



United States Department of the Interior

BUREAU OF MINES
2401 E STREET, NW.
WASHINGTON, D.C. 20241

February 21, 1984

Mr. David H. Tiktinsky
Project Manager M.S. 697-SS
High Level Waste Branch-MMSS
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

WM Record File
B-6934

VIA Project: 10, 11, 16
Docket No. _____

PDR
LPDR B, N, S

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(Return to WM, 623-SS)	<u>15</u>

Dear Mr. Tiktinsky:

Enclosed for processing is a project proposal aimed at applying Bureau developed technology to clean air of radioactive aerosols in the ventilation system of an underground nuclear waste disposal facility. Could this project, if you like, be funded from Account Number 7134 set up in the Bureau's headquarters? If funded, we could begin this fiscal year and complete the work in FY 1985.

As requested, we have also enclosed the latest quarterly and monthly reports which have already been sent to Cindy Fleenor in accordance with interagency agreement number NRC-02-80-075.

Sincerely,

Earle B. Amey

Earle B. Amey
Division of Health and Safety
Technology

Enclosures

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WM DOCKET CONTROL
CENTER

8411080077
84/02/21

PROJECT PROPOSAL

FY 1985

Center Number:
Date Submitted:
Originator:

Project Title: Air Cleaning for an Underground Nuclear Waste Storage Facility
 Program: Not applicable
 Program Element: Not applicable
 Subelement: Not applicable
 Research Center: Denver Research Supervisor: J. Condon
 Group Supervisor: R.F. Drouillard Principal Investigator: W. Stroud

Start Date: March 1984

Completion Date: March 1985

Funding

	Prior	FY85	FY86	FY87
In-house:	0	107,000	0	0
Contract:	0		0	0
Total:	0	107,000	0	0

Estimated Total Cost from Start to Completion:

Personnel Requirements

	<u>FY85 Person Years</u>	<u>FY86 Person Years</u>
Professional	(0.58)	(0.42)
Technical	(0.29)	(0.21)
Clerical	(0.05)	(0.05)

Indicate Major Equipment or Facilities Required (In-House) (Either available or to be purchased)

Estimated New Major-Equipment Cost (FY85)

- | | |
|---|-----------|
| 1. Twilight Mine Radiation Facility | Available |
| 2. Prototype air cleaner w/10,000 CFM fan | Available |
| 3. Ionizing radiation monitoring system | Available |
| 4. Condensation nucleus counter and diffusion battery | Available |
| 5. Aerosol particle size analysis system | \$13,000 |

PURPOSE

To investigate the application of Bureau developed technology in air cleaning to the control of radioactive aerosols in the ventilation system of an underground nuclear waste disposal facility.

BACKGROUND

- (a) Problem Significance - Federal standards for a facility handling radioactive material limit the amount of this material that can be discharged from a site. This would include airborne radioactive material transported from an underground facility by the ventilation system. The material can be introduced into the ventilation system as a result of container damage during storage operations.
- (b) Status of Current Technology - The Bureau of Mines has spent several years of in-house and contract effort in the development of an air cleaning system for removal of radioactive aerosols from underground uranium mine atmospheres [1]. Basic requirements for this system called for (1) a relatively low cost filter media with a long useful filter life, (2) an efficiency of at least 90% for the removal of radioactive aerosols and, (3) a low pressure drop across the filter elements [2]. HEPA filters have very high removal efficiency but fail to meet the other requirements [3]. A prototype air cleaning system has been developed that met the aforementioned needs [2]. Test results of this system in the Bureau's Twilight Mine radiation facility and in an active uranium mine showed a removal efficiency for radioactive aerosols in excess of 95%. In addition, there was no appreciable permanent filter loading in a mine environment with high levels of diesel smoke and rock dust over a test period of six months. Air flow rates through the system were around 10,000 ft /min.
- (c) Need for Research by the Bureau - Although the prototype air cleaning system is considered ready for use in the uranium mining industry, it needs additional work to fully evaluate the removal mechanism before it can be considered for use in a nuclear waste disposal facility. The Bureau of Mines has the test facilities and the experience needed to perform this project. Funding would have to come from other government agencies.

TECHNICAL APPROACH

The proposed research would be concentrated on the performance of the filter media in removing aerosols covering the size spectrum likely to be encountered in an underground atmosphere. The filter media used in the air cleaning system developed for the Bureau of Mines is designed to perform primarily as a surface collector rather than as a depth filter. Such a design lends itself to reversed-flow pulsed-air cleaning and improved filter life. Tests show that this filter media performs well on aerosols within the size range that radon daughters are encountered, but there is no information on the actual mechanism of collection. In addition, there is inadequate information on the performance of the filter media over the aerosol size range that would likely be encountered in an underground waste disposal atmosphere. To study

these filter characteristics, the prototype air cleaning system would be re-installed in the Twilight Mine and research conducted using known aerosol sizes and radioactive material that is inherent in a uranium mine.

ANTICIPATED BENEFITS

The expected benefits would be an air cleaning system with a filter media having high removal efficiency, low resistance to air flow and long useful life in an underground environment.

RESEARCH OBJECTIVES

Specific research objective are:

- 1.0 Determine the filter media's removal efficiency in the aerosol size range below 0.5 micrometers.
- 2.0 Investigate the filtering mechanisms for the filter media over the aerosol size range of 10 micrometers down to 0.001 micrometers [4].
- 3.0 Investigate the effectiveness of the filter's pulsed air cleaning system over the total size range of aerosols likely to be encountered in an underground atmosphere.
- 4.0 Determine filter media useful life expectancy with aerosol mass concentration likely to be encountered in an underground environment without mining activities.

RESEARCH PLAN

The research plan for this project consists of 6 main tasks to be completed in a period of 12 months. These tasks are outlined below.

Task 1.0 - Re-install the prototype air cleaning system in the Bureau's Twilight Mine facility.

Sub-task (a) - Fabricate transitions and install the vane-axial fan and the filter element housing at the air cleaning site in the mine.

Sub-task (b) - Install instrumentation needed for monitoring radioactivity, pressures, air flow rates and environmental conditions.

Sub-task (c) - Prepare and test dust generating system.

Sub-task (d) - Make necessary equipment purchases. Proposed duration of Task 1.0: 3.5 months.

Task 2.0 - Determine filter media's removal efficiency for aerosol sizes below 0.5 micrometer.

Sub-task (a) - Generate an aerosol with a useful amount of particles below 1 micrometers in diameter (diesel smoke and dust).

Sub-task (b) - Make particle size measurements using appropriate instrumentation [5] above and below the filter elements.

Proposed duration of Task 2.0: 1.0 month

Task 3.0 - Investigate the filtering mechanisms for the proprietary filter material over the aerosol size range of 10 micrometers down to 0.001 micrometers.

Sub-task (a) - Measure site of aerosol collection on filter material using collection plates suitable for analysis by a scanning electron microscope.

Sub-task (b) - Determine collection site or sites for radioactive particulates using radiometric techniques.

Proposed duration of Task 3.0: 1.0 month

Task 4.0 - Investigate the effectiveness of the pulsed air system in cleaning the filter elements over the aerosol size range likely to be found in underground atmospheres.

Sub-task (a) - Place a particulate load on the filters and then clean the filters using the compressed air pulse cleaning system.

Sub-task (b) - Make aerosol size determinations of residual particles on filter using SEM techniques.

Proposed duration of Task 4.0: 3 months

Task 5.0 - Determine the filter media's useful life expectancy with aerosol mass concentrations typical of underground environments with no mining activities. This task will be carried out to a certain extent while the aforementioned tasks are underway.

Proposed duration of Task 5.0: 2 months

Task 6.0 - Prepare final report.

Proposed duration of Task 6.0: 1.5 months

COORDINATION WITH BUREAU CENTERS AND OUTSIDE ORGANIZATIONS

No other groups are working on this type of air cleaning system for the proposed application in nuclear waste disposal facilities. Some of the quantitative aerosol analyses will be done through other government agencies including MSHA.

PROJECT PERSONNEL

W. Stroud	Metallurgist	100%
E. Smith	Electronics Tech.	50%
R. Holub	Research Physicist	5%

REFERENCES

- 1.0 Arthur D. Little, Inc., Engineering Evaluation of Radon Daughters Removal Techniques. BuMines Open File Rept. 164-82, 1982, 205 pp; National Technical Information Services, Springfield, VA.
- 2.0 Foster-Miller, Inc., Designing, Building and Testing an Air Cleaning System for Working Level Control in Uranium Mines, USBM Contract No. H0292017, 1984 - In Preparation.
- 3.0 Burchstead, C.A., A. B. Fuller and J. E. Kahn., Nuclear Air Cleaning Handbook, ERDA 76-21, 1976, 290 pp.
- 4.0 Dennis, R., Editor, Handbook of Aerosols, ERDA TID-26608, 1976, 142 pp.
- 5.0 American Conference of Governmental Industrial Hygienists. Air Sampling Instruments for Evaluation of Atmospheric Contaminants, 6th Edition, 1983.



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January 24, 1984

U.S. Nuclear Regulatory Commission
Division of Contracts
Washington, D.C. 20555

ATTN: Cindy Fleenor
Technical Assistance Contracts Branch

SUBJECT: Quarterly Progress Report - October-December 1983, Interagency Agreement Number NRC-02-80-075, "Technical Assistance for Assessment of Repository Siting and Design"

Dear Mrs. Fleenor:

Enclosed is our thirteenth quarterly progress report on the subject interagency agreement for the period October 1, 1983 through December 31, 1983. This is in accordance with Article 1, Number 3.1-Reporting Requirements.

Progress

At the request of the Nuclear Regulatory Commission (NRC), the Ground Control personnel of the Bureau of Mines (BOM), Department of Interior, provided technical assistance in response to a Site Characterization Plan presented to NRC at the Fourth DOE/NRC Meeting relating to the repository, design, exploratory shaft, and in situ testing. The BOM participated as a reviewer of the program presented by the Office of Nuclear Waste Isolation at the above meeting. The main area of review assigned to the BOM was in situ testing.

BOM Radiation Hazards personnel reviewed a draft technical position report titled "Subtask 1.2 - Post Emplacement Monitoring." Their conclusions indicated that the author met the goal of pointing out the significant problems of monitoring nuclear waste packages after emplacement. However, some of the suggested techniques appeared to be impractical.

Progress inadvertently omitted from last quarter's report:

On August 2, 1983, three BOM personnel visited the Basalt Waste Isolation Project at Hanford, WA. The purpose was to inspect a diamond overcoring drill being tested by Rockwell Hanford for use in the exploratory shaft. A trip report (August 10, 1983) has been sent to Mr. David Tiktinsky, NRC. Costs for this trip are shown in the revised financial statement at the end of this report.

Moreover, steps have been taken to assure that Mr. Ed Hollop will remain as the lead BOM contact on salt. Mr. Lindsay Mundell will now act as Mr. Hollop's backup.

Travel

At the request of NRC, a pre-meeting was attended at the Willste Building, Silver Springs, Maryland, to discuss repository design, in situ testing and exploratory shaft design and construction in salt. The meeting covered subjects relating to a meeting with DOE and Office of Nuclear Waste Isolation at Columbus, Ohio, November 25-26, 1983.

Another trip was made to attend the Civilian Radioactive Waste Management Information meeting. The subjects covered during the three-day meeting included regulatory issues, site characterization, waste package and repository design.

On November 28, 1983, Maynard Serbousek traveled to Seattle, WA to attend a review meeting on BWIP with NRC and Golder Associates (NRC consultants). The purpose of the meeting was to discuss the exploratory shaft test plan. This meeting was followed by another three-day meeting (November 29th-December 1st) at Richland, WA to review the same test plan with DOE and Rockwell Hanford. A trip report is currently being prepared by Mr. Serbousek and will be forwarded to the NRC Project Manager.

Future Work

Again, future work under the interagency agreement will remain focused on the review of site characterization reports with top priority given to assessing the state-of-the-art of large diameter horizontal nuclear waste emplacement holes. As noted in the quarterly financial report which follows, the majority of the personnel costs spent during the last two quarters is in response to this effort.

Financial Status

The following summary of expenditures is provided for the period covering October 1 through December 31, 1983:

<u>Cost Component</u>	<u>Current Obligations</u>	<u>Cummulative Expenditures from Start of Agreement</u>
Personnel	\$23,294 ^{1/}	\$130,321
Travel	2,353	9,577
Transportation	-0-	306
Other (Assessment for Bureau Admin. Sys.)	-0-	82,500
	<u>\$25,647</u>	<u>\$222,704</u>
	Balance Remaining	\$567,296

^{1/}The majority of personnel costs is a result of the major research task discussed under Future Work which is transmitted monthly under a separate cover.

Revised summary of expenditures for period covering July 1 through September 30, 1983:

<u>Cost Component</u>	<u>Current Obligations</u>	<u>Cumulative Expenditures from Start of Agreement</u>
Personnel	\$12,712 ^{1/}	\$107,027
Travel	205	7,224
Transportation	-0-	306
Other (Assessment for Bureau Admin. Sys.)	-0-	82,500
	<u>\$12,917</u>	<u>\$197,057</u>
	Balance Remaining	\$592,943

Sincerely,

Earle B. Amey

Earle B. Amey, Staff Engineer
Division of Health and Safety
Technology

^{1/}The majority of personnel costs is a result of the major research task discussed under Future Work which is transmitted monthly under a separate cover.



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January 24, 1984

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U.S. Nuclear Regulatory Commission
Division of Contracts
Washington, D.C. 20555

ATTN: Cindy Fleenor
Technical Assistance Contracts Branch

SUBJECT: Monthly Progress Report - December 1983 Interagency Agreement
Number NRC-02-80-075, "State-of-the-Art Assessment for Large
Diameter Horizontal Nuclear Waste Emplacement Holes"

Dear Mrs. Fleenor:

Enclosed is our fourth monthly progress report on the subject interagency agreement for December 1983. This is in accordance with Article I, Number 3.1-Reporting Requirements.

Earle B. Amey

Earle B. Amey, Staff Engineer
Division of Health and Safety
Technology

Enclosures

December 1983 Monthly
STATE-OF-THE-ART ASSESSMENT
OF
LARGE DIAMETER HORIZONTAL
NUCLEAR WASTE EMPLACEMENT HOLES

1.0 Drilling of Emplacement Holes

Principal Investigator - Gerald L. Finfinger

Work Completed During Reporting Period

Research this month was primarily centered on borehole surveying techniques. Since controlled directional drilling has application in the oil and gas industry a large variety of equipment has been developed and tested for borehole surveying. However, the degree of accuracy requested in this project proposal (hole deviation less than 12 inches from the starting point) is greater than is normally attempted in most drilling operations. Instrument accuracy, survey calculation method, survey interval and borehole geometry all contribute to the overall accuracy of the survey. Open-ended boreholes could be checked for total deviation since both ends of the borehole could be surveyed externally. However dead-ended holes would have to rely totally on the internal survey for deviation control. The proper combination of survey instrument, calculation method and most importantly the survey interval would have to be properly selected to obtain the desired borehole characteristics. Further investigations should reveal if any case histories exist which are similar to the nuclear waste emplacement holes. The preliminary draft on drilling and tunneling technology which has application to the nuclear waste emplacement holes has been completed.

Work Completed to Date

All computer implemented literature searches on drilling, tunnelling and surveying have been completed. Leading manufacturers have been contacted and product information has been obtained.

2.0 Maintaining Integrity of Emplacement Holes

Principal Investigator - Daniel R. Babich

Work Completed During Reporting Period

Research consisted of compiling the findings to date into three (3) preliminary drafts pertaining to:

1. General rock mechanics considerations and host rock characteristics of emplacement holes in basalt and tuff deposits.
2. The influence of discontinuities on nuclear waste repository stability.
3. Effects of temperature upon waste isolation hole stability.

In addition, results of research into methods of hole casing is being prepared as a preliminary draft.

Work Completed to Date

Literature searches of rock mechanics and hole casing were completed. Literature search started for grouting techniques. Three (3) rock mechanics drafts completed. Preliminary draft on hole casing started.

3.0 Backfilling of Emplacement Holes

Principal Investigator - Robert Evans

Work Completed During Reporting Period

During this reporting period the use of sonic and gamma radiation detection devices for determining density of solids was discussed with a representative of the Schlumberger Company. Four additional articles including, "Assessment of Retrieval Alternatives for the Geologic Disposal of Nuclear Waste", were reviewed. An outline for "Backfilling of Emplacement Holes," was prepared. (Task 3.2). No significant findings for this period are presented.

During the next reporting period work will continue on preparing the first drafts for the sections, "Materials for Backfilling," (Task 3.3) and "Mechanical, Pneumatic and Hydraulic Systems for Backfilling" (Task 3.4).

4.0 Retrieving Waste Canisters from Emplacement Holes

Principal Investigator - Gerald L. Finfinger

Work Completed During Reporting Period

A computer implemented literature search has been conducted and pertinent information is being received. Both cased and noncased holes are being considered. Particular emphasis is being paid to overcoring technology since operations similar to the retrieval requirement have been conducted. Equipment needed for the overcoring operation has been designed and built for previous studies; however, the operation was conducted from a surface site. Drawings and equipment specifications are being obtained.

Work Completed to Date

Same

Man-Effort

<u>Task</u>	<u>Man-Hours This Period</u>	<u>Total Man- Hours to Date</u>	<u>Percent of Available Hours</u>
1.0	111	372	33%
2.0	273	572	48%
3.0	20	268	43%
4.0	109	109	32%

Edward D. Thimons
Edward D. Thimons

Distribution:

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