TRUNKING
CALCULATION OF TOTAL ACTIVITY

TRUNK SECTION No.	SURFACE AREA x 10^3 (cm^2)	ACM READING[1] x 10^3 (cpm)	ESTIMATED TOTAL ACTIVITY[2] (kBq)
1	49	40	1400
2	33	37	900
3	30	40	880
4	30	30	660
5	20	35	510
6	24	12	210
7	49	13	460
8	31	10	220
9	27	0.75	8.6
10	66	1.1	38
12	28	0.50	3.7
16	27	1.0	14
Total:	410 (= 41 m^2)		~ 5000 (= 5 MBq)

[1] Area Contamination Meter: Ludlum Model 2223 Scaler with Model 43-89 probe.

[2] Instrument efficiency, detector surface area, 4-π geometry and background subtraction accounted for.

No contamination was detected in the fume hoods and associated trunking located on the north side of the R/A Laboratory in the radioactive agent synthesis area. As well, no contamination was detected in the trunking which connects these fume hoods to the trunking mounted on the roof of the laboratory vault.

In general, the levels of loose contamination in the fume hood trunking (up to 15 Bq/cm^2) exceeded regulatory criteria.

Fixed Contamination In Fume Hoods

Two separate contaminated areas were detected in the working areas of Fume Hoods A and B. In Fume Hood A, the contamination consisted of an area of approximately 1 m^2 located along the back, left side and bottom of the working area. Of

7 swipe samples taken in this fume hood, only one showed contamination above the detection limit of the swipe counter, indicating that the contamination was primarily fixed. The level of loose contamination detected was well below the regulatory limit. In Fume Hood B, a contaminated area of approximately 300 cm^2 was found along the front of the working area. All swipe samples taken in this area indicated loose contamination above the detection limit of the swipe counter, but below the regulatory limit for loose contamination.

The total activity of the fixed contamination detected inside Fume Hood A was estimated [7] to be 40 kBq, with an average surface contamination of 2 Bq/cm^2. At a distance of 0.5 m from the surface, the corresponding dose rate exceeded regulatory criteria. With respect to Fume Hood B, the total activity was estimated to be 80 Bq, with an average surface contamination of 0.1 Bq/cm^2. The corresponding dose rate at 0.5 m from the surface was within regulatory limits, indicating this fume hood did not require remedial decontamination.

Fixed Contamination On Exterior Concrete Walkway

Approximately 10 m^2 of concrete walkway located adjacent to the exterior of the R/A Laboratory in the southernmost portion of Building 12 was found to be contaminated with Strontium-90. The distribution of the contamination was in the form of discrete "hot spots", as shown schematically in Figure 10. The level of contamination ranged from approximately 80 Bq to 1215 Bq, as measured with a Berthold Area Contamination Meter equipped with a beta/gamma tube [7].

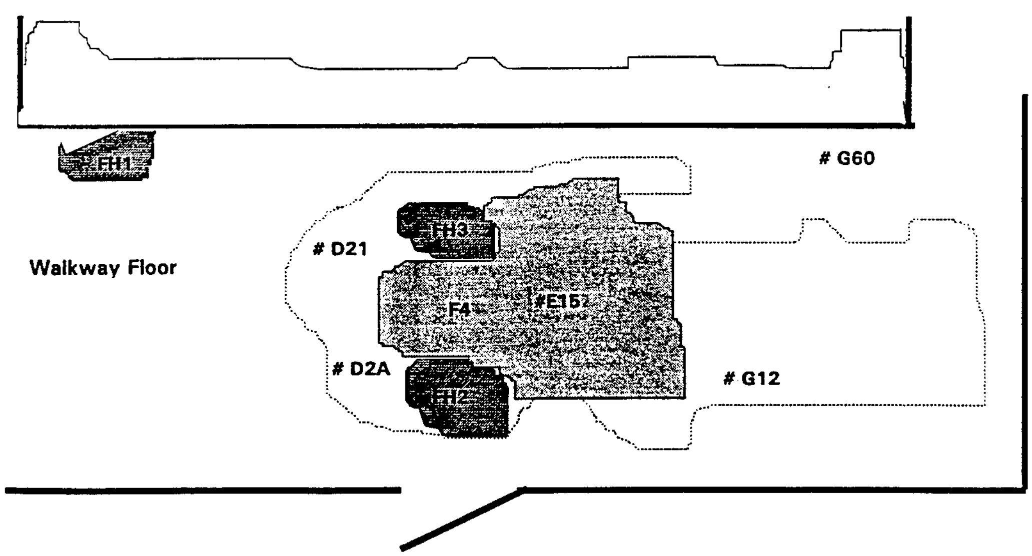

Figure 10. Distribution Of Contamination On R/A Laboratory Walkway

A hole approximately 10 cm x 10 cm x 2 cm deep was chipped in the concrete at one of the strongest 'hot spots" to estimate the depth of contamination. Readings at the bottom of the hole were an order of magnitude less than the surface readings but were still at least one order of magnitude above background. These results and the contamination pattern indicated the contamination was likely caused by a spill of a Strontium-90 liquid source on the concrete which was subsequently spread along the walkway, probably by people walking through the area. The liquid had penetrated the concrete to a depth greater than 2 cm. The total amount of contamination, estimated by summing the activity in each area for the total number of areas, was approximately 300 kBq [7]. The average contamination level over the affected walkway area was 3 Bq/cm^2, yielding a dose rate 0.5 m above the contaminated walkway of approximately 1 μSv/h, which exceeded regulatory criteria.

Fixed Contamination On Roof Of R/A Laboratory

Two separate contaminated areas, located underneath joints in the exterior fume hood trunking, were identified on the concrete roof of the R/A Laboratory vault , as shown schematically in Figure 11. The larger area encompassed approximately 1.8 m^2, while the smaller area covered approximately 0.12 m^2. Of 9 swipe samples taken in these areas, only one indicated the presence of loose contamination. This sample showed activity near the detection limit of the swipe counter and was well within regulatory limits for loose contamination.

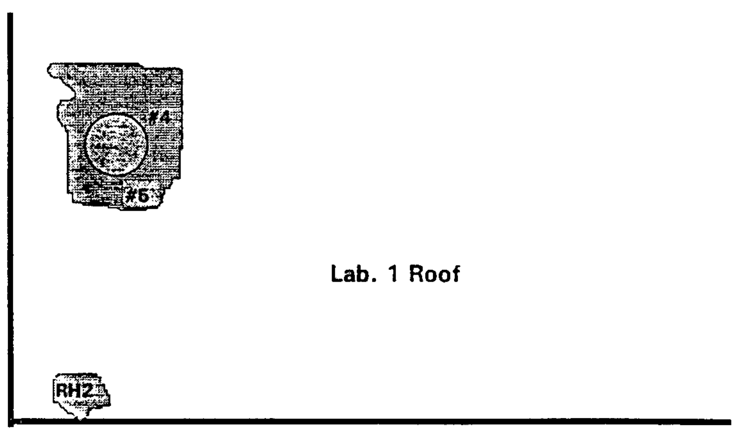

Figure 11. Distribution Of Contamination On R/A Laboratory Roof

The total activity for the larger contaminated area located under Trunk Section #9 was estimated [7] to be 2 kBq, with an average surface contamination of 0.06 Bq/cm^2. At a distance of 0.5 m, the corresponding dose rate was well below regulatory limits, indicating that there was no requirement to perform remedial decontamination in this case. For the smaller area located under Trunk Section #7, the total activity was estimated to be 100 Bq with an average surface contamination of 0.04 Bq/cm^2. The corresponding dose rate at 0.5 m was again within regulatory limits.

R/A Laboratory Decontamination

Following completion of the radiological survey, SAIC Canada was retained under DGNS Regional Individual Standing Offer contract to carry out the radiological decontamination of the R/A Laboratory. The work within the laboratory was carried out over a two week period in March 1996, whereas the exterior concrete surfaces were decontaminated in November 1996. Several activities were undertaken to prevent the spread of loose contamination and to prepare the vault area for decontamination. For example:

- all trunking material on the roof of the laboratory was sealed in plastic sheeting;
- all areas where radioactive contamination had been detected were marked;
- all contaminated waste material such as disposable coveralls, gloves and cleaning material were packaged, labelled and placed in waste drums for eventual removal and disposal.

The survey team also carried out decontamination work to remove the loose contamination from the fume hood trunking and the fixed contamination from the working surfaces of Fume Hoods A and B within the R/A Laboratory [8]. In the case of the trunking, this was accomplished by disconnecting individual sections and removing the accumulated contaminated dust in the trunking interior by dry brushing. Contaminated debris and cleaning materials were packaged and placed in appropriately labelled metal containers for subsequent removal and disposal. The working surfaces of the fume hoods were scrubbed with metal brushes and the scrapings/paint residues were also packaged for disposal in the same manner. On completion of this decontamination, only background levels of radiation were measured on the affected surfaces and no loose contamination above the detection limit of the swipe counter was detected on swipe samples. Thus, the final radiological decontamination of the R/A Laboratory had the following objectives [9]:

- to remove fixed contamination from the exterior concrete walkway and the concrete roof of the R/A Laboratory;
- to package and dispose of all contaminated waste in accordance with appropriate regulations, and
- to conduct a final survey of the decontaminated areas to certify that fixed and loose contamination levels were below regulatory limits.

Contamination Control

In accordance with their contamination control plan, SAIC Canada personnel implemented several contamination control measures to prevent the spread of contamination during the course of work. Some of these measures included [9]:

- providing monitoring and washing facilities;
- establishing a "clean/dirty" line with a single access control point to the contaminated area;
- providing expedient dust containment structures around localized contaminated areas, and
- conducting thorough surveys and decontamination of all equipment, personal protective clothing and material prior to leaving the contaminated area.

Personnel wore individual protective equipment consisting of full and/or half-face respirators, and disposable coveralls including hoods, gloves and boot coverings. The personnel also carried radiation survey equipment, individual dosimeters and wore hearing protection while operating concrete cutting equipment.

Concrete Walkway Decontamination

The fixed contamination on the floor of the concrete walkway outside of the R/A Laboratory vault centred around three "hot spots", designated as FH1, FH2 and FH3 in the schematic drawing in Figure 10. The walkway was completely isolated in accordance with the contamination control plan. Plastic sheeting was placed over all doorways leading to this area and a "clean/dirty" line was established, as shown in Figure 12.

Starting with the "hot spots", the concrete was first chiselled to an average depth of 2 cm, followed by conducting a radiological survey. The survey results indicated that the contamination had penetrated the concrete to a greater depth. For example, contamination was detected at depths exceeding 10 cm in the FH2 area. This was attributed to the possibility that a liquid spill containing Strontium-90 had penetrated a crack which ran across the area, as shown in Figure 13. The concrete was further chiselled away and surveys repeated until the contamination levels were reduced to background levels.

The fine concrete dust produced while chiselling was carefully collected with small brushes into dust pans. Damp disposable cloths were then used to wipe the entire area in order to remove the fine dust trapped in the rough surface of the decontaminated areas. All contaminated concrete rubble, dust and cloths were packaged as contaminated waste for disposal.

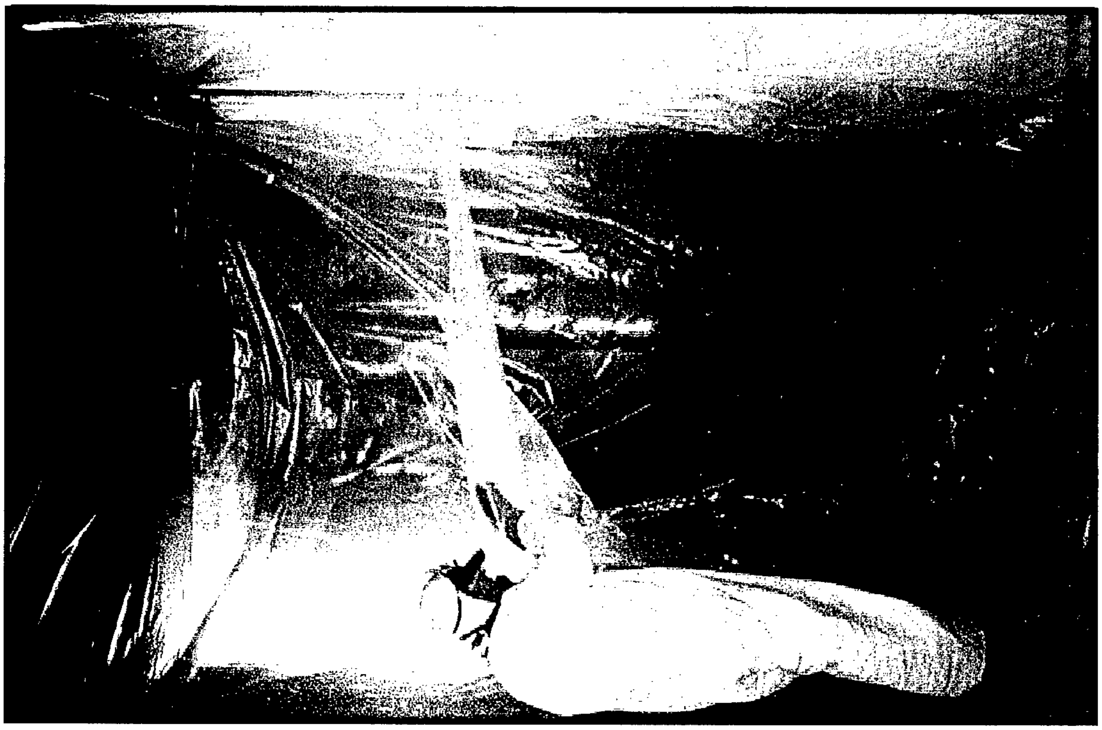

Figure 12. Contamination Control Plastic Sheeting And "Clean/Dirty" Line

Figure 13. Contaminated Walkway With Marked Hot Spots FH2 and FH3

R/A Laboratory Roof Decontamination

The concrete roof of the R/A Laboratory vault was decontaminated in the same manner as the walkway. As shown schematically in Figure 11, two separate areas located underneath the joints of the exterior fume hood trunking, designated RH1 and RH2, were identified for decontamination. As noted above, the fume hood trunking had been removed and decontaminated previously. Small dust containment huts were constructed and placed around the contaminated areas to completely isolate these areas. All decontamination work was then carried out inside these huts, as shown in Figure 14.

The work on area RH2 centred around a steel-lined access hatch located in the R/A Laboratory roof. Fixed contamination was detected between the liner and the concrete. This area was thoroughly decontaminated by carefully scrubbing with steel brushes and wiping the inside of the liner and the space between the liner and concrete, as shown in Figure 15. Fine dust trapped in the rough surface of decontaminated areas, around the steel liner and inside the containment huts was carefully collected using damp cloths. Decontamination work continued until the contamination levels were reduced to background levels.

Radiological Certification

The contaminated areas on the walkway and laboratory roof were surveyed and swipe samples taken at three different stages during the decontamination work. The purpose of the first survey was to accurately define the contaminated areas and confirm the contamination levels reported earlier [7]. The second survey was intended to determine whether loose and/or airborne contamination had been produced by the decontamination work. Upon completion of all decontamination work, a final survey was conducted to confirm the absence of fixed and loose contamination. A comparison of the survey results, using the Berthold Area Contamination Meter equipped with a beta/gamma counting tube, are given [9] in Table V. In general, the contamination levels detected during the first survey were in good agreement to those detected in the same areas during an earlier survey [7]. The complete survey results are given in Reference 9.

A total of 81 swipe samples was taken in the R/A Laboratory walkway and roof contaminated areas. None of these samples indicated the presence of loose contamination above the detection limit of the swipe counter [9].

In general, the final survey results indicated that the decontamination work was successful and that all fixed contamination in the walkway concrete and the laboratory roof had been reduced to background levels. No areas of fixed or loose contamination were identified above the detection limit of the radiological survey instruments. Based on these results, the swipe sample results, and the results of previous surveys, the Building 12 R/A Laboratory was certified as having no fixed or loose radiological contamination which exceeded regulatory criteria [9]. An estimate of the total activity removed from the concrete by the decontamination work is given in Table VI.

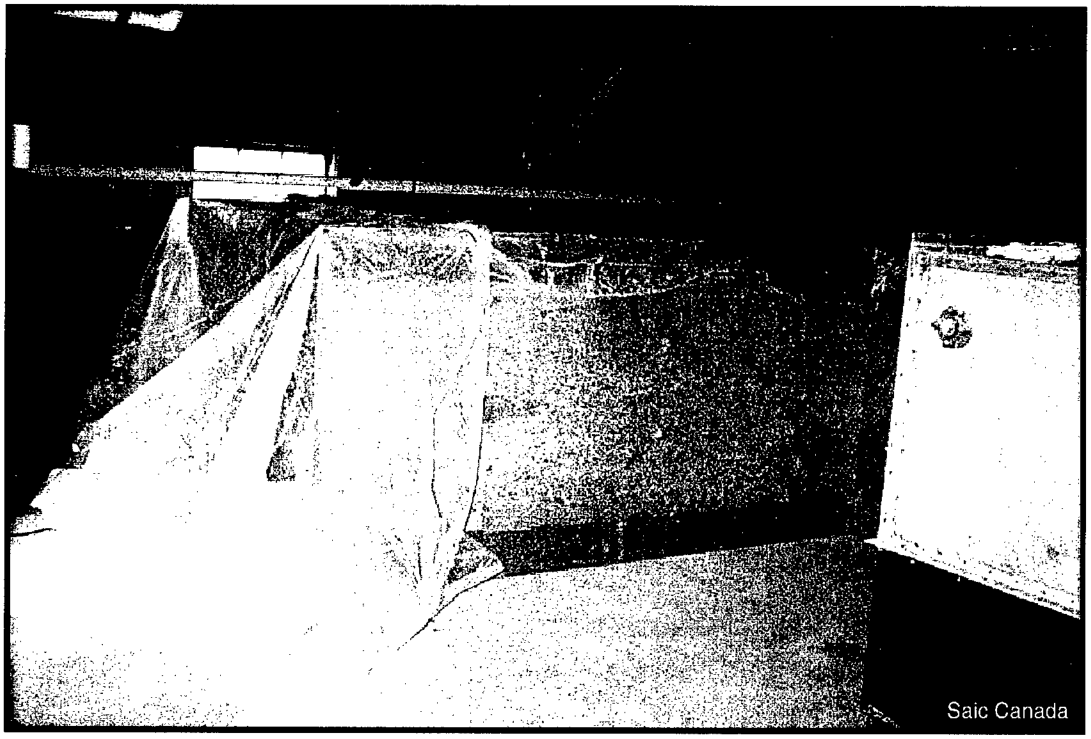

Figure 14. Contamination Control Using A Dust Containment Hut

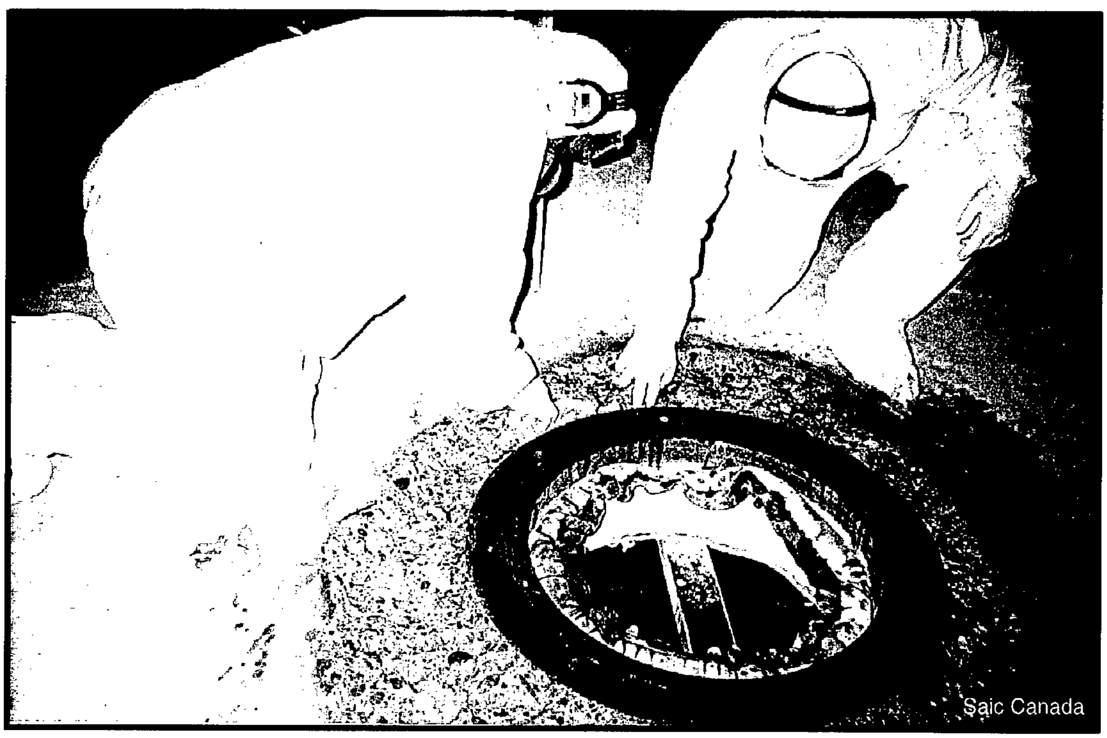

Figure 15. Decontamination Of R/A Laboratory Roof Access Hatch and Liner

TABLE V
BERTHOLD ACM SURVEY RESULTS COMPARISON

AREAS SURVEYED	CONTAMINATION LEVEL (cps)[1]		
	FIRST SURVEY	SECOND SURVEY	FINAL SURVEY
Walkway - FH1	79.0	15.2	17.5
Walkway - FH2	803.0	23.9	17.2
Walkway - FH3	1007.0	59.0	17.5
Walkway Floor	43.7	43.7[2]	17.5
Lab Roof - RH1	60.0	15.8	15.6
Lab Roof - RH2	55.0	49.7[3]	15.9
ACM Detection Rate	18.4	17.9	18.2

[1] Readings taken with a Berthold Area Contamination Meter equipped with a beta/gamma counting tube. All readings taken while the meter was in contact with the concrete surface.

[2] Reading taken prior to decontamination of the walkway floor area (F4).

[3] Reading taken prior to decontamination of the roof area (RH2).

TABLE VI
ESTIMATE OF CONTAMINATION REMOVED

AREAS SURVEYED	SURFACE AREA (m^3)	MAX. NET COUNT (cps)	ESTIMATED ACTIVITY (kBq)
Walkway - FH1	0.13	65.0	57.46
Walkway - FH2	0.12	789.0	643.82
Walkway - FH3	0.05	993.0	337.62
Walkway Floor	0.18	29.7	36.35
Lab Roof - RH-1	0.90	46.0	281.52
Lab Roof - RH-2	0.05	77.0	26.18
Total:	1.43	-	1382.95

Waste Characterization

The solid waste accumulated during the decontamination work included contaminated concrete, cleaning tools and protective clothing. This waste, with a total volume of approximately 0.36 m^3, was contained in two 205 L drums. All pieces of removed concrete were first surveyed, as shown in Figure 16. Contaminated pieces were placed in the two drums while "clean" pieces were released as normal waste for disposal. At the completion of work, one drum was filled to capacity while the second drum was 80% full. The total weight of the waste was: drum 1:- 375.4 kg, drum 2:- 301.7 kg.

Ten swipe samples were taken on the exterior surfaces of the two waste drums to determine whether loose contamination was present. None of the samples indicated the presence of loose contamination above the detection limit of the swipe counter [9].

The total activity of the contaminated waste within the two drums was estimated [9] as shown in Table VII. The values were based on conservative assumptions related to instrument counting efficiency and assuming a concrete density of 2300 kg/m^3, an average void fraction of 20% in each container and a total concrete mass of 677.1 kg.

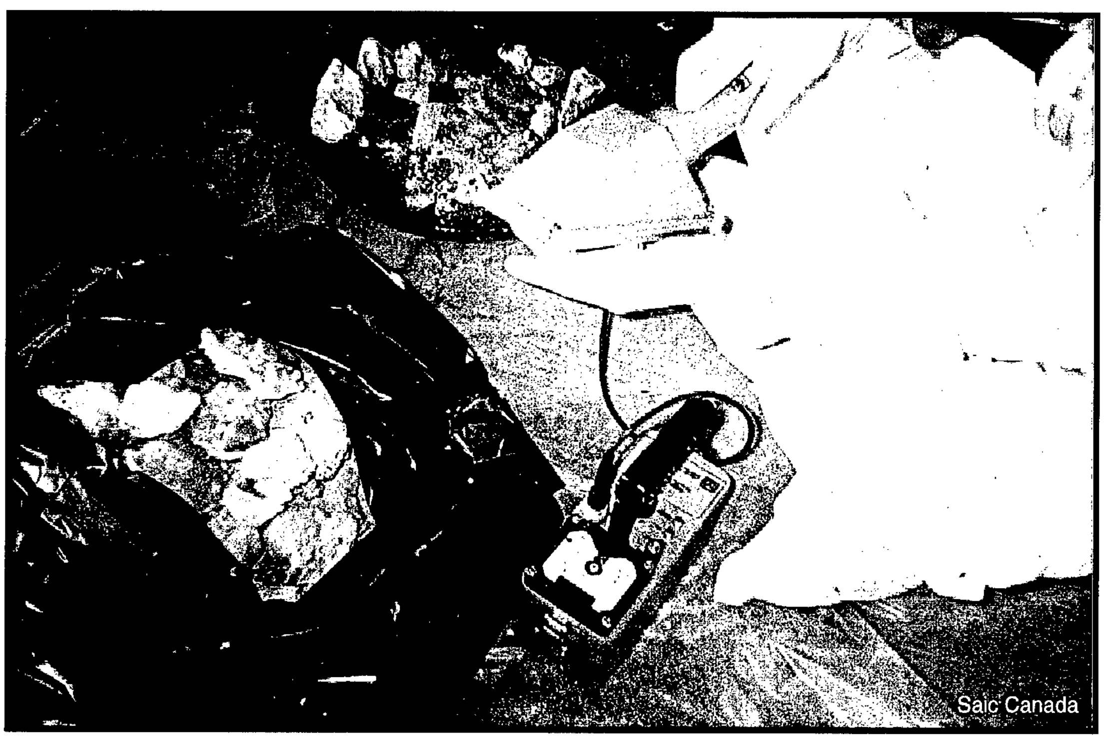

Figure 16. Radiological Survey of Removed Concrete

TABLE VII
CONTAMINATED WASTE CHARACTERIZATION

CONTAINER	VOLUME (m^3)	MASS (kg)	TOTAL ACTIVITY (kBq)	SPECIFIC ACTIVITY (kBq/kg)
Drum #1	0.204	375.4	730.0	1.94
Drum #2	0.164	301.7	653.0	2.16
Total:	0.364	677.1	1383.0	2.05[1]

[1] Mean value of specific activity for the two drums.

The total activity estimated for the waste drums (Table VII) was in close agreement with the total activity estimated for the removed contamination (Table VI).

In accordance with AECB regulations [10] and subject to certain conditions, solid radioactive material may be disposed of in municipal landfill sites at concentrations up to one Scheduled Quantity (SQ) per kilogram for fixed contamination. The SQ for Strontium-90 is 3.7 kBq. As indicated in Table VII, the specific activity of the contaminated waste in each of the drums was less than the release limit for Strontium-90 and the drums therefore qualified for disposal as non-hazardous waste in a standard landfill. The estimated specific activity of the waste was based on conservative assumptions; thus, the actual activity was expected to be even further below the Strontium-90 SQ release criteria. Thus, the drums were removed and disposed of as non-hazardous waste in the CFB Suffield landfill.

Lead Removal

Public Works Government Services Canada (PWGSC)/Edmonton issued a Request For Proposal in December 1995 for the sale and removal of the lead lining in the Building 12 vaults. In accordance with the Request For Proposal, any residual profits remaining from the sale of the lead sheet, after contractor extraction costs and profit had been accounted for, were returned to DRES in the form of technical services of equivalent value. That is, the sale of the lead material itself covered the costs of removing the lead from the building vaults.

A technically-acceptable proposal was received subsequently from SAIC Canada whereby the contractor proposed to combine the lead removal and complete the R/A Laboratory decontamination (see above) as one project. SAIC Canada sub-contracted the lead removal operation to Lambco Industries of Edmonton. The lead was removed from all vaults, including accessible areas of the R/A Laboratory, during February 1996.

The lead sheeting on the walls and floor of each vault were cut into 1 m x 1 m sections using a mechanical chisel, as shown in Figure 17. These smaller sheets were then rolled up (see Figure 18), removed manually from the vaults, unrolled and placed on wooden pallets as flat sheets. As shown in Figure 19, each pallet contained up to twenty sheets when fully loaded for transport. The lead sheets at the wall-mounting points were cut after removing the lead cap over the wooden strip to which the lead sheets had been press fitted, as shown in Figure 20. The ceiling sheets were cut flush to the joint between the wall and ceiling, as shown in Figure 21, leaving a small strip of lead underneath the concrete where the vault ceiling had been placed on top of the walls during construction. In the case of the vault with restricted access, a hole was cut out of the side of the vault at ground level to allow workers to enter the vault and remove lead sheet, as shown in Figure 22.

The removed lead (approximately 80 tonnes total) was sold subsequently to a smelter where the sheets were re-melted into ingots which were suitable for use as feedstock for the manufacture of lead products. One lot (0.7 tonnes) of lead sheet cut-outs was supplied to the Royal Military College, Kingston, Ontario for equipment shielding applications.

Figure 17. Cutting Lead Sheet With A Mechanical Chisel

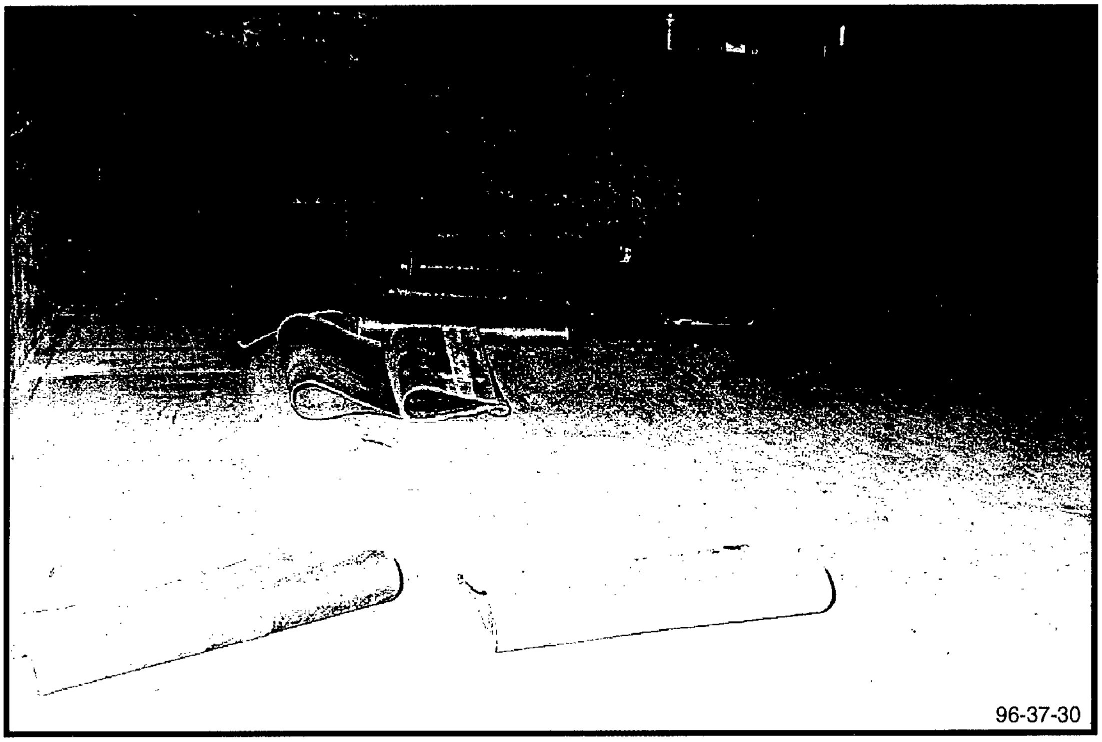

Figure 18. Rolled Up Lead Sheets

Figure 19. Pallets Loaded With Lead Sheets

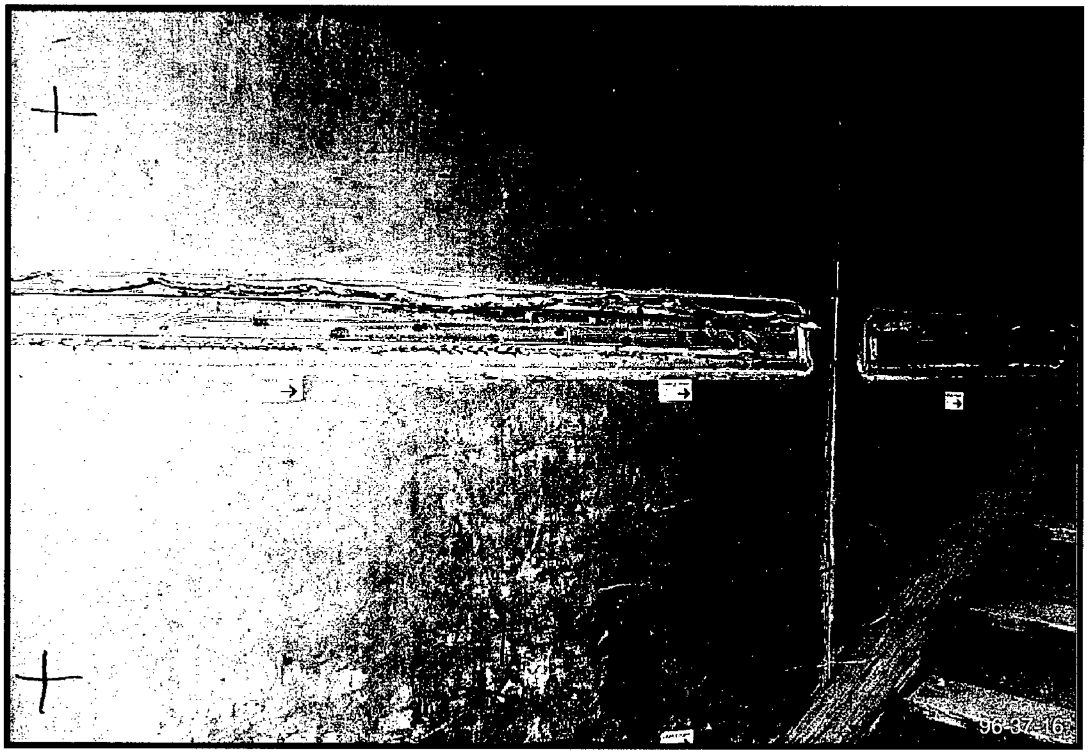

Figure 20. Removal Of Wall Mounting Strip

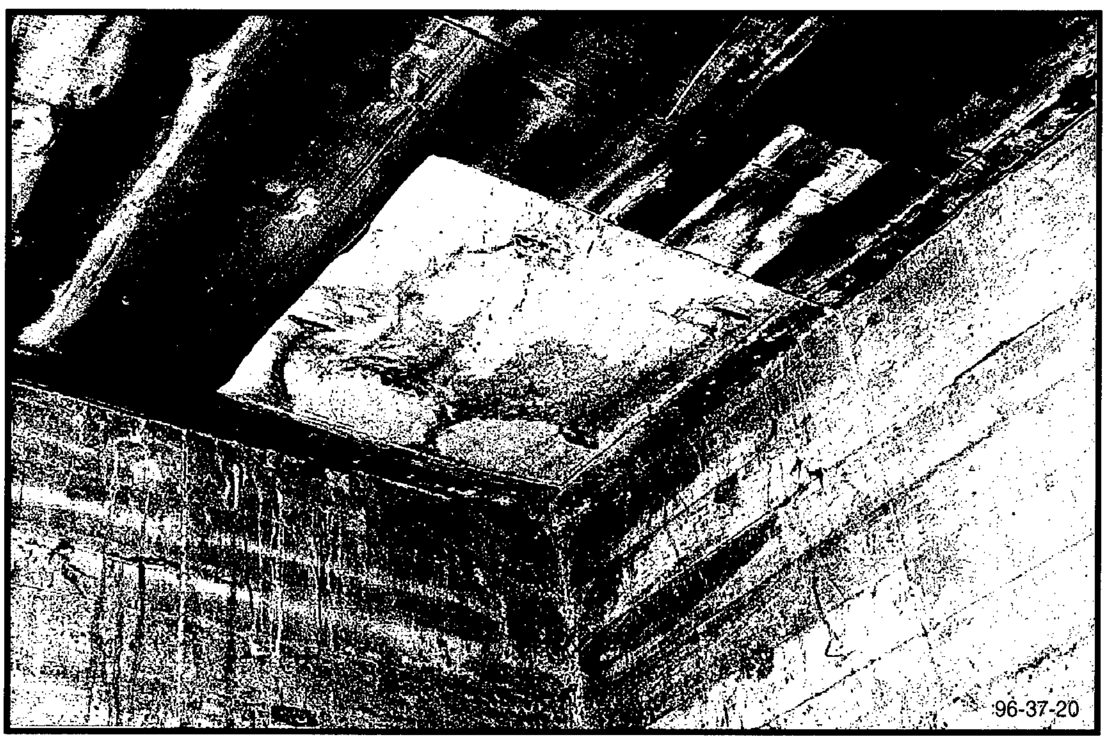

Figure 21. Cutting Ceiling-Mounted Lead Sheets

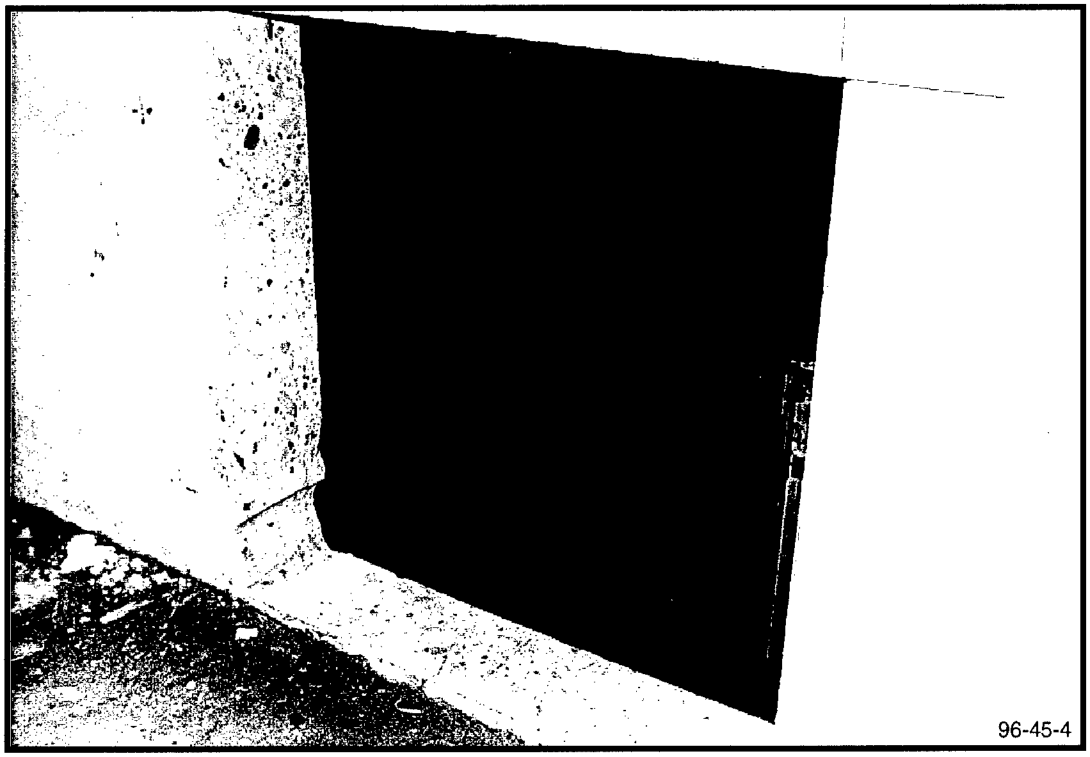

Figure 22. Access Hole To Central Vault

Technical Services

The sale of the lead sheets (at approximately $0.33/pound), after accounting for contractor expenses and profit, yielded a surplus of approximately $13K for conversion to technical services of equivalent value. At DRES request, SAIC Canada subsequently performed the following services, using this surplus as payment:

- several radioactive sources no longer needed for laboratory research purposes were packaged and shipped to AECL, Chalk River, for disposal;
- additional field trial support was provided by SAIC Canada in conjunction with a DRES R/D project in countermine technology.

Certification

Before turning Building 12 over to the CFB Suffield Base Engineering Branch for demolition, several surveys were conducted in and around the structure to determine levels of residual contamination, if any. For example:

- Surveys were conducted throughout Building 12 with portable Chemical Agent Monitors. These surveys showed no responses in either the G- or H-mode. This indicated that chemical agent contamination, if any, was below physiological harmful levels and that demolition operations could proceed without the requirement for chemical protective equipment. Residual agent contamination, especially nerve agent contamination, was not expected, given agent volatility and length of time since the R/A Laboratory was used for agent synthesis;

- As described above, radiological surveys conducted by SAIC Canada during decontamination operations confirmed that any radiological contamination within the building had been reduced to acceptable, safe levels for human exposure. A memorandum was issued by DGNS to CFB Suffield indicating the Building 12 radiological decontamination was acceptable and that demolition of the building could now be undertaken.

- Soil samples were taken around Building 12 as part of a separate ecological risk assessment study involving potentially contaminated sites at CFB Suffield. No chemical agents (mustard) or radiological contaminants were detected, although some samples taken north of the building itself showed elevated levels of thiodiglycol (mustard hydrolysis product) and 1,4-dithiane (mustard degradation product). These results indicated there may be potential soil contamination problems associated with an old mustard spill which apparently occurred near some buried vats containing hydrolysed mustard sludge.

- A small number of swabs were taken of concrete surfaces in the area where pesticides had been stored. These swabs showed less than 1 ppm DDT content, indicating decontamination of this storage area was not necessary.

Demolition

Building 12 was transferred to the CFB Suffield Base Engineering Branch for demolition following the completion of the radiological decontamination operations. This demolition will be carried out in the near future as part of the Base modernization program. The following activities will be carried out:

- all electrical, gas and water utilities will be disconnected and removed from the building;

- the building superstructure will be demolished and any remaining structural materials will be placed in the CFB Suffield construction landfill;

- depending on available funding, a) the vaults will be sealed up and left in place, or b) the vault roofs will be collapsed into the vaults using explosive demolition techniques. Any other concrete rubble will also be placed in the vaults. The dismantled R/A Laboratory fume hoods will be left in the R/A Laboratory vault;

- if the vault roofs are collapsed, then the vault walls will be demolished to the level of the building concrete base and the vaults filled in with soil. The base itself will be covered with approximately 1 m of soil.

- The site will be allowed to reseed naturally with native grasses.

DISCUSSION

The construction of Building 12 and its history of use required that a systematic approach be adopted for decontaminating and decommissioning this building. This process required several years to complete and involved many organizations, including DRES, CFB Suffield, Public Works/Government Services Canada, Crown Assets Distribution Centre and several contractors. Other agencies, such as the Atomic Energy Control Board and the DND/Director General Nuclear Safety, became involved during contract work to decontaminate and remove radiological materials from the building. All agencies worked well together to remove the contaminants in a safe, environmentally-acceptable manner. Building 12 has now been rendered safe for demolition. Additional remedial work will be required around the Building 12 site; for example, the old, buried mustard vats located to the north of the building may pose an environmental hazard. Remediation of these vats will be undertaken in the future.

A unique feature of the decommissioning process was the use of building materials, specifically the vault lead linings, to cover certain costs and to provide DRES with additional technical services. The lead linings were manufactured before 1945 (before atomic weapons testing) and were thus "cleaner" with respect to atmospheric radiological contaminants compared to lead products manufactured later. This made the lead suitable for use, for example, as high quality shielding material for sensitive radiological equipment. Efforts were made to find buyers (other than scrap mills) for the lead, including nuclear research facilities (AECL), cancer treatment facilities and architects associated with constructing such facilities. However, a buyer could not be found and thus this favourable intrinsic property was lost when the lead was sold to a scrap mill and re-melted into ingots.

CFB Suffield will accrue savings in operations and maintenance costs with the removal of Building 12 from the Base facilities inventory. These savings can be applied to the Base modernization program and development of new facilities.

REFERENCES

1. Final Report Volume 1. Inventory Of Radioactive Material, Defence Research Establishment Suffield. Acres International, January 1991.

2. Final Report Volume 2. Selection Of Alternatives For Decommissioning Low Level Radioactive Waste Vault at Defence Research Establishment Suffield. Acres International P09987.00, December 1991.

3. Final Report. Defence Research Establishment Suffield Low Level Radioactive Waste Disposal. Canatom Inc. Radioactive Waste Services Division Report CRWS 6500-05 Rev. 1, 11 April, 1994.

4. R.M. Duncan, AECB Directorate of Fuel Cycle and Materials Regulation letter 37-1-0-0 (DRES Waste Management Facility), dated 8 August 1994.

5. DND Environmental Assessment Manual (interim), A-LM-007-009/AX-000, 2 October 1991.

6. SAIC Canada Report: Master Plan For Radiological Decommissioning, Version 2.1. January 1995.

7. SAIC Canada Report: Phase II Radiological Decommissioning, Lab 1, Building 12 DRES, CFB Suffield, SSC 310ZE.W8462-3-FB38, dated 11 May 1995.

8. SAIC Canada Report: Phase III Radiological Decommissioning , Lab 1, Building 12 DRES, CFB Suffield, SSC 310ZE.W8462-3-FB38, dated June 1996.

9. SAIC Canada Report: Phase III Radiological Decommissioning, Lab 1, Building 12 DRES, CFB Suffield. Concrete Decontamination. SSC 310ZE.W8462-3-FB38, dated 18 December 1996.

10. Atomic Energy Control Regulations, Atomic Energy Control Board, Schedule 1, Part 1, p. 27.

ANNEX A

ENVIRONMENTAL IMPACT ASSESSMENT BUILDING 12 DECOMMISSIONING PROJECT

DND PROJECT REGISTRATION AND EARP DECISION FORM

1. Base/Station	2. Command	3. Province/Territory
DRES	CRAD	ALBERTA
4. Project No. (if applicable)	5. DSP No. (if applicable)	6. Serial No. (if applicable)
EP FY 95/96		

7. Location

DEFENCE RESEARCH ESTABLISHMENT SUFFIELD

8. Project Title

DRES BUILDING 12 DECOMMISSIONING

9. Study Conducted

- [X] Initial Screening - Using Class Assessment
- [ ] Initial Environmental Evaluation (IEE)
- [ ] Environmental Impact Statement (EIS)

Yes [ ]
No [X]

10. Assessment Decision

- [ ] Code 1 - Automatic Exclusion (Proceed) - Exclusion List Item No: [ ]
- [ ] Code 2 - Insignificant Adverse Effects (Proceed)
- [X] Code 3 - Adverse Effects Mitigable (Proceed)
- [ ] Code 4 - Effects Unknown (IEE Required)
- [ ] Code 5 - Mitigation Unknown (IEE Required)
- [ ] Code 6 - Significant Adverse Effects (Panel Review Required)
- [ ] Code 7 - Significant Public Concern (Panel Review Required)
- [ ] Code 8 - Automatic Referral (Panel Review Required)
- [ ] Code 9 - Unacceptable Effects (Project Abandoned)

11. OPI (Directorate/Branch/Unit/Section)

	Name, Rank, Position	Phone No.	Date
Recommended by (Screening Officer)	J. M. McAndless (signature) John M. McAndless Est. Envir. O.	(403) 544-4635	October '94
Approved by (CO/SSO/Director)	Bryan G. Laidlaw Director/Program Support	(403) 544-4659	OCTOBER '94

(This form may be reproduced locally)

DND ENVIRONMENTAL SCREENING FORM

(This Form must be accompanied by Registration and Decision Form)

12. PROJECT DESCRIPTION

General

The project consists of decommissioning and demolishing an obsolete building that contains underground storage vaults and a laboratory (R/A Laboratory). The storage vaults are empty but contain recoverable lead lining of pre-atomic testing vintage. Prior to demolition, the laboratory requires surveying for residual radioactivity, decontaminating radioactively-contaminated surfaces, removing and transporting radioactively-contaminated materials to AECL/Chalk River for disposal and certifying the laboratory decontaminated for decommissioning purposes.

Project Rationale

As part of the CFB Suffield facilities upgrade, DRES Building 12 and the R/A Laboratory and storage vaults contained therein are scheduled for decommissioning and demolition. The R/A Laboratory cannot be decommissioned until proper decontamination of residual radioactivity is carried out.

Activities

Remove all stored equipment and library journals from Building 12.
Sell and remove vault lead lining through Crown Assets.
Under contract, conduct a full survey in and around the R/A Laboratory to determin the extent of radioactive contamination. Decontaminate surface contamination where possible. Remove, package and transport radioactively-contaminated materials to AECL/Chalk River for disposal. Certify the R/A Laboratory meets accepted release criteria for decommissioning and demolition.
Remove Building 12 superstructure.
Demolish and bury the vaults and laboratory in-situ.
Restore the site to grade level.

13. DESCRIPTION OF EXISTING ENVIRONMENT

Location

CFB Suffield Magazine Area, DRES Building 12 Complex.

Zoning & Present Use

DND Federal Land Reserve. The DRES Building 12 Complex is a secured, fenced area located in the Magazine Area on the perimeter of the CFB Suffield Base Administration area. The Building 12 Complex is currently used for the general storage of surplus equipment.

General Description

Building 12 is an obsolete World War II-vintage wood-frame structure. The building houses four lead-lined concrete vaults located partially underground. Two of the vaults have been combined and a laboratory equipped with fume hoods constructed within.

Valued Ecosystem Components (VECs)

Atmospheric emissions/noise
Worker Health and Safety

14. SOURCES OF INFORMATION USED

Literature Consulted DND Environmental Assessment Review Process Manual (interim) Canatom Inc. Final Report Contract W7702-3-0376. DRES Low-Level Radioactive Waste Disposal AECB Waste Facilities Operating Licence WFOL-307-6 CFAO 36-50 Environmental Protection Management CFAO 36-55 Hazardous Materials Management DRES Environmental Audit Final Report Feb 92 (Acres International)
Consultations Establishment Radiation Safety Officer/DRES Head/Field Operations Section/DRES Director/Program Support Division/DRES Base Environmental Officer/CFB Suffield Canatom Inc.
Site Visits Building 12 Complex is visited frequently by DRES staff during the normal course of duties.
Maps and Drawings National Defence Mapping and Charting Branch, CFB Suffield Map MCE 142W TR78, Edition 7 1:50,000 P09196.01 MR Magazine Area DND Environmental Audit of DRES Report Figure 6
Public Meetings None required
Other

15. SCREENING MATRIX

Attached?	☒ Yes ☐ No

16. DESCRIPTION OF POTENTIAL IMPACTS

(Use additional sheets if necessary)

1. Description: Decontamination of radioactive surfaces within and around the R/A Laboratory could produce atmospheric emissions in the form of radioactive particulates or dust.

Significance: Not significant. Small amounts of contamination are localized within a laboratory which is designed as a containment facility. Techniques such as filtered vacuums will be used to collect any loose contamination. Fixed contamination can be removed from equipment and material without producing radioactive dust.

2. Description: Worker exposure to radioactive sources could produce adverse short-term and long-term health risks.

Significance: Not significant. Previous surveys of the R/A laboratory have shown radioactivity levels to be relatively low and localized. Long term continuous exposure would be required to create potential health effects. Workers wear appropriate protective equipment (oral/nasal masks) and employ accepted personnel decontamination methods when working in proximity to radioactively-contaminated materials.

3. Description: Operations such as packaging, removal and transportation of radioactively-contaminated material are Code 1 automatic exclusions. Hazardous materials are removed and disposed of in accordance with guidelines and regulations. The disposal of such material is through approved carriers to approved facilities (AECL Chalk River).

Significance: no environmental assessment required

4. Description: Removal of lead lining from vaults could create lead fumes and dust.

Significance: Exposure of unprotected personnel to lead fumes and particulates can cause adverse long term health effects. Lack of contamination control may cause spread of lead contamination and secondary exposures.

5. Description: Demolition of building superstructure and concrete vaults may create dust and noise above ambient levels.

Significance: Not significant. Building 12 is located in a secure compound remote from the main Base Administration Area. Personnel in the Magazine Area nearby normally work indoors where sound attenuation is effective. Most noise will be of short duration and transient in nature.

6. Description

Significance

7. Description

Significance

17. MITIGATION AND MONITORING

(Use additional sheets if necessary)

1. Self-contained vacuuming equipment is used to contain loose contamination. Radiation survey instruments are used to continually monitor for ambient radiation levels.
2. Radiation survey instruments and personnel thermoluminescent dosimeters are employed to continuously monitor worker exposure to radioactive sources. Personnel wear protective clothing and oral-nasal masks to prevent direct skin exposure or ingestion of radioactive particulates.
3. None required.
4. Lead removal takes place indoors with plastic sheeting and industrial containment procedures employed similar to those used to prevent radioactive contamination spread. Workers wear protective clothing, respiratory protection, and undergo decontamination after each work shift in accordance with industrial safety standards.
5. If necessary, site workers wear ear hearing protection and oral-nasal masks to prevent ingestion of concrete dust.
6.

18. CONCLUSIONS

This project may proceed as a Code 3 project. There are no significant environmental impacts and any adverse health risks can be fully mitigated with known procedures and protective equipment.

DND ENVIRONMENTAL SCREENING MATRIX #1

PROJECT TYPE
GENERIC

PROJECT TITLE
B12 Decommissioning

ACTIVITIES	ENVIRONMENTAL COMPONENTS														
	PHYSICAL					BIOLOGICAL					SOCIAL				
	Atmosphere/Noise	Soils	Terrain	Surface Water	Ground Water	Terrestrial Habitat	Terrestrial Animals	Aquatic Habitat	Aquatic Animals	Vegetation	Land Use/Heritage	Recreation/Aesthetics	People/Health	Economy	Services
R/A Lab contamination survey													▲		
R/A Lab decontamination	X												▲		
Radwaste removal and disposal															
Vault lead removal	X												▲		
Vault and R/A Lab demolition	X														
Building superstructure removal	X														
Site restoration	X		►												

LEGEND

- ☐ No impact
- / Potential impact (unknown significance)
- X Not Significant
- ► Improvement
- ◄ Significant impact (unknown mitigation)
- ▲ Impact Mitigable
- ▼ Significant Non-Mitigable Impact
- ■ Unacceptable impact
- 0 Impact with Significant Public Concern

(See Reverse for instructions)

POTENTIAL ISSUES
1. Atmospheric Emissions
2. Worker Health and Safety
3. Noise
4.
5.
6.
7.
8.
9.
10.
(Use additional sheets if necessary)

(Reproduce Locally)

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THE DECOMMISSIONING OF DRES BUILDING 12

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McANDLESS, JOHN M., and COLE, DAVID

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THIS REPORT DESCRIBES THE SYSTEMATIC APPROACH TO DECONTAMINATING AND DECOMMISSIONING DRES BUILDING 12, AN OBSOLETE STUCTURE CONTAINING UNDERGROUND LEAD-LINED CONCRETE VAULTS AND A CHEMICAL LABORATORY FACILITY. THIS BUILDING HAD BEEN USED SINCE WORLD WAR II FOR A VARIETY OF PURPOSES SUCH AS THE STORAGE OF RADIOACTIVE AND PESTICIDE WASTES, THE SYNTHESIS OF RADIOACTIVE CHEMICAL WARFARE AGENTS FOR RESEARCH PURPOSES AND AS A SITE FOR TRAINING cANADIAN FORCES PERSONNEL IN NUCLEAR, CHEMICAL AND BIOLOGICAL EMERGENCY RESPONSE.

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MILITARY FACILITIES
DECONTAMINATION
DECOMMISSIONING
MILITARY CHEMICAL AGENTS
RADIOACTIVE WASTES
PESTICIDES
HAZARDOUS MATERIALS
WASTE DISPOSAL
LEAD MATERIALS