

**ALLIED TECHNOLOGY GROUP, INC.
CHI-SQUARED TEST OF RELIABILITY DATA SHEET**

Instrument Model:		Instrument Serial No.	Background Count Rate C_B :	
Last Calibration Date:		Detector Model	Detector Serial No.	
Today's Date:		Data Collected By:	Source ID No.	
Count Number	CPM Gross (C_G)	CPM Net (C_i)	$(C_i - \bar{c})$	$(C_i - \bar{c})^2$
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
Sum		$\Sigma (C_i)$		
Mean (\bar{c})		$\Sigma (C_i)/10$		
Sum of Squares = $\Sigma (C_i - \bar{c})^2$				
Standard Deviation (σ) = SQRT $\Sigma (C_i - \bar{c})^2/9$				
Theoretical Standard Deviation (σ_t) = \sqrt{c}				
Reliability Factor (R.F.) = σ/σ_t				
Calculations Completed By:			Date:	
Data and Calculations Reviewed By:			Date:	

**ALLIED TECHNOLOGY GROUP, INC.
COUNTING SYSTEM EFFICIENCY DATA SHEET**

Instrument Model		Instrument Serial No.	
Last Calibration Date	Detector Model	Detector Serial No.	
Today's Date		Data Collected By	
Alpha		Beta-Gamma	Channel (Circle One)
Source number:			
Source activity ($\mu\text{Ci/dpm}$) =		on	(A_0)
Source decay time to today		days (t)	
Source radionuclide half life		days ($t^{1/2}$)	
Source radionuclide decay constant = $\ln(s)/(t^{1/2}) =$		/day (λ)	
$A(\text{today}) = A_0 * e^{-\lambda t} =$	($\mu\text{Ci/dpm}$)		
Net count rate = source count rate (CPM) - background count (CPM)			
Efficiency =	$\frac{\text{Net Count rate} * 4.5E-7}{A(\text{today} - \mu\text{Ci/dpm})}$		counts/disintegration
Efficiency =	counts/disintegration		
Calculations Completed By:		Date:	
Data and Calculations Reviewed By:		Date:	

ALLIED TECHNOLOGY GROUP FIELD OPERATIONS
HEALTH PHYSICS OPERATING PROCEDURE

OPERATION AND CALIBRATION
OF THE
LUDLUM MODEL 9 ION CHAMBER

Allied Technology Group, Inc.
47375 Fremont Blvd.
Fremont, California 94538

Prepared by:
D. Spicuzza

Allied Technology Group, Inc.

PROCEDURE/PLAN APPROVAL PAGE

This procedure: HP-IP-004, OPERATION AND CALIBRATION OF THE LUDLUM MODEL 9 ION CHAMBER, has been reviewed and approved by the following:

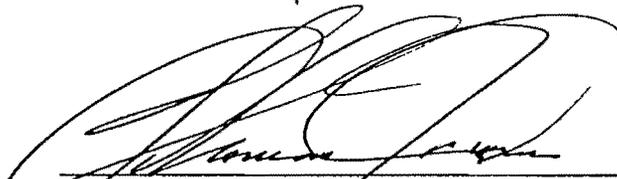
APPROVAL SIGNATURES:



William G. Haney, Project Director

4/10/95

Date



Thomas J. O'Dou, CHP, Project Radiation Safety
Officer, HP Technical Support

4/12/95

Date

**REVISION RECORD INDICATING
LATEST DOCUMENT REVISION**

Procedure Number: HP-IP-004

Title: OPERATION AND CALIBRATION OF THE LUDLUM MODEL 9 ION CHAMBER

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Rev. No.	1
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1.0 SCOPE

This procedure sets forth the specific requirements to be used for the operation and calibration of the Ludlum Model 9 Ionization Chamber Radiation Detector for use on Allied Technology Group, Inc. field projects.

2.0 PURPOSE

The purpose of this procedure is to provide instructions for the operation and calibration of the Ludlum Model 9 Ion Chamber in accordance with the requirements specified in Reference 3.1.1.

3.0 REFERENCES

3.1 References

- 3.1.1 Regulatory Guide 10.8, Rev.2-1987, Guide for the Preparations of Applications for Medical Use Programs.
- 3.1.2 ANSI N3.1-1987, Selection, Qualifications and Training of Personnel For Nuclear Power Plants.
- 3.1.3 Manufacturer's instruction manual for the Ludlum Model 9 Ion Chamber.
- 3.1.4 ANSI N323-1978, Instrument Test and Calibration.
- 3.1.5 HP-OP-001, Radiation and Contamination Survey Techniques.
- 3.1.6 HP-OP-002, Radiological Area Posting and Access Control.

4.0 PRECAUTIONS, LIMITATIONS

4.1 Precautions

- 4.1.1 The ion chamber is vented to atmosphere, it is sensitive to changes in atmospheric pressure and ambient temperature.
- 4.1.2 When the shield is open, protect the thin face against puncture damage.
- 4.1.3 When using this instrument in a known, or suspected contaminated area, seal the instrument in a protective media (i.e., plastic, poly) to prevent contamination of the instrument.

- 4.1.4 Check the zero setting during use on the low range. Adjust as necessary. Readjustment is not required on the higher ranges.

4.2 Limitations

- 4.2.1 The operation of the Model 9 depends on the condition of the battery. Therefore, the battery check should be performed before each use and periodically during use to ensure proper operation.
- 4.2.2 Calibration shall be performed semi-annually, after maintenance is performed, if the instrument fails the performance test or if proper operation is in question.
- 4.2.3 A daily performance test is required when the instrument is in use.

5.0 Responsibilities and Qualifications

5.1 Responsibilities

- 5.1.1 ATG Radiological Field Operations Manager shall be responsible to:

- 5.1.1.1 Implement this procedure.
- 5.1.1.2 Periodically review adherence to the requirements of this procedure.
- 5.1.1.3 Ensure Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure.

- 5.1.2 Health Physics Supervisors shall:

- 5.1.2.1 Perform periodic surveillance of the use and maintenance of the instrument.
- 5.1.2.2 Ensure instruments in use are calibrated at specified intervals.
- 5.1.2.3 Ensure that records pertaining to the instrument are maintained on file throughout the duration of the project and copies retained in the permanent project file.

- 5.1.3 Health Physics Technicians shall be responsible to:

- 5.1.3.1 Perform the requirements in Section 6.1, 6.2, 6.3 and 6.4 of this procedure.

5.1.3.2 Document all records in this procedure.

5.1.3.3 Notify Health Physics Supervision of any unsafe or unusual conditions observed during operation of the instrument.

5.1.4 Health Physics Instrument Personnel shall be responsible to:

5.1.4.1 Perform the requirements of Sections 6.2, 6.3, and 6.4 of this procedure.

5.2 Qualifications

5.2.1 Health Physics Technicians shall be qualified in accordance with the requirements of ANSI 3.1 - 1987 to operate this instrument for any of the following: Surveys, radiation work permits and job coverage.

5.2.2 Junior Health Physics and Decontamination Technicians may operate this instrument under supervision of a Health Physics Technician meeting the requirements of section 5.2.1.

6.0 PROCEDURE

6.1 Operation

6.1.1 Verify that the instrument has a valid Calibration Data Sticker Label # ATGL-DCK and is not out of calibration, and the daily performance test has been completed and initialled on the Performance Test Daily Check Sticker. If the performance test has not been completed, have a Health Physics Technician perform the test (Section 6.3).

6.1.2 Inspect the instrument for any obvious physical damage which could interfere with its proper operation. Include inspection for loose, damaged knobs, buttons, broken or damaged meter movements/displays, dented or corroded instrument cases, punctured/deformed probe/probe window(s). Particular attention should be given to cables and connectors, since these components frequently become damaged or worn. Any instrument or detector having a questionable physical condition shall not be used until properly corrected.

6.1.3 Perform a battery check on the instrument by turning the range selector switch on the meter face to the "BAT" position. Observe the meter needle position on the meter face. Ensure the needle position is above the "BAT TEST" area on the meter face scale. If not, replace the batteries in accordance with Reference 3.3.1. and repeat the above test.

- 6.1.4 Turn the range selector switch on the meter face to the X1 range setting and wait approximately 5 minutes. Re-zero the meter in a low background radiation area by turning the zero adjust knob on the meter face to obtain a reading on the meter of zero, if necessary.
- 6.1.5 If the instrument fails any of the above checks, remove it from service, notify Health Physics Supervision, and arrange for repair of the meter.
- 6.1.6 Turn the audio switch switch on the meter face to the "ON" position.
- 6.1.7 For gamma exposure rates proceed as follows:
 - 6.1.7.1 Ensure the β shield is covering the mylar window.
 - 6.1.7.2 When entering a radiation area of unknown radiation levels turn the range selector switch on the meter face to the highest scale X100 range (1 Rem/hr to 5 Rem/hr range) and scale down until a upscale meter needle deflection is observed on the meter scale face.
 - 6.1.7.3 If possible, place the entire chamber volume in and perpendicular to the radiation field of interest.

NOTE: If the entire detector volume is not in the radiation field, detector response will be low by the fraction of the volume exposed.
 - 6.1.7.4 Allow sufficient time for the meter to respond. The Ludlum Model-9 instrument has a response time of approximately 3 seconds to achieve 90% of full scale.
 - 6.1.7.5 Proceed with use of the instrument.
- 6.1.8 Determine the presence of β radiation as follows:
 - 6.1.8.1 Obtain a γ exposure rate measurement in accordance with Step 6.1.7 of this procedure. β shield closed (closed window (CW)).
 - 6.1.8.2 Slide the β shield back exposing the mylar window.
 - 6.1.8.3 Take an open window (OW) reading.
 - 6.1.8.4 A higher reading with the β shield open indicates the presence of β radiation.

NOTE: In situations where very low photons are encountered, the phenolic shield may attenuate these photons. In such cases, the low energy photons may appear to be beta radiation.

6.1.9 Determine the approximate β dose rate for contact/surface exposure rates as follows:

6.1.9.1 Take a γ exposure rate reading (CW) with approximately 1/2" from the surface of interest.

6.1.9.2 Slide back the β shield and take a reading with the mylar window open (OW) at the same location.

6.1.9.3 Using the β correction (BCF), calculate the approximate β exposure rate as follows:

$$\beta \text{ exposure rate} = \text{BCF} \times (\text{OW} - \text{CW})$$

6.1.10 For 30cm β exposure rates:

6.1.10.1 Take a γ reading (CW) approximately 30cm from the source.

6.1.10.2 Slide back the β shield and take a reading with the mylar window open (OW) at the same location.

6.1.10.3 Using a BCF of 1.5, calculate the approximate β exposure rate as follows:

$$\beta \text{ exposure rate} = \text{BCF}(1.5) \times (\text{OW} - \text{CW})$$

6.1.11 Surveys under unusual atmospheric conditions:

6.1.11.1 These ion chambers are vented to atmospheric pressure and are sensitive to changes in pressure and temperature. The error, however, is approximately < 10% for temperatures between 40°F to 120°F and 10% for altitude changes of 2,000 feet.

6.1.11.2 If the instrument is to be used outside these ranges, refer to Reference 3.1.3 for correction factors.

6.1.12 Return of the instrument after surveys.

- 6.1.12.1 After completion of a survey, perform a battery check, (Section 6.1.3 of this procedure) and decontaminate as applicable, and return the instrument to its proper storage location.
- 6.1.12.2 If the battery check indicates an unsatisfactory condition, survey results should be evaluated by Health Physics Supervision.

6.2 Calibration

6.2.1 Calibration shall be performed by the manufacturer or a qualified vendor.

NOTE: The Health Physics Technician or Health Physics Instrument Technician shall perform steps 6.2.2 through 6.2.7 of this procedure.

6.2.2 Upon receipt from the manufacturer or qualified vendor, perform a physical inspection of the instrument. Record as satisfactory or unsatisfactory on ATGF-015.

6.2.3 Perform a battery check; replace if necessary. Record as satisfactory or unsatisfactory on ATGF-015.

6.2.4 Determine contact beta correction factor as follows:

- 6.2.4.1 Obtain the depleted uranium slab. Utilizing fixed geometry, perform a Closed Window Source Reading. Record results on ATGF-015.
- 6.2.4.2 Perform an Open Window Source Reading. Record results on ATGF-015.
- 6.2.4.3 Record the actual beta dose rate from the depleted uranium slab as indicated on the source assay certificate on ATGF-015.
- 6.2.4.4 Calculate the Beta Correction Factor (BCF) as follows:

$$\text{BCF} = \frac{\text{Actual Beta Dose Rate}}{\text{OPEN Window} - \text{CLOSED Window}}$$

NOTE: Calculated BCF is to be used for contact readings only. BCF for 30cm readings is 1.5.

6.2.4.5 Record the BCF on ATGF-015.

6.2.5 Determine performance test reference data.

6.2.5.1 Record the Cs-137 source serial number on ATGF-015.

6.2.5.2 Perform an Open Window Source Reading with the Cs-137 source in contact with the mylar window. Record results on ATGF-015.

6.2.5.3 Calculate the reference value range $\pm 10\%$ of the source reading and record results on ATGF-015.

6.2.6 Attach the manufacturer or qualified vendor's Calibration Data Sheet to ATGF-015.

6.2.7 If the above calibration steps are completed satisfactorily, attach a completed Calibration Data Sticker Label # ATGL-DCK and a Performance Test Daily Check Sticker to the instrument. Complete Section 3 of ATGF-015.

6.3 Performance Test

6.3.1 Do a performance test on the instrument and record all data on ATGF-003, Daily Instrument Performance Test Log.

6.3.2 Obtain the performance test source designated by the ATGF-015, and Label # ATGL-DCK on the instrument.

6.3.3 Record the information for each section of ATGF-003.

6.3.4 Examine the instrument for any obvious physical damage which could interfere with its proper operation.

6.3.5 Verify that the instrument has a current Calibration Data Sticker Label # ATGL-DCK, and a Performance Test Daily Check Sticker.

6.3.6 Turn the range selector switch to the "BAT" position and check that the battery is within the "BAT TEST" range on the meter scale face.

6.3.7 Turn the range selector switch to the X1 position and perform a zero check on the instrument. Adjust the "ZERO ADJUST" knob on the meter face to obtain a reading of zero if necessary.

6.3.8 Expose the detector to the designated source. If the response is within the designated range for the source, record "P" for pass on the Daily Instrument Performance Test Log. If the instrument fails, record "F" for fail and remove the

instrument from service for repair or calibration.

- 6.3.9 If the instrument passes the performance test, initial the Performance Test Daily Check Sticker on the instrument and initial the Daily Instrument Performance Test Log (ATGF-003).

6.4 Maintenance

- 6.4.1 Instruments shall be stored in areas which prevent damage by movement, accumulation of moisture or dust. Detector covers shall be used for storage when practical.
- 6.4.2 Electronic maintenance shall be performed by an Health Physics Instrumentation Technician or by the manufacturer or an approved vendor.

7.0 RECORDS

The following records will be generated and retained in the permanent project file as a result of using this procedure.

- 7.1 ATGF-003, Daily Instrument Performance Test Log
- 7.2 ATGF-015, Instrument Service Record - Ludlum Model 9

8.0 FORMS

- 8.1 ATGF-003, Daily Instrument Performance Test Log
- 8.2 ATGF-015, Instrument Service Record - Ludlum Model 9

INSTRUMENT SERVICE RECORD- LUDLUM MODEL 9

SECTION 1: INSTRUMENT DATA

Model 9 Serial Number:	Calibration Date:
Depleted Uranium Source Serial Number:	Assay Date:

SECTION 2: CALIBRATION DATA

Note: See Attached Calibration Data Sheet for the Dose Rate Calibration

Physical Condition	<input type="checkbox"/> Satisfactory	<input type="checkbox"/> Unsatisfactory
Battery Test	<input type="checkbox"/> Satisfactory	<input type="checkbox"/> Unsatisfactory
Beta Correction Factor:	$\frac{\text{Actual Beta Dose Rate}}{\text{OPEN Window} \text{ --- } - \text{CLOSED Window} \text{ ---}} = \text{BCF}$	

Cs-137 Source Serial Number	Source Reading	Range 10% of Source Reading

SECTION 3: REMARKS

Checked By:	Date:
Calibration Due Date:	Date:
Reviewed By:	Date:

ALLIED TECHNOLOGY GROUP FIELD OPERATIONS
HEALTH PHYSICS OPERATING PROCEDURE

CONTROL AND ISSUANCE OF
POCKET IONIZATION CHAMBERS (PICs)

Allied Technology Group, Inc.
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Prepared by

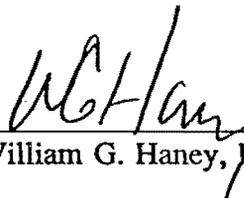
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PROCEDURE/PLAN APPROVAL PAGE

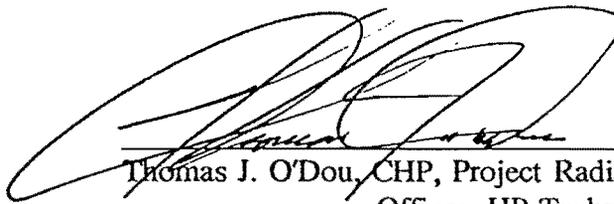
This procedure: Control And Issuance Of Pocket Ionization Chambers (PICs) has been reviewed and approved by the following:

APPROVAL SIGNATURES:



William G. Haney, Project Director

4/12/95
Date



Thomas J. O'Dou, CHP, Project Radiation Safety
Officer, HP Technical Support

4/12/95
Date

**REVISION RECORD INDICATING
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Procedure Number: HP-IP-006

Title: Control And Issuance Of Pocket Ionization Chambers (PICs)

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CONTROL AND ISSUANCE OF POCKET IONIZATION CHAMBERS (PICs)

1.0 SCOPE

This procedure shall provide the guidelines for the issuance and control of pocket ionization chamber instruments used on A.T.G. field projects.

2.0 PURPOSE

This procedure ensures that proper issuance and control of Pocket Ionization Chambers (PICs) and is performed in accordance with the provisions of documents in Section 3.1 of this procedure.

3.0 REFERENCES AND DEFINITIONS

3.1 References

- 3.1.1 HP-OP-004, Issue and Use of Radiation Work Permits (RWPs).
- 3.1.2 HP-OP-002, Radiological Area Posting and Access Control.
- 3.1.3 HP-IP-005, Calibration of Pocket Ionization Chambers.
- 3.1.4 Regulatory Guide 8.4, Direct Reading and Indirect Reading Dosimeters.
- 3.1.5 ANSI N322, Inspection and Test Specifications for Direct and Indirect Reading Dosimeters.
- 3.1.6 Manufacturer's technical manual(s).

3.2 Definitions

- 3.2.1 **Pocket Ionization Chamber (PIC)** - A small, portable ion chamber provided with an internal electroscope that can be read on an internal scale. These ion chambers allow the integrated gamma dose to be checked periodically by the user. A PIC may also be known as a self-reading dosimeter (SRD) or direct reading dosimeter (DRD).

4.0 PRECAUTIONS, LIMITATIONS

- 4.1 PICs shall receive a calibration check every six (6) months.

- 4.2 Any PIC lacking a current calibration sticker shall be considered OUT OF SERVICE and returned to the designated A.T.G. location.

5.0 RESPONSIBILITIES

- 5.1 ATG Radiological Field Operations Manager (Project Manager) shall be responsible to:
- 5.1.1 Implement this procedure.
 - 5.1.2 Periodically review adherence of personnel to the requirements of this procedure.
 - 5.1.3 Ensure Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure.
 - 5.1.4 Ensure personnel are qualified to perform the requirements of this procedure and have a working knowledge of PICs.
- 5.2 Health Physics Supervisors shall:
- 5.2.1 Perform periodic surveillance of the use and maintenance of the PICs.
 - 5.2.2 Ensure PICs are calibrated at specified intervals.
 - 5.2.3 Maintain an inventory of PIC locations and users.
- 5.3 Health Physics Technicians shall be responsible for:
- 5.3.1 Collection of PICs requiring calibration and notification of Health Physics Supervisor.
 - 5.3.2 Performing release surveys on the PICs requiring calibration.
 - 5.3.3 Ensuring all personnel issued PICs are using the PIC correctly in accordance with the provisions of the RWP.
- 5.4 Escorts shall:
- 5.4.1 Return PICs issued to any personnel in their group.
- 5.5 Any personnel issued a PIC shall:
- 5.5.1 Make sure the dosimeter issued always has a valid, dated calibration sticker.
 - 5.5.2 Read the PIC and act upon the indication as required by the RWP and the Health Physics Technician.

6.0 PROCEDURE

6.1 Control of PICs

- 6.1.1 The Health Physics Supervisor shall maintain a copy of an updated inventory of all A.T.G. PICs at the job site.
- 6.1.2 When the PICs are due for calibration check, the Health Physics Supervisor shall determine the location of the PICs, collection of the PICs, and arrange for recalibration of the PICs.

6.2 Issuance of PICs

- 6.2.1 Calibrated PICs shall be stored for issue at a designated location at the A.T.G. job site.
- 6.2.2 A PIC charger shall be maintained at the A.T.G. job site. PICs shall be rezeroed prior to issuance and each day before work.
- 6.2.3 Health Physics shall issue PICs to cover 10% of a group of visitors. If visitors intend to separate at any time while in a controlled area, each group will be assigned the required 10%, with a minimum of two visitors in each group having a PIC assigned to them.
- 6.2.4 When issuing a PIC to a visitor, Health Physics personnel shall assign a 0-200 mR PIC, note the serial number, and complete the PIC issue log, ATGF-018, with all pertinent information.
 - 6.2.4.1 Visitors may be required to enter a radiological area and/or an RWP required area, the PIC requirements will be decided by the Health Physics Supervisor and PICs will be issued accordingly.
- 6.2.5 Health Physics Supervisors shall determine the need for PIC issuance in accordance with References 3.1.1 and 3.1.2.
 - 6.2.5.1 PICs shall not be issued to individuals for extended use. PICs shall be issued on an as needed or job duration basis.
 - 6.2.5.2 A.T.G. staff may self issue PICs in accordance with the provisions of this procedure.
- 6.2.6 At the time of issue Health Physics personnel should instruct visitors being issued the PIC:
 - 6.2.6.1 On the proper reading of the PIC and action to be taken upon off-scale indication of the PIC.

- 6.2.6.2 That if the PIC is dropped or mishandled, readings may not be indicative of true exposure. If this happens notify Health Physics personnel immediately.
- 6.2.6.3 PICs shall be worn adjacent to the TLD or film badge during work periods. In all instances, PICs shall be returned to Health Physics, or proper storage location, at the end of the day.

6.3 Return of PICs

- 6.3.1 PICs shall be returned to issue point upon completion of shift or after the completion of RWP requirements.
- 6.3.2 At the completion of the RWP work, or the end of the work day, temporarily assigned PICs shall be returned to the issuance point.
- 6.3.3 Lost and damaged PICs shall be handled in accordance with the provisions of Reference 3.1.1.

7.0 RECORDS

The following records will be generated and retained in the permanent project file as a result of using this procedure.

- 7.1 ATGF-018, PIC Issue Log.

8.0 FORMS

- 8.1 ATGF-018, PIC Issue Log.

ALLIED TECHNOLOGY GROUP FIELD OPERATIONS
HEALTH PHYSICS OPERATING PROCEDURE

OPERATION AND CALIBRATION OF THE MODEL LV-1
LOW VOLUME AIR SAMPLER

Allied Technology Group, Inc.
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Prepared by

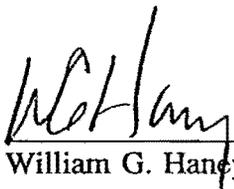
D. Spicuzza

Allied Technology Group, Inc.

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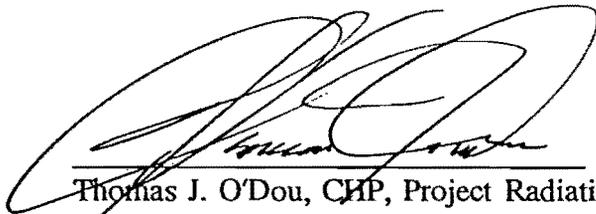
This procedure: HP-IP-007 has been reviewed and approved by the following:

APPROVAL SIGNATURES:



William G. Haney, Project Director

4/12/95
Date



Thomas J. O'Dou, CHP, Project Radiation Safety
Officer, HP Technical Support

4/12/95
Date

**REVISION RECORD INDICATING
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Procedure Number: HP-IP-007

Title: Operation and Calibration of the Model LV-1 Low Volume Air Sampler

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OPERATION AND CALIBRATION OF THE MODEL LV-1 LOW VOLUME AIR SAMPLER

1.0 SCOPE

This procedure sets forth the specific requirements to be used for the operation and calibration of the F & J Specialty Products Model LV-1 low volume air samplers used on Allied Technology Group, Inc. field projects.

2.0 PURPOSE

The purpose of this procedure is to provide instructions for the operation, use, and calibration of the F & J Specialty Products Model LV-1 low volume air samplers in accordance with the requirements of Reference 3.1.

3.0 REFERENCES

3.1 References

- 3.1.1 Regulatory Guide 10.8, Rev. 2-1987, Guide for the Preparation of Applications for Medical Use Programs
- 3.1.2 ANSI N3.1-1987, Selection, Qualification and Training of Personnel for Nuclear Power Plants
- 3.1.3 HP-OP-010, Air Sampling and Analysis
- 3.1.4 Technical Manual for the F & J Specialty Products Model LV-1 Regulated Low Volume Air Sampler
- 3.1.5 HP-OP-005, Control of Radioactive Material

4.0 PRECAUTIONS, LIMITATIONS

4.1 Precautions

- 4.1.1 Do not operate air samplers in an explosive environment unless the air sampler is specifically certified and designated for such use.
- 4.1.2 Ensure the power switch is in the "off" position prior to plugging any air sampling devices into electrical outlets.

- 4.1.3 Air samplers shall be considered internally contaminated and controlled in accordance with Reference 3.1.5.

4.2 Limitations

- 4.2.1 Calibration shall be performed annually, after maintenance is performed, or if the air sampler proper operation is in question.
- 4.2.2 Calibration shall be performed by the manufacturer or a qualified vendor only.
- 4.2.3 True flow is center of the rotometer ball reading.
- 4.2.4 Some rotometers are calibrated in liters per minute (LPM) vice cubic feet per minute (CFM). 1 CFM = 28.32 LP
- 4.2.5 Air samplers shall be operated in accordance with this procedure and Reference 3.1.3.
- 4.2.6 Only F & J TEDA impregnated (or equivalent) charcoal cartridges shall be used during operation of the air samplers.
- 4.2.7 Only F & J Model FP47 type (or equivalent) filters should be used for particulate air sampling.

5.0 RESPONSIBILITIES AND QUALIFICATIONS

5.1 Responsibilities

- 5.1.1 The ATG Radiological Field Operations Manager (Project Manager) is responsible for:
 - 5.1.1.1 Implementation of this procedure.
 - 5.1.1.2 Periodic reviews of adherence to the requirements of this procedure.
 - 5.1.1.3 Ensure Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure.
- 5.1.2 Health Physics Supervisors are responsible to:
 - 5.1.2.1 Perform periodic surveillance of the use and maintenance of the air sampler.
 - 5.1.2.2 Ensure the air samplers are calibrated at specified intervals.

5.1.2.3 Ensure that records pertaining to use and maintenance of air samplers are maintained on file throughout the duration of the project and copies retained in the permanent project file.

5.1.3 Health Physics Technicians are responsible for:

5.1.3.1 Performance of the requirements of this procedure.

5.1.3.2 Documentation of all records in this procedure.

5.1.3.3 Notification to Health Physics Supervision of any unsafe or unusual conditions observed during operation of the air sampler.

5.2 Qualifications

5.2.1 Health Physics Technicians shall be qualified in accordance with the requirements of ANSI 3.1 - 1987 to operate this air sampler.

5.2.2 Junior Health Physics and Decontamination Technicians may operate this air sampler under supervision of a Health Physics Technician meeting the requirements of Section 5.2.1.

6.0 PROCEDURE

6.1 Operation

6.1.1 Preparation

6.1.1.1 Upon receipt of the air sampler from the manufacturer or qualified vendor, complete form ATGF-028 and place a copy with the air sampler.

6.1.1.2 Verify that the instrument has a valid Calibration Data Sticker, Exhibit Label #ATGL-ASC.

6.1.1.3 Inspect the air sampler for any obvious physical damage.

6.1.1.4 Air sampling equipment should be prepared prior to entering work areas in order to minimize potential contamination of equipment.

6.1.1.5 Check for adequate power supply prior to entering the work area.

6.1.1.6 The Model LV-1 air sampler is provided with a six and one-quarter amp fuse for overload protection. Check the fuse located near the on/off power switch prior to air sampler operation. Replace if necessary.

6.2 Sample Collection

6.1.2.1 Air samples shall be collected in accordance with the provisions of Reference 3.1.3.

6.1.2.2 Load a new particulate and new charcoal cartridge (if applicable) into the sample holder. Particulate filter should be placed "fuzzy" side in (away from the flow). Charcoal cartridge should be placed in the sampler with the air flow indicator facing toward the pump.

NOTE: An inspection of the sample holder should be made prior to the placing of the filter(s) in the holder. Insure all O-rings are in place prior to use of the sample holder.

6.1.2.3 Connect the sample holder to the air sampler inlet connection via the quick disconnect coupling. Insure the sample holder "clicks" into position.

6.1.2.4 Place the air sampler in a position that is appropriate for the area to be sampled.

6.1.2.5 Turn on the air sampler and observe the flow rate. Using the Calibration Data Sticker (Label # ATGL-ASC) as a reference; adjust the flow rate by rotating the flow adjustment knob at the bottom of the air flow regulator to the desired flow rate. Clockwise movement increases flow; counter clockwise movement decreases flow.

6.1.2.6 Record the sample start date/time and flow rate on the appropriate forms in accordance with the provisions of Reference 3.1.3.

6.1.2.7 Run the sampler until a volume indicated in Reference 3.1.3 has been collected.

6.1.2.8 Upon collection of the desired volume, observe the flow rate to ensure it has not changed significantly, and turn off the air sampler.

6.1.2.9 Record the stop time and flow rate on the appropriate forms in accordance with the provisions of Reference 3.1.3.

- 6.1.2.10 Remove the filter and cartridge (if applicable) from the sample holder and place them in an envelope or bag taking care not to cross contaminate the filter and cartridge.
- 6.1.2.11 Count the filter(s) in accordance with the provisions of Reference 3.1.3.

6.2 Maintenance

- 6.2.1 No special storage requirements.
- 6.2.2 Electrical repair of this instrument shall be performed by the manufacturer or an approved vendor only.

7.0 RECORDS

The following records will be generated and retained in the permanent project file as a result of using this procedure.

- 7.1 ATGF-028, Instrument Service Record - Low Volume Air Sampler
- 7.2 ATGL-ASC, Calibration Data Sticker

8.0 FORMS

- 8.1 ATGF-028, Instrument Service Record - Low Volume Air Sampler
- 8.2 ATGL-ASC, Calibration Data Sticker (Label)

EXHIBIT 8.2

AIR SAMPLER CALIBRATION DATA STICKER (LABEL)

ATGL-ASC

Air Sampler Calibration

Gauge Model No. _____

Gauge Serial No. _____

Pump Model No. _____

Pump Serial No. _____

Calibration Date: _____

Calibration Due Date: _____

Indicated Flow	Actual Flow

Calibrated By: _____

**INSTRUMENT SERVICE RECORD
LOW VOLUME AIR SAMPLER**

SECTION 1: INSTRUMENT DATA

AIR SAMPLER SERIAL NO:

MAKE:

MODEL:

CALIBRATION DATE:

CALIBRATION DUE DATE:

SECTION 2: CALIBRATION DATA

PHYSICAL CONDITION OF INSTRUMENT:

SATISFACTORY

UNSATISFACTORY

SECTION 3: REMARKS

REVIEWED BY:

DATE:

ALLIED TECHNOLOGY GROUP FIELD OPERATIONS
HEALTH PHYSICS OPERATING PROCEDURE

OPERATION AND CALIBRATION OF THE MODEL H-9400
HIGH VOLUME AIR SAMPLER

Allied Technology Group, Inc.
47375 Fremont Blvd.
Fremont, CA 94538

Prepared by

D. Spicuzza

Allied Technology Group, Inc.

PROCEDURE/PLAN APPROVAL PAGE

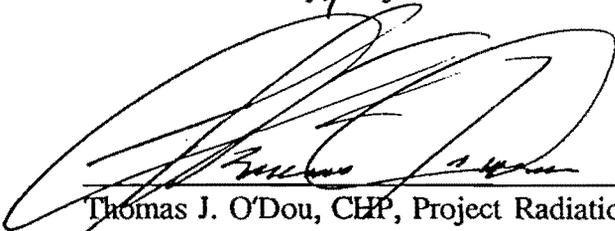
This procedure: HP-IP-008 has been reviewed and approved by the following:

APPROVAL SIGNATURES:



William G. Haney, Project Director

4/12/95
Date



Thomas J. O'Dou, CHP, Project Radiation Safety
Officer, HP Technical Support

4/12/95
Date

REVISION RECORD INDICATING
LATEST DOCUMENT REVISION

Procedure Number: HP-IP-008

Title: Operation and Calibration of the Model H-9400 High Volume Air Sampler

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Rev. No.	Date

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Date	10/20/93
Approval	

OPERATION AND CALIBRATION OF THE MODEL H-9400 HIGH VOLUME AIR SAMPLER

1.0 SCOPE

This procedure sets forth the specific requirements to be used for the operation and calibration of the F & J Specialty Products Model H-9400 High Volume Air Samplers used on Allied Technology Group, Inc. field projects.

2.0 PURPOSE

The purpose of this procedure is to provide instructions for the operation, use, and calibration of the F & J Specialty Products Model H-9400 High Volume Air Samplers in accordance with the requirements of Reference 3.1.

3.0 REFERENCES

3.1 References

- 3.1.1 Regulatory Guide 10.8, Rev. 2-1987, Guide for the Preparation of Applications for Medical Use Programs
- 3.1.2 ANSI N3.1-1987, Selection, Qualification and Training of Personnel for Nuclear Power Plants
- 3.1.3 HP-OP-010, Air Sampling and Analysis
- 3.1.4 Technical Manual for the F & J Specialty Products Model H-9400 High Volume Air Sampler
- 3.1.5 HP-OP-005, Control of Radioactive Material

4.0 PRECAUTIONS, LIMITATIONS

4.1 Precautions

- 4.1.1 Do not operate air samplers in an explosive environment unless the air sampler is specifically certified and designated for such use.
- 4.1.2 Ensure the power switch is in the "off" position prior to plugging any air sampling devices into electrical outlets.

- 4.1.3 Air samplers shall be considered internally contaminated and controlled in accordance with Reference 3.1.5.

4.2 Limitations

- 4.2.1 Calibration shall be performed annually, after maintenance is performed, or if the air sampler proper operation is in question.
- 4.2.2 Calibration shall be performed by the manufacturer or a qualified vendor only.
- 4.2.3 Air samplers shall be operated in accordance with this procedure and Reference 3.1.3.
- 4.2.4 Some gauges are calibrated in liters per minute (LPM) vice cubic feet per minute (CFM). 1 CFM = 28.32 LPM
- 4.2.5 Only F & J Model FP-4.0 (4 inch) type (or equivalent) filters should be used for particulate air sampling.

5.0 RESPONSIBILITIES AND QUALIFICATIONS

5.1 Responsibilities

- 5.1.1 The ATG Radiological Field Operations Manager (Project Manager) is responsible for:
- 5.1.1.1 Implementation of this procedure.
 - 5.1.1.2 Periodic reviews of adherence to the requirements of this procedure.
 - 5.1.1.3 Ensure Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure.
- 5.1.2 Health Physics Supervisors are responsible to:
- 5.1.2.1 Perform periodic surveillance of the use and maintenance of the air sampler.
 - 5.1.2.2 Ensure the air samplers are calibrated at specified intervals.
 - 5.1.2.3 Ensure that records pertaining to use and maintenance of air samplers are maintained on file throughout the duration of the project and copies retained in the permanent project file.

- 5.1.3 Health Physics Technicians are responsible for:
 - 5.1.3.1 Performance of the requirements of this procedure.
 - 5.1.3.2 Documentation of all records in this procedure.
 - 5.1.3.3 Notification to Health Physics Supervision of any unsafe or unusual conditions observed during operation of the air sampler.

5.2 Qualifications

- 5.2.1 Health Physics Technicians shall be qualified in accordance with the requirements of ANSI 3.1 - 1987 to operate this air sampler.
- 5.2.2 Junior Health Physics and Decontamination Technicians may operate this air sampler under the direct supervision of a Health Physics Technician meeting the requirements of section 5.2.1.

PROCEDURE

6.1 Operation

6.1.1 Preparation

- 6.1.1.1 Upon receipt of the air sampler from the manufacturer or qualified vendor, complete Form ATGF-029 and place a copy with the air sampler.
- 6.1.1.2 Verify that the instrument has a valid Calibration Data Sticker, Exhibit Label # ATGL-ASC.
- 6.1.1.3 Inspect the air sampler for any obvious physical damage.
- 6.1.1.4 Air sampling equipment should be prepared prior to entering work areas in order to minimize potential contamination of equipment.
- 6.1.1.5 Check for adequate power supply prior to entering the work area.

6.2 Sample Collection

- 6.1.2.1 Air samples shall be collected in accordance with the provisions of Reference 3.1.3.
- 6.1.2.2 Load a new 4" particulate filter into the filter holder by unscrewing (counter-clockwise) the outer retaining ring on the filter holder.

Particulate filter should be placed "fuzzy" side in (away from the flow). After filter is centered in the filter holder, screw back on the outer retaining ring (clockwise). Hand tighten only.

NOTE: An inspection of the filter holder should be made prior placing the filter in the holder. Ensure the mesh backing screen is in place and not damaged. Ensure the flow gauge is not damaged and is securely fit into the air sampler exhaust port.

6.1.2.3 Place the air sampler in a position that is appropriate for the area to be sampled.

6.1.2.4 Turn on the air sampler and observe the flow rate on the gauge. Using the Calibration Data Sticker (Label # ATGL-ASC) as a reference; record the sample start date/time and flow rate on the appropriate forms in accordance with the provisions of Reference 3.1.3.

6.1.2.5 Run the sampler until a volume indicated in Reference 3.1.3 has been collected.

6.1.2.6 Upon collection of the desired volume, observe the flow rate to ensure it has not changed significantly, and turn off the air sampler.

6.1.2.7 Record the stop time and flow rate on the appropriate forms in accordance with the provisions of Reference 3.1.3.

6.1.2.8 Remove the filter from the filter holder and place it in an envelope or bag taking care not to cross contaminate the filter.

6.1.2.11 Count the filter in accordance with the provisions of Reference 3.1.3.

6.2 Maintenance

6.2.1 No special storage requirements.

6.2.2 Electrical repair of this instrument shall be performed by the manufacturer or an approved vendor only.

7.0 RECORDS

The following records will be generated and retained in the permanent project file as a result of using this procedure.

7.1 ATGF-029, Instrument Service Record - High Volume Air Sampler

7.2 ATGL-ASC, Calibration Data Sticker Label

8.0 FORMS

8.1 ATGF-029, Instrument Service Record - High Volume Air Sampler

8.2 ATGL-ASC, Calibration Data Sticker

EXHIBIT 8.2

AIR SAMPLER CALIBRATION DATA STICKER (LABEL)

ATGL-ASC

Air Sampler Calibration

Gauge Model No. _____

Gauge Serial No. _____

Pump Model No. _____

Pump Serial No. _____

Calibration Date:

Calibration Due Date:

Indicated Flow	Actual Flow

Calibrated By: _____

**INSTRUMENT SERVICE RECORD
HIGH VOLUME AIR SAMPLER**

SECTION 1: INSTRUMENT DATA

AIR SAMPLER SERIAL NO:

MAKE:

MODÉL:

CALIBRATION DATE:

CALIBRATION DUE DATE:

SECTION 2: CALIBRATION DATA

PHYSICAL CONDITION OF INSTRUMENT:

SATISFACTORY

UNSATISFACTORY

SECTION 3: REMARKS

REVIEWED BY:

DATE:

ATG, INC.

HP-IP-011
Revision 0

ALLIED TECHNOLOGY GROUP FIELD OPERATIONS
HEALTH PHYSICS OPERATING PROCEDURE

OPERATION OF THE LUDLUM MODEL 18 ANALYZER WITH THE LUDLUM
MODEL 43-68 GAS PROPORTIONAL DETECTOR

Allied Technology Group, Inc.
47375 Fremont Blvd.
Fremont, California 94538

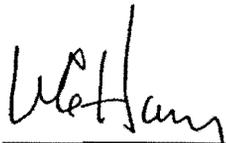
Prepared by
D. Spicuzza

Allied Technology Group, Inc.

PROCEDURE/PLAN APPROVAL PAGE

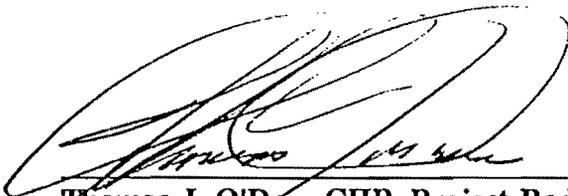
This procedure: HP-IP-011, OPERATION OF THE LUDLUM MODEL 18 ANALYZER WITH THE LUDLUM MODEL 43-68 GAS PROPORTIONAL DETECTOR, has been reviewed and approved by the following:

APPROVAL SIGNATURES:



William G. Haney, Project Director

9/10/95
Date



**Thomas J. O'Dou, CHP, Project Radiation Safety
Officer, HP Technical Support**

9/10/95
Date

**REVISION RECORD INDICATING
LATEST DOCUMENT REVISION**

Procedure Number: HP-IP-011

Title: OPERATION OF THE LUDLUM MODEL 18 ANALYZER WITH THE LUDLUM
MODEL 43-68 GAS PROPORTIONAL DETECTOR

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OPERATION OF THE LUDLUM MODEL 18 ANALYZER WITH LUDLUM MODEL 43-68 GAS PROPORTIONAL DETECTOR

1.0 SCOPE

This procedure sets forth specific requirements to be used for the operation of the Ludlum Model 18 Analyzer with Ludlum Model 43-68 Gas Proportional Detector for use on A.T.G. field projects.

2.0 PURPOSE

The purpose of this procedure is to provide instructions for the operation of the Ludlum Model 18 Analyzer with Ludlum Model 43-68 Gas Flow Proportional Detector.

3.0 REFERENCES

- 3.1.1 Regulatory Guide 10.8, Rev.2-1987, Guide for the Preparations of Applications for Medical Use Programs
- 3.1.2 ANSI N3.1-1987, Selection, Qualification and Training of Personnel For Nuclear Power Plants
- 3.1.3 Manufacturer's instruction manual for the Ludlum Model 18 Analyzer.
- 3.1.4 Manufacturer's instruction manual for the Ludlum Model 43-68 Gas Proportional Detector
- 3.1.5 Manufacturer's instruction manual for the Ludlum Model 2750 Flow Control Meter
- 3.1.6 ANSI N323-1978, Instrument Test and Calibration

4.0 PRECAUTIONS, LIMITATIONS

4.1 Precautions

- 4.1.1 Take care not to puncture the thin mylar window of the gas proportional detector.
- 4.1.2 To prevent contamination of the probe, avoid contact with the person(s) or object(s) being surveyed.
- 4.1.3 When using this instrument in a known or suspected contaminated area, seal the instrument case in a protective media (i.e., plastic, poly) to prevent contamination of the instrument case.

4.2 Limitations

- 4.2.1 The operation of the Model 18 depends on the condition of the battery. Therefore, the battery check should be performed before operation and periodically during use to ensure proper operation.
- 4.2.2 Calibration shall be performed semiannually, after maintenance is performed, if the instrument fails the performance test or if its proper operation is in question.
- 4.2.3 A daily performance test is required when the instrument is in use.

5.0 RESPONSIBILITIES AND QUALIFICATIONS

5.1 Responsibilities

5.1.1 ATG Radiological Field Operations Manager is responsible to:

- 5.1.1.1 Implement this procedure.
- 5.1.1.2 Periodically review the adherence of personnel to the requirements of this procedure.
- 5.1.1.3 Ensures by training and experience Health Physics Technicians are qualified to perform the requirements of this procedure.

5.1.2 Health Physics Supervisors are responsible to:

- 5.1.2.1 Perform periodic surveillance of the use and maintenance of the instrument.
- 5.1.2.2 Ensure the instrument is calibrated at specified intervals.
- 5.1.2.3 Ensure that records pertaining to the instrument are maintained on file throughout the duration of the project and copies retained in the permanent project file.

5.1.3 Health Physics Technicians are responsible to:

- 5.1.3.1 Perform the requirements in Section 6.1, and 6.3 of this procedure.
- 5.1.3.2 Document all records in this procedure.
- 5.1.3.3 Notify Health Physics Supervision of any unsafe or unusual conditions observed during operation of the instrument.

5.2 Qualifications

5.2.1 Health Physics technicians shall be qualified in accordance with the requirements of Reference 3.1.2 operate this instrument for any of the following:

Surveys, radiation work permits and job coverage.

5.2.2 Junior Health Physics and Decontamination Technicians may operate this instrument under supervision of a Health Physics Technician meeting the qualification requirements of section 5.2.1.

6.0 PROCEDURE

6.1 Flushing the Ludlum Model 43-68 Gas Proportional Detector

6.1.1 The Ludlum Model 43-68 Gas Proportional Detector must be flushed prior to use.

6.1.2 Connect the Ludlum Model 43-68 Gas Proportional Detector to the Ludlum Model 18 Analyzer using the supplied cable with series "C" type connectors.

6.1.3 The following is a list of recommended equipment for flushing the detector:

- a) P-10 Gas (90% argon, 10% methane)
- b) Dual Stage Regulator (One stage to show supply pressure. Second stage to reduce supply pressure to 1-2 psi).
- c) Needle valve between the second regulator stage and flowmeter for easier flow adjustment.
- d) Ludlum Model 2750 Flow Control Meter 0-100 cc/min.

6.2 Flush

6.2.1 Connect the counting gas input and output lines to the detector.

CAUTION

The Model 43-68 uses double ended quick connects. Both the male and female quick connects have to be connected to allow gas flow through the detector. **DO NOT** flow gas into the detector unless both inlet and outlet are connected. It will rupture the detector.

- 6.2.2 Connect the regulator to the P-10 gas supply bottle. Ensure the gas bottle supply is off. Ensure the outlet valve of the regulator is in the closed position.
- 6.2.3 Connect the gas supply line to the "SUPPLY" port of the flowmeter.
- 6.2.4 Connect the gas line from the "TO DET" port of the flowmeter to the gas input line of the detector.
- 6.2.5 Connect the gas line from the output of the detector to the "FROM DET" port of the flowmeter.
- 6.2.6 Open the "EXHAUST" port of the flowmeter by connecting a male quick connect to the port.
- 6.2.7 Ensure the needle valve located at the bottom of the "IN" gauge on the flowmeter is fully closed (clockwise).
- 6.2.8 Turn main supply on and flush detector at 100 cc/min at 1- 2 psi gauge pressure for (1) hour.
- 6.2.9 The flow of gas through the detector can be increased by opening (turning counterclockwise) the needle valve at the bottom of the "IN" gauge on the flowmeter and vice versa.

NOTE

A faster flush time can be realized if the output gas line is disconnected from the output of the detector. A male quick connect must be connected to the output port of the detector to ensure gas flow through the detector. Flush time may be reduced to 20-30 minutes.

CAUTION

The main supply should be reduced to less than 50 cc/min before the output gas line is reconnected.

- 6.2.10 After flush is complete, set flow to 30-50 cc/min.

- 6.2.11 After the output line is reconnected check for detector leakage by comparing the readings on the "IN" and "OUT" gauges on the flowmeter. If a difference of more than 5 cc/min is observed tag the detector out of service and do not use until the detector has been repaired.
- 6.2.12 Disconnect the input quick connect on the detector.
- 6.2.13 Disconnect the output quick connect on the detector.
- 6.2.14 Turn the main gas supply off.
- 6.2.15 After two hours of use or when a noticeable decrease in detector efficiency is observed during use, whichever come first, the detector must be re-flushed.
- 6.2.16 Re-flush the detector following Steps 6.2.1 thru 6.2.14.

6.3 Operation

- 6.3.1 Verify that the instrument has a valid Calibration Data Sticker Label # ATGL-DCK and is not out of calibration, and the daily performance test has been completed and initialled on the Performance Test Daily Check Sticker. If the performance test has not been completed, have a Health Physics Technician perform the test (Section 6.3).
- 6.3.2 Inspect the instrument for any obvious physical damage which could interfere with its proper operation. It should include inspecting for loose, damaged knobs, buttons, broken or damaged meter movements/displays, dented or corroded instrument cases, punctured/deformed probe/probe window(s). Particular attention should be given to cables and connectors, since these components frequently become damaged or worn. Any instrument or detector having a questionable physical condition shall not be used until properly corrected.
- 6.3.3 Perform a battery check on the instrument by moving the switch to the "BAT" position. Observe the meter indication for the current battery condition.
- 6.3.4 If unsatisfactory results are obtained, refer to Reference 3.1.3 for the replacement of the batteries and repeat the check. The instrument shall display a satisfactory battery check prior to each use.
- 6.3.5 Set the audio switch to the "on" position. Set the response switch to the slow "s" position, and range selector to the lowest setting.

NOTE

The Model-18 analyzer has a 3 position high voltage adjustment switch labeled HV1, HV2, and HV3 that allows for selection of desired voltage operating points. The positions of the switch are as follows:

HV-1: Alpha	~ 1,200 volts
HV-2: Beta/Alpha	~ 1,700 volts
HV-3: Not Used (GM Detector Use Only)	~ 900 volts

- 6.3.6 Position the high voltage adjustment switch to the HV-1 (Alpha) position. In a low background area perform a background check on the instrument. Observe the instruments reading. Reading should be between 0 and 5 cpm. If a greater reading is noted, the detectors mylar window may be damaged, the instrument should be taken out of service and Health Physics Supervision notified immediately.

NOTE

When using the Model 43-68 detector, to do an evaluation of a surface which may contain natural radioactivity (such as concrete or plaster), determine background near contact with a non-contaminated section of the material. This will ensure that activity determination accounts for the presence of low-level natural radioactivity in the material.

- 6.3.7 Position the high voltage adjustment switch to the HV-2 (Beta/Alpha) position. In a low background area perform a background check on the instrument. Observe the instruments reading. Reading should be between 200 and 300 cpm. If a greater reading is noted, the detectors mylar window may be damaged, the instrument should be taken out of service and Health Physics Supervision notified immediately.
- 6.3.8 If a low background rate cannot be achieved check the instrument probe face for contamination. Decontaminate if necessary, taking care not to damage the probe face.
- 6.3.9 Proceed with operation in accordance with the desired use.
- 6.3.10 If performing a direct probe survey for beta/gamma surface contamination, the detector face should be within 1/2" of the surface being surveyed. The movement rate of the detector probe should be one probe width per second or slower.

6.4.11 If the instrument passes the performance test, record "P" for pass on form ATGF-003, then initial the Performance Test Daily Check Sticker on the instrument and initial the Performance Test Log Sheet.

6.5 Calculation of Minimal Detectable Activity (MDA)

6.5.1 Calculation of MDA when meter is used for stationary (static) readings.

6.5.1.1 After obtaining a background count rate, the MDA can be calculated using the following formula:

$$MDA = \frac{4.65}{E * (A/100)} \times \text{SQRT} (B_R/2t_c)$$

where

MDA = activity level in disintegrations/minute/100cm²
B_R = background count rate in counts/minute
t_c = meter time constant in minutes
E = detector efficiency in counts/disintegration
A = active probe area in cm²

6.5.2 Calculation of MDA when meter is used for scanning.

6.5.2.1 After obtaining a background level the MDA can be calculated using the following formula:

$$MDA = \frac{3 \times R_B}{E \times (A/100)}$$

where

MDA = activity level in disintegrations/minute/100cm²
R_B = background rate in counts/minute
E = detector efficiency in counts/disintegration
A = active probe area in cm²

NOTE

This yields an approximation of MDA based on a scan rate of approximately 2 inches per second. The MDA will increase with higher scan rates.

- 6.3.11 If performing a direct probe survey for alpha surface contamination, the detector face should be within 1/4" of the surface being surveyed. The movement rate of the detector probe should be one probe width per second or slower.
- 6.3.12 If counting smears, masslinn etc. the counting time should be a minimum of 30 seconds, or when meter deflection stabilizes.
- 6.3.14 When performing direct scan surveys of objects, surface areas etc., static readings should be performed frequently to insure the detection of residual activity.

6.4 Performance Test

- 6.4.1 Conduct a performance test daily check on the instrument and record all data on form ATGF-003, Performance Test Log Sheet.
- 6.4.2 Obtain a 100cm² Tc-99 Performance Test source.
- 6.4.3 Record the information for each section of form ATGF-003.
- 6.4.4 Examine the instrument for any obvious physical damage which could interfere with its proper operation.
- 6.4.5 Verify that the instrument has a current Calibration Data Sticker and Performance Test Daily Check Sticker.
- 6.4.6 Perform a Battery Check to ensure that the battery is within the Batt OK range on the meter.
- 6.4.7 Place the high voltage adjustment switch in the HV-2 position. Expose the detector to the performance test source. If the response is within the designated range for the source, proceed to step 6.4.11. If the instrument fails, record "F" for fail on form ATGF-003 and remove the instrument from service for repair or calibration.
- 6.4.8 Obtain a 100cm² Th-230 Performance Test source.
- 6.4.9 Place the high voltage adjustment switch in the HV-2 position. Expose the detector to the performance test source. If the response is within the designated range for the source, proceed to step 6.4.11. If the instrument fails, record "F" for fail on form ATGF-003 and remove the instrument from service for repair or calibration.
- 6.4.10 If the instrument fails any portion of the performance test, log the instrument as failing on the Performance Test Log Sheet, remove from service and notify Health Physics Supervision.

6.6 Maintenance

- 6.6.1 Instruments shall be stored in areas which prevent damage by movement, accumulation of moisture or dust. Detector covers shall be used for storage when practical.
- 6.6.2 Electronic maintenance (except probe and cable replacements) shall be performed by an Health Physics Instrumentation Technician, by the manufacturer or by an approved vendor.

7.0 RECORDS

The following records will be generated and retained in the permanent project file as a result of using this procedure.

- 7.1 Form ATGF-003 Daily Instrument Performance Test Log Sheet
- 7.2 Calibration Data Sticker
- 7.3 Performance Test Daily Check Sticker

8.0 FORMS AND EXHIBITS

8.1 Forms

- 8.1.1 ATGF-003 - Daily Instrument Performance Test Log Sheet

8.2 Exhibits

- 8.2.1 Performance Test Daily Check Sticker
- 8.2.2 Calibration Data Sticker

ALLIED TECHNOLOGY GROUP FIELD OPERATIONS
HEALTH PHYSICS OPERATING PROCEDURE

RADIATION AND CONTAMINATION SURVEY TECHNIQUES

Allied Technology Group, Inc.
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Prepared by

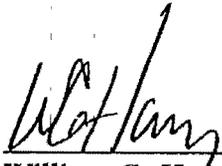
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Allied Technology Group, Inc.

PROCEDURE/PLAN APPROVAL PAGE

This procedure: Radiation and Contamination Survey Techniques has been reviewed and approved by the following:

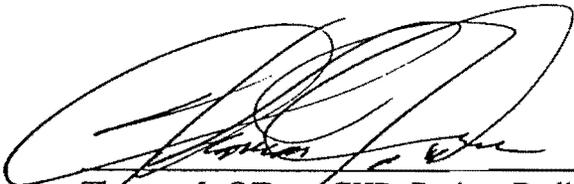
APPROVAL SIGNATURES:



William G. Haney, Project Director

4/12/95

Date



Thomas J. O'Donoghue, CHP, Project Radiation Safety
Officer, HP Technical Support

4/12/95

Date

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RADIATION AND CONTAMINATION SURVEY TECHNIQUES

1.0 SCOPE

This procedure provides guidelines for the performance and documentation of Radiation and Contamination surveys on Allied Technology Group, Inc. field projects.

2.0 PURPOSE

The purpose of this procedure is to specify requirements for consistent general radiological surveys and documentation of acquired data for routine, pre-operation and post-operation surveys as well as job coverage surveys. This procedure is intended to satisfy the requirements of DOE Order 5480.11.9g (3) (b) and 5480.11.9.g (4) (a) (b) (c) and 10 CFR 20.

3.0 REFERENCES AND DEFINITIONS

3.1 References

- 3.1.1 10 CFR 20, Standards for Protection Against Radiation
- 3.1.2 DOE 5480.11, Radiation Protection for Occupational Workers
- 3.1.3 ANSI N3.1 - 1987, Selection, Qualifications and Training of Personnel For Nuclear Power Plants
- 3.1.4 NUREG/CR-5849 -1992, Manual for Conducting Radiological Surveys in Support of License Termination
- 3.1.5 HP-OP-003, Release of Materials from Radiologically Controlled Areas
- 3.1.6 HP-OP-002, Radiological Area Posting and Access Control

3.2 Definitions

- 3.2.1 Activity - The rate of disintegration (transformation) or decay of radioactive material. The units of activity for the purpose of this procedure are disintegrations per minute (dpm), Becquerel (Bq), or micro-Curies for loose contamination and disintegrations per minute or millirad/hour for fixed contamination.
- 3.2.2 Check Source - A sample of radioactive material in which the exact quantity of radioactive material is not known but the type and energy of the emission is known. These sources are used for field qualitative response checks or radiation detection instrumentation. These sources are labelled with a sticker that indicates an

approximate value of the count rate to be expected when performing a qualitative response check.

- 3.2.3 Contamination - Deposition of radioactive material in any place it is not desired, particularly where its presence may be harmful. The harm may be actual exposure to individuals or release of the material to the environment or general public. Contamination may be due to the presence of alpha particle, beta particle or gamma ray emitting radionuclides.
- 3.2.4 Controlled Area - Any area to which access is controlled in order to protect individuals from exposure to radiation and radioactive materials and/or to prevent the release of radioactive materials to the uncontrolled areas.
- 3.2.5 Fixed Contamination - Radioactive contamination that is not readily removed from a surface by applying light to moderate pressure when wiping with a paper or cloth disk smear, or masslin.
- 3.2.6 Minimum Detectable Activity (MDA) - For purposes of this procedure, MDA for removable radioactive contamination is defined as the smallest amount of sample activity that will yield a net count with a 95% confidence level based upon the background count rate of the counting instrument used.
- 3.2.7 Qualitative Response Check - A check of a radiation detection instrument in which the performance of the instrument is checked against a check source for response only.
- 3.2.8 Quantitative Response Check (Performance Test) - A check of a radiation detection instrument in which performance of the instrument is checked against a reference standard with an acceptance value of $\pm 10\%$ of the reference value.
- 3.2.9 Reference Standard - A sample of radioactive material, usually with a long half-life, in which the activity and the type of emission is known and is N.I.S.T. traceable. These standards are used for calibration and quantitative source checks (Performance Test) of radiation detection instruments.
- 3.2.10 Transferrable (Loose) Contamination - Radioactive contamination that is readily removed from a surface by applying light to moderate pressure when wiping with a paper or cloth disk smear, or masslin.
- 3.2.11 Radiation Work Permit (RWP) - A document generated by Health Physics to provide:
- 3.2.11.1 A description and scope of the work to be performed.
 - 3.2.11.2 The existing radiological conditions in the work area.

- 3.2.11.3 The limitations placed upon the scope of work.
- 3.2.11.4 The maximum radiological limits allowed.
- 3.2.11.5 The protective measures to be employed during the work to protect the worker(s).
- 3.2.11.6 The period of time the RWP is valid.
- 3.2.11.7 Special instructions to workers and Health Physics Technicians during the course of work.
- 3.2.11.8 The proper approvals required to start work.

4.0 PRECAUTIONS, LIMITATIONS

4.1 Precautions

- 4.1.1 Personnel performing surveys in known or suspected contaminated areas should avoid unnecessary contamination of survey instruments by using plastic film coverings and exercise care. Covering the mylar window may decrease the beta and alpha efficiency; avoid covering mylar windows.
- 4.1.2 Exercise care when performing contact measurements with mylar window exposed to prevent damage.
- 4.1.3 Avoid unnecessary exposure when performing surveys by practicing good ALARA practices.
- 4.1.4 The surveyor should be aware of:
 - 4.1.4.1 The operation and limitations of the survey instrument(s) used; refer to the particular instrument's operation and calibration procedure.
 - 4.1.4.2 The anticipated range of radiation and contamination levels in the area to be surveyed.
 - 4.1.4.3 Activities in the area that may have or will change radiological safety conditions.
 - 4.1.4.4 Safety considerations and requirements in effect in the area to be surveyed.

- 4.1.4.5 The nature of the work to be performed in the area the survey is to be performed if the survey is to be used for Radiation Work Permit generation.
- 4.1.5 Radiation surveys used as a basis for Radiation Work Permits or area postings shall be performed by a Health Physics Technician meeting the requirements of Reference 3.1.3 or by an individual not meeting those requirements under the direct supervision of an Health Physics Technician.
- 4.1.6 Equipment or area surveys used to determine radiation and contamination levels for informational purposes only (such as during decontamination to check progress) may be performed by individual's not meeting the requirements of Reference 3.1.3
- 4.1.7 Health Physics Technicians shall follow all applicable RWP and posting instructions when performing radiation and contamination surveys.
- 4.1.8 Health Physics shall leave an area immediately if during the survey the radiation detection instrument in use appears to be malfunctioning or radiological conditions in the area being surveyed change unexpectedly.
- 4.1.9 All material such as smears or other survey materials shall be treated as radioactive material until a survey is performed on the material in question.
- 4.1.10 Sources of radiation smaller than the open window area of an ion chamber instrument may require the use of different beta correction factors. Also, the field beta correction factor and the contact beta correction factor will differ. Refer to the appropriate ion chamber operation and calibration procedure or the calibration sticker for these values.
- 4.1.11 Contact exposure rates shall be measured at a distance of less than one inch from the source of radiation.
- 4.1.12 Thirty-centimeter (~12 inches) readings shall be used as the whole body reading for posting purposes.
- 4.1.13 Prior to entering the area or performing any survey, each radiation detection instrument shall be:
- Battery Checked.
 - Checked for obvious physical damage.
 - Quantitatively response-checked daily prior to use.
 - Checked to ensure the instrument is within current calibration.

If any of the above conditions are unsatisfactory, the instrument shall be tagged out of service and not used.

4.2 Limitations

- 4.2.1 This procedure does not apply to characterization surveys, nor is it intended to alter current or future characterization survey techniques.
- 4.2.2 For exposure rate surveys used to determine RWP requirements, job coverage, or stay times, an ion chamber instrument should be used.
- 4.2.3 The survey techniques described in this procedure do not alter or replace the requirements of Reference 3.1.5.
- 4.2.4 When using cloths (or masslin) to perform large area smears, results shall be reported in disintegrations per minute (DPM) or mrad/hr above background. Do not attempt to quantify the survey area.
- 4.2.5 Radiation and contamination surveys may be used to write RWP's if the survey has been performed within 24 hours of RWP initiation or there is reasonable assurance that conditions have not changed.

5.0 RESPONSIBILITIES

- 5.1 The ATG Radiological Field Operations Manager shall be responsible for:
 - 5.1.1 Implementation of this procedure.
 - 5.1.2 Periodic reviews of adherence to the requirements of this procedure.
 - 5.1.3 Ensure Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure.
- 5.2 The Health Physics Supervisors shall be responsible for:
 - 5.2.1 Reviewing and approving data generated by the use of this procedure.
 - 5.2.2 Insuring personnel using this procedure comply with all procedural requirements.
- 5.3 Health Physics Technicians shall be responsible for:
 - 5.3.1 Performing the requirements of this procedure.
 - 5.3.2 Completing all required records and submitting them for review to Health Physics Supervision.

- 5.4 Junior Health Physics/Decontamination Technicians shall be responsible for:
 - 5.4.1 Performing the requirements of this procedure under direct supervision of an Health Physics Technician.
 - 5.4.2 Completing all required records under direct supervision of an Health Physics Technician.

6.0 PROCEDURE

6.1 General

- 6.1.1 Radiation and contamination surveys shall be performed on an as-needed basis. The need for performing a survey is identified by the following conditions:
 - 6.1.1.1 An RWP is needed to perform an approved job.
 - 6.1.1.2 A procedural requirement requires a survey.
 - 6.1.1.3 A condition exists where radiological data is needed to form a decision by Health Physics supervision.
 - 6.1.1.4 An investigation is required due to abnormal conditions or indications.
 - 6.1.1.5 An on-going job requires a survey to update radiological postings and/or RWP.
- 6.1.2 Determine the type of survey to be performed and select the proper radiation detection instrument(s) for the survey.
 - 6.1.2.1 Select an instrument capable of detecting the type of radiation to be surveyed.
 - 6.1.2.2 Select an instrument capable of detecting the range of exposure rate or contamination level expected.
 - 6.1.2.3 Select an instrument calibrated to the range of expected emission energy.
 - 6.1.2.4 Select an instrument that has been calibrated for the type of radiation to be surveyed.
- 6.1.3 Review and sign in on the applicable RWP for the area to be surveyed.

- 6.1.4 When entering posted or suspected high radiation areas, or unknown areas, the ion chamber instrument range selector switch shall be selected to the highest range and moved down through the lower ranges until the meter indicates on scale.
- 6.1.5 When surveying for radiation levels using an ion chamber, gamma reading shall be taken with the beta window closed.
- 6.1.6 When surveying for beta radiation levels using an ion chamber, readings shall be taken with the beta window open (OW) and then closed (CW). The beta correction factor (CF) for contact beta readings is listed on the instrument calibration sticker. The beta correction factor for field beta readings (30cm from source) is 1.5.
- Corrected beta dose rate = (OW-CW) X CF**
- 6.1.7 Instruments used to perform radiation and contamination surveys shall be operated in accordance with their operation and calibration procedure.
- 6.2 Standard Health Physics Practices concerning performance of Radiation Surveys.
- 6.2.1 Check out necessary survey instruments and comply with operational procedures of the instrument's operation and calibration procedure.
- 6.2.2 The instrument's operation and calibration procedure may be used to assist in determining necessary survey instruments. Instrument limitations are described in these procedures.
- 6.2.3 General Area Beta/Gamma Radiation Surveys.
- 6.2.3.1 General area surveys are normally conducted to measure only gamma radiation levels. However, when suspected, general area beta radiation levels can be measured with Model-9, RO2, or RO2A (or equivalent) using the field beta correction factor of 1.5. Document all general area beta radiation levels ≥ 1 mrad/HR on the survey form.
- 6.2.3.2 For general area room surveys, hold the instrument detector at waist to chest level, utilizing the highest reading obtained for documentation of survey records and postings. Normally, general area surveys are considered as being greater than 30cm away from relevant components and equipment.
- 6.2.3.3 General area room surveys for RWP's should include accessible areas and positions or levels where personnel will be performing work.
- 6.2.3.4 Survey data should be documented in accordance with Section 6.6 of this procedure.

6.3 Contact Beta/Gamma Radiation Surveys.

6.3.1 Contact surveys should be taken at approximately one inch away from relevant components and equipment.

6.3.1.1 Conduct Beta Radiation surveys:

- (a) On open radioactive systems and exposed contaminated equipment internals.
- (b) Whenever leakage from a radioactive system is in evidence or is suspected to have occurred.

6.3.2 Contact surveys should also be taken on relevant components and equipment which personnel will be likely to contact during the performance of their work.

6.3.3 When conducting contact surveys on surfaces with high levels of exposed surface contamination, obtain an open window reading and a closed window reading to determine the beta contribution.

6.3.3.1 Denote all corrected Beta readings on the survey form.

- (a) True Beta Dose Rate is determined by open window reading minus closed window reading times the beta correction factor of 1.5 for field beta measurements or the contact beta correction factor found on the calibration stickers for contact beta measurements.

6.3.4 Document survey data in accordance with Section 6.6 of this procedure.

6.4 Standard Health Physics Practices concerning Smearable Contamination Surveys.

6.4.1 Smear Surveys

6.4.1.1 Wipe a cloth or paper disc smear over an area of 100 cm². 100 cm² is approximated by a four-inch square or an 18-inch "S".

6.4.1.2 Avoid cross-contaminating the smear samples.

6.4.1.3 Count the disc smears on the appropriate counting equipment. The following guidelines should be used when counting smears.

- (a) The Model-3/44-9 or equivalent should be used for counting smears > 1,000 dpm and smears taken in posted contaminated areas for beta-gamma.

- (b) The Model-3/43-5 or equivalent should be used to count smears obtained from contaminated areas for alpha.
 - (c) All smears taken for the purpose of determining if the item or area smeared is below the posting requirements for loose activity in accordance with Reference 3.1.6, must be counted on instruments capable of detecting 20 dpm alpha and 1,000 dpm beta-gamma (Model-2929).
 - (d) Report results in units of dpm/100 cm² and document in accordance with Section 6.6 of this procedure.
- Smear results >50,000 cpm may be reported in mrad/hr/100 cm².

6.4.2 Large Area Smear Survey (Wipe)

- 6.4.2.1 Large area smears are used to obtain a gross indication of contamination levels in large areas or on pieces of equipment suspected to have contamination present. Large area smears may also be used to check normally clean areas or equipment for presence of contamination.
- 6.4.2.2 Wipe over the surface to be surveyed.
- 6.4.2.3 Count the wipe with a count rate meter equipped with a 44-9 probe or equivalent for beta-gamma and/or a Model-3/43-5 or equivalent for alpha.
- 6.4.2.4 Use the highest reading obtained for reporting results. Results should be recorded in units of dpm/wipe above background.
 - (a) When using wipes to check a clean area, or piece of equipment for contamination; if there is any indication of activity above background on the wipe, the area must be smeared using disc smears in accordance with Step 6.4.1 of this procedure.
- 6.4.2.5 Document results in accordance with Section 6.6 of this procedure.

6.5 Standard Health Physics Practices concerning Fixed Contamination Surveys.

- 6.5.1 Fixed contamination surveys are used to obtain indications of fixed contamination levels on surface areas, pieces of equipment, or tools for characterization and/or release surveys.
- 6.5.2 The Model-3/44-9 or equivalent should be used for fixed contamination surveys for beta-gamma.

- 6.5.3 The Model-3/43-5 or equivalent should be used for fixed contamination surveys for alpha.
- 6.5.4 When surveying for fixed beta-gamma contamination the probe should be held within one-half inch or less from the surface being surveyed. The movement rate of the detector probe should be one probe width per second or slower.
- 6.5.5 When surveying for fixed alpha contamination the probe should be held within one-quarter inch or less from the surface being surveyed. The movement rate of the detector probe should be one probe width per second or slower.
- 6.5.6 When performing direct scan surveys of objects, surface areas etc., static readings should be performed frequently to insure the detection of residual activity.
- 6.5.7 When performing free release or characterization surveys 100 % of all accessible areas should be direct frisk surveyed.
- 6.5.8 Use the highest reading obtained for reporting results. Results should be reported in units of net CPM above background or dpm/100 cm².

6.5.8.1 The following formula should be used for converting direct probe readings in CPM to dpm/100 cm² :

$$\text{dpm/100 cm}^2 = \frac{\text{Gross CPM} - \text{Background CPM}}{\text{Instrument Efficiency (Eff. c/d)}} \times \frac{100}{\text{Probe Area (cm}^2\text{)}}$$

- 6.5.9 Document the results in accordance with Section 6.6 of this procedure.

6.6 Documentation of Surveys

- 6.6.1 All radiation and contamination surveys shall be documented on an Radiological Survey Report ATGF-001.
 - 6.6.1.1 Smears counted with portable instruments shall have the results recorded in the appropriate columns.
 - 6.6.1.2 Drawings shall be included as necessary to clearly explain survey locations.
 - 6.6.1.3 The header of the ATGF-001 shall be complete when turned in for review.
 - 6.6.1.4 All unused blank areas of ATGF-001 shall have N/A entered in the area.

- 6.6.1.5 Survey numbers are obtained from the Radiation/Contamination Survey Log ATGF-034.
- 6.6.1.6 Gamma readings are recorded in mR/hr.
- 6.6.1.7 Corrected beta readings shall be annotated as such.
- 6.6.1.8 Neutron readings shall be annotated as mrem/hr.
- 6.6.1.9 Alpha values shall be annotated with the α symbol.
- 6.6.1.10 Beta values shall be annotated with the β symbol.
- 6.6.1.11 Contact readings shall be annotated with an asterisk.
- 6.6.1.12 30 cm readings shall be annotated with the value underlined.
- 6.6.1.13 Smear locations shall be numbered with the number circled.
- 6.6.1.14 Large area smears shall be numbered with the number inside a triangle.
- 6.6.1.15 A narrative explanation of abnormal or unsafe conditions should be included on the survey.
- 6.6.2 Smears counted with fixed instrumentation such as the Ludlum Model-2929 shall be recorded on Form ATGF-006.
- 6.6.3 Isotopic analysis results shall be attached to Form ATGF-001. The survey (ATGS) number shall be recorded on each page.

7.0 RECORDS

The following records are generated by the use of this procedure. These records shall be reviewed daily by Health Physics supervision and retained in the permanent project file.

- 7.1 Smear Counting Analysis Report, ATGF-006
- 7.2 Radiological Survey Report, ATGF-001
- 7.3 Radiation/Contamination Survey Log, ATGF-034

8.0 **FORMS**

8.1 ATGF-006, Smear Counting Analysis Report

8.2 ATGF-034, Radiation/Contamination Survey Log

8.3 ATGF-001, Radiological Survey Report

ALLIED TECHNOLOGY GROUP FIELD OPERATIONS
HEALTH PHYSICS OPERATING PROCEDURE

RADIOLOGICAL AREA POSTING AND ACCESS CONTROL

Allied Technology Group, Inc.
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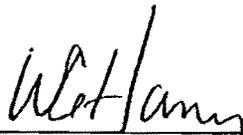
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PROCEDURE/PLAN APPROVAL PAGE

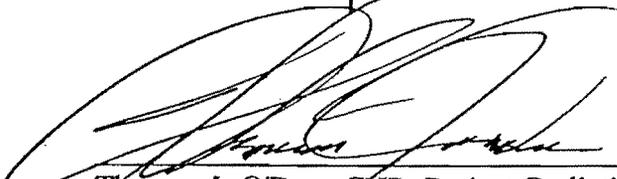
This procedure: HP-OP-002, RADIOLOGICAL AREA POSTING AND ACCESS CONTROL, has been reviewed and approved by the following:

APPROVAL SIGNATURES:



William G. Haney, Project Director

4/12/95
Date



Thomas J. O'Dou, CHP, Project Radiation Safety
Officer, HP Technical Support

4/12/95
Date

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Title: Radiological Area Posting and Access Control

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RADIOLOGICAL AREA POSTING AND ACCESS CONTROL

1.0 SCOPE

This procedure sets forth the specific requirements for posting and access control of radiological areas on Allied Technology Group, Inc. (ATG) field projects.

2.0 PURPOSE

- 2.1 The purpose of this procedure is to identify the requirements and types of signs necessary to clearly identify radiological conditions in a specific area or location within an area.
- 2.2 This procedure specifies the requirements for access to and egress from controlled radiological areas identified in this document.

3.0 REFERENCES AND DEFINITIONS

3.1 References

- 3.1.1 DOE Order 5480.11 (12-88), Radiation Protection for Occupational Workers
- 3.1.2 10 CFR 20 (1-92), Standards for Protection Against Radiation
- 3.1.3 ANSI N3.1 - 1987, Selection, Qualification and Training of Personnel for Nuclear Power Plants
- 3.1.4 HP-OP-005, Radioactive Material and Source Control
- 3.1.5 HP-OP-004, Issue and Use of Radiation Work Permits
- 3.1.6 HP-OP-001, Radiation and Contamination Survey Techniques

3.2 Definitions

NOTE: These definitions are for informational purposes only and are to be used as posting guidelines. See Section 6.0 of this procedure for actual posting requirements.

- 3.2.1 **Alarming Dosimeter:** A device which continuously integrates the dose received and alarms at pre-set dose and exposure rate settings.
- 3.2.2 **Annual Limit of Intake (ALI):** The derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide by the reference man that would result in a committed effective dose equivalent of 5 rems(0.05 Sv) or a

committed dose equivalent of 50 rems (0.5 Sv) to any individual organ or tissue. (ALI values for intake by ingestion and by inhalation of selected radionuclides are given in Table 1, Columns 1 and 2 of Appendix B of Reference 3.1.2. One ALI is equivalent to 2000 DAC-Hrs.

- 3.2.3 As Low As Reasonably Achievable (ALARA):** An approach to radiation protection for the control and management of exposure (both individual and collective) to the work force and the general public; thus ensuring a level of exposure as low as social, technical, economic, practical, and public policy considerations permit. The ALARA program is structured to increase worker awareness of exposure reduction techniques and the associated benefits of that reduction.
- 3.2.4 Barricade:** Any rope, ribbon or other barrier, yellow and magenta in color, erected to warn personnel of radiological hazards within a Controlled Area.
- 3.2.5 Controlled Area:** Any area to which access is controlled in order to protect individuals from exposure to radiation and radioactive materials and/or prevent the inadvertent release of radioactive material to the uncontrolled areas.
- 3.2.5.1 Any area, building or room in which radiological area exists shall be bounded by a Controlled Area to act as a buffer zone to protect individuals from exposure to radiation and prevent the inadvertent release of radioactive material to the uncontrolled areas.
- 3.2.5.2 Any area, building or room where residual fixed alpha contamination exceeds 100 dpm/100cm² and/or fixed beta-gamma contamination exceeds 1000 dpm/100cm².
- 3.2.5.3 Any area, building or room in which an individual may receive a dose equivalent of 0.5 mR, but less than 2 mR in any one hour at 30cm from the radiation source or from any surface through which the radiation may penetrate.
- 3.2.5.4 Any area, building or room where, in the opinion of the Radiological Field Operations Manager (Project Manager), posting of the area, building or room is necessary for adequate control of existing radiological conditions.
- 3.2.6 Derived Air Concentration (DAC):** The concentration of a given radionuclide in air which, if breathed by the reference man for w working year of 2,000 hours under conditions of light work (inhalation rate of 1.2 cubic meters of air per hour [2.4 E⁺³ m³]), results in an intake of one ALI. DAC values are given in Table 1, Column 3, of Appendix B of Reference 3.1.2. One DAC-Hr is approximately 2.5 mrem total effective dose equivalent.

- 3.2.7 Health Physics Technician:** An individual who performs radiological protection functions and meets the requirements of Reference 3.1.3.
- 3.2.8 Hot Particle:** A hot particle is a small, discrete, highly radioactive form of contamination. Because of their small size, hot particles spread easily. Because of their high dose rates and activity, hot particles on the skin can cause high dose rates to a very small area of the skin. High energy beta hot particles such as irradiated fuel fragments, exhibit penetrating beta radiation. Approximately 50% of their high energy betas will penetrate through a 90 mg/cm² shield. Low energy beta hot particles such as cobalt which originates from the activation of stellate (high cobalt alloy), exhibits low penetrating beta radiation. Approximately 10% of their low energy betas will penetrate through a 90 mg/cm² shield.
- 3.2.9 Hot Spot:** Any small (< 1ft²) location which contains or is a source of penetrating radiation with a reading of ≥ 100 mR/hr and at least 5 times the 30cm exposure rate.
- 3.2.10 Radiological Area:** A generic term used to describe any posted area within a Controlled Area where specific radiological hazards exist. Radiological Areas shall be posted with signs conforming with Reference 3.1.2. The background color is to be yellow and the symbol color may be black or magenta. The wording on the sign shall be appropriate for identification and control of the radiological hazards specified.
- 3.2.10.1 Radioactive Materials Area:** Any designated area where materials meeting or exceeding any of the following criteria are stored or used:
- * The amount of licensed material in the area exceeds 10 times the quantity of such material specified in Appendix C of Reference 3.1.2.
 - * Posting of an RMA is not required if the radioactive material is stored inside a posted Contaminated or Airborne Radioactivity Area.
- 3.2.10.2 Airborne Radioactivity Area:** Any room, enclosure, or area in which airborne radioactive materials, composed wholly or partly of licensed material, exist in concentrations
- (a) In excess of the derived air concentrations (DACs) specified in Table 1, Column 3, of Appendix B of Reference 3.1.2.
 - (b) To such a degree that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6 percent of the annual limit on intake (ALI) or 12 DAC-hours.

- 3.2.10.3 Contaminated Area: Any area where loose surface contamination levels exceed 1000 dpm/100cm² for beta-gamma emitters and/or 20 dpm/100cm² for alpha emitters.
- 3.2.10.4 Highly Contaminated Area: Any area where loose surface contamination levels are:
- * $\geq 2\text{K dpm/100cm}^2$ loose α
 - * $\geq 100\text{K dpm/100cm}^2$ loose $\beta \tau$
- unless transuranics are present then:
- * ≥ 200 dpm/100cm² loose α
 - * $\geq 50\text{K dpm/100cm}^2$ loose $\beta \tau$
- 3.2.10.5 Radiation Area: An area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 5 mrem (0.05 mSv) but less than 100 mrem in 1 hour at 30cm from the radiation source or from any surface that the radiation penetrates.
- 3.2.10.6 High Radiation Area: An area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 100 mrem (1 mSv) in 1 hour at 30cm from the radiation source or from any surface that the radiation penetrates.
- 3.2.10.7 Very High Radiation Area: An, area accessible to individuals, in which radiation levels could result in an individual receiving an absorbed dose in excess of 500 rads (5 grays) in 1 hour at 1 meter from a radioactive source or from any surface that the radiation penetrates.
- 3.2.10.8 Radiography Area: Any area where X-ray producing equipment or radioactive sources are in use to perform radiography.
- 3.2.11 **Resuspension**: The probability that loose radioactive contamination on surfaces will become airborne.

4.0 PRECAUTIONS, LIMITATIONS

- 4.1 Signs identifying radiological hazards shall be posted on all sides of the barrier surrounding the identified radiological hazard area.

- 4.2 Signs identifying radiological hazards shall be firmly attached to the barrier surrounding the identified radiological hazard with materials that will withstand the effects of adverse weather and use conditions.
- 4.3 Radiation detection instruments used to identify and quantify radiological hazards shall be:
 - 4.3.1 Calibrated with sources approximating the type emissions and energies expected during surveys.
 - 4.3.2 Have a detection capability applicable to the type emission expected.
 - 4.3.3 Used by only qualified operators.
 - 4.3.4 Have a range capable of measuring the highest expected exposure rate or contamination level expected during the survey.
- 4.4 Radiation and contamination surveys used for the purpose of radiological protection shall be performed by personnel meeting the requirements of Reference 3.1.3.
- 4.5 Entry into areas identified as Very High Radiation Areas requires prior approval from the ATG Radiological Field Operations Manager (Project Manager) for each specific entry.
- 4.6 Personnel exiting Contaminated Areas shall perform a whole-body contamination survey immediately upon exit from area.
- 4.7 A TLD or film badge is required to be worn by individuals as specified by the work plan and/or RWP.
- 4.8 Highly Contaminated Areas require an assessment to determine the probability of resuspension prior to entry. Respiratory protection, decontamination or other engineering methods will be considered in Highly Contaminated Areas prior to entry.
- 4.9 All tools and equipment leaving a Contaminated Area shall be surveyed and decontaminated or packaged and labeled prior to leaving the immediate vicinity of the Contaminated Area.

5.0 RESPONSIBILITIES

5.1 Individuals are responsible for the following:

- 5.1.1 Complying with all radiation protection instructions and postings.
- 5.1.2 No smoking, eating, drinking or chewing while in a Controlled Area.
- 5.1.3 Performing a job or task in such a manner that the creation and spread of contamination are minimized.

- 5.1.4 Performing a job or task in such a manner that complies with good ALARA practices and principles.
- 5.1.5 Presenting all tools and equipment to Health Physics personnel for surveying prior to removing the items from a Controlled Area.
- 5.1.6 Obey "Evacuate" or "Stop Work" orders from Health Physics personnel.
- 5.1.7 Not loitering in radiation areas.
- 5.1.8 Keep track of your current radiation exposure and exposure limits.
- 5.1.9 Wear dosimetry in a manner required by the Radiation Work Permit (RWP).
- 5.1.10 Performing a personal contamination survey upon exit from a Controlled Area.
- 5.1.11 Report the loss, damage or unexpected exposure of dosimetry to Health Physics immediately.
- 5.1.12 Wear protective clothing and equipment specified by the RWP or area postings.
- 5.1.13 Avoid skin or clothing contact with contaminated surfaces.
- 5.1.14 Minimize the amount of radioactive waste generated.
- 5.1.15 Maintain training qualifications current.
- 5.1.16 Notify Health Physics of wounds, sores or rashes before entering any area where contamination exists and exit immediately if a wound occurs in such an area.

5.2 Health Physics is responsible for the following:

- 5.2.1 Performing radiation, contamination, and airborne radiological surveys as necessary to verify the adequacy of area postings and the radiological controls within an area.
- 5.2.2 Installation of all radiological postings and a demonstrated understanding of control requirements.
- 5.2.3 Notifying the area occupant(s) when an area is initially posted or when area posting is changed.

6.0 AREA POSTING

6.1 When any of the criteria for a Controlled Area as defined in Section 3.2.5 of this procedure or Radiological Area are met, an area shall be properly posted using the sign specified for the identified radiological hazard.

6.2 Controlled Area

6.2.1 Controlled Areas shall be designated by clearly and conspicuously posting all accessible sides of the area with a sign bearing the following:

CONTROLLED AREA

6.2.2 To enter a Controlled Area, a person must meet all posted requirements. A Controlled Area shall surround all Radiological Areas. A TLD or film badge is required in all Controlled Areas, unless the area is specifically posted "No TLD Required for Entry".

6.3 Radiological Area

NOTE: Dose rate measurements used to determine criteria for Radiation Areas or High Radiation Areas should be made at a distance of 30cm from the radioactive source or from any surface through which the radiation penetrates.

6.3.1 An area shall be clearly and conspicuously posted as a Radiological Area by display signs on all accessible sides of the area of a yellow background with a super-imposed magenta or black trefoil.

6.3.2 Signs as defined in this procedure shall be posted as required to define specific radiological hazards/areas within a Radiological Area.

6.3.3 Access requirements for Radiological Areas shall be posted on a sign at all routine access points.

6.3.4 Radiation Area

6.3.4.1 A Radiological Area shall be posted "Radiation Area" when the following condition exists:

- (a) Any area, accessible to individuals, in which the individual could receive a dose equivalent ≥ 2 mrem but less than 100 mrem in 1

hour at 30cm from the radiation source or from any surface through which the radiation penetrates.

- 6.3.4.2 Access requirements for Radiation Areas shall be restricted to Radiation Workers wearing TLDs or film badges and signed-in on an approved RWP.
- 6.3.4.3 Radiation Areas shall be clearly and conspicuously posted by displaying on all accessible sides of the area, signs of a yellow background with a superimposed magenta or black trefoil and the words:

CAUTION RADIATION AREA

- 6.3.4.4 These Radiation Areas shall also be posted "Radiation Work Permit (RWP) Required for Entry", and "TLD or Film Badge Required for Entry".
- 6.3.5 High Radiation Area
- 6.3.5.1 A Radiological Area shall be posted "High Radiation Area" when the following condition exists:
- (a) Any area, accessible to individuals, in which the individual could receive a dose equivalent ≥ 100 mrem but less than 5 rem in 1 hour at 30cm from the radiation source or from any surface through which the radiation penetrates.
- 6.3.5.2 Access to High Radiation Areas shall be restricted to Radiation Workers wearing a TLD or film badge and a self-reading dosimeter, possessing a dose-rate instrument, and signed-in on an approved RWP.
- NOTE: In lieu of a dose rate instrument, an alarming dosimeter set to alarm at the maximum dose and exposure rate allowed by the RWP is acceptable.

- 6.3.5.3 High Radiation Areas shall be clearly and conspicuously posted by displaying on all accessible sides of the area, signs of a yellow background with a superimposed magenta or black trefoil and the words:

DANGER HIGH RADIATION AREA

- 6.3.5.4 The anticipated exposure rate or range of exposure rates should be written or posted with each sign identifying a High Radiation Area.
- 6.3.5.5 These High Radiation Areas shall also be posted "TLD or Film Badge Required", "Dose Rate Instrument or Alarming Dosimeter Required", "Radiation Work Permit (RWP) Required for Entry" and "HP Required for Entry".
- 6.3.5.6 Each point of entrance or access shall be equipped with one or more of the following:
- (a) A control device that limits the level of radiation to which an individual might be exposed to less than 100 mrem in 1 hour.
 - (b) A control device that energizes a conspicuous audible or visible alarm in such a manner that the entering individual is alerted the fact that entry into a High Radiation Area has occurred.
 - (c) Some form of positive control (such as key control) over each entry, posted with a means for secure lockout during periods when access is not required.

6.3.6 Very High Radiation Area

NOTE: Dose rate measurements used to determine criteria for Very High Radiation Areas should be made at a distance of 100cm from the radioactive source or from any surface through which the radiation penetrates.

- 6.3.6.1 A Radiological Area shall be posted "Very High Radiation Area" when the following condition exists:
- (a) Any area, accessible to individuals, in which the individual could receive a dose equivalent ≥ 5 rem in 1 hour at 1 meter from the radiation source or from any surface through which the radiation penetrates.

6.3.6.2 Access to Very High Radiation Areas shall be restricted to qualified Radiation Workers on an approved RWP, wearing a TLD or film badge and a self-reading dosimeter, and possessing a dose-rate instrument or device described in Steps 4.3 or 6.3.5.2. Additionally, individuals shall be escorted by a Health Physics Technician that is aware of dose margins and associated stay times. All personnel shall be aware of the maximum and average exposure rates prior to entry.

6.3.6.3 Very High Radiation Areas shall be clearly and conspicuously posted by displaying on all accessible sides of the area, signs of a yellow background with a superimposed magenta or black trefoil and the words:

* For exposure rates of 5 R/hr to 50 R/hr

DANGER VERY HIGH RADIATION AREA

* For exposure rates > 50 R/hr

GRAVE DANGER VERY HIGH RADIATION AREA

6.3.6.4 The anticipated exposure rate or range of exposure shall be written on, or posted with each sign identifying a Very High Radiation Area.

6.3.6.5 These Very High Radiation Areas shall also be posted "TLD or Film Badge Required", "Dose Rate Instrument or Alarming Dosimeter Required", "Radiation Work Permit (RWP) Required for Entry" and "HP Required for Entry".

6.3.6.6 Each point of entrance or access shall be equipped with a positive locking device keyed with a unique lock. Control of the keys to this area shall be maintained by the ATG Radiological Field Operations Manager (Project Manager) or his/her designee.

6.3.7 Airborne Radioactivity Area

6.3.7.1 A Radiological Area shall be posted "Airborne Radioactivity Area" when the following condition exists:

- (a) Any room, enclosure, or area in which airborne radioactive materials, composed wholly or partly of licensed material, exists

in concentrations of 10 percent of the DAC value for the specific radionuclide as listed in Table 1, Column 3, in Appendix B of Reference 3.1.2.

- 6.3.7.2 Airborne Radioactivity Areas shall be clearly and conspicuously posted by displaying on all accessible sides of the area, signs of a yellow background with a superimposed magenta or black trefoil and the words:

**CAUTION AIRBORNE
RADIOACTIVITY AREA**

- 6.3.7.3 Airborne Radioactivity Areas shall also be posted "Radiation Work Permit (RWP) Required for Entry", and "Health Physics Required for Entry".

6.3.8 Radioactive Materials Area

- 6.3.8.1 A Radiological Area shall be posted "Radioactive Materials Area" when the following condition exists:
- (a) Any area, or room in which licensed material is used or stored in an amount exceeding 10 times the quantity of such material specified in Appendix C of Reference 3.1.2.
- 6.3.8.2 Radioactive Materials Areas shall be clearly and conspicuously posted by displaying on all accessible sides of the area, signs of a yellow background with a superimposed magenta or black trefoil and the words:

CAUTION RADIOACTIVE MATERIALS AREA

- 6.3.8.3 Radioactive Materials Areas must be posted, "TLD or Film Badge Required for Entry" and "RWP Required for Entry".
- 6.3.8.4 The exterior package surface of any radioactive material shall be labeled in accordance with Reference 3.1.4.

6.3.9 Contaminated Area

- 6.3.9.1 A Radiological Area shall be posted "Contaminated Area" when the conditions outlined in Step 3.2.10.3 of this procedure exist.
- 6.3.9.2 Contaminated Areas shall be clearly and conspicuously posted by displaying on all accessible sides of the area, signs of a yellow background with a superimposed magenta or black trefoil and the words:

CAUTION CONTAMINATED AREA

- 6.3.9.3 Contaminated Areas shall also be posted "RWP Required for Entry", and "Personnel Contamination Survey Required Upon Exiting". Each Contaminated Area that is to be entered shall have a step-off pad maintained in an uncontaminated condition located at the access/egress point.
- 6.3.9.4 Contaminated Areas which require personnel access on a daily basis should have a frisking station within 10 feet of the access/egress point, if background radiation levels permit. All personnel exiting the Contaminated Area shall perform a whole-body frisk upon exiting the area.

6.3.10 Highly Contaminated Area

- 6.3.10.1 In addition to the requirements listed in step 6.3.9 contaminated areas with loose activity meeting the requirements of Step 3.2.10.4 of this procedure exist shall be posted "DANGER", or "CAUTION", "HIGHLY CONTAMINATED AREA" (vice "CONTAMINATED AREA") and "Health Physics Required for Entry".

6.3.11 Radiography Area

- 6.3.11.1 The area shall be clearly and conspicuously posted to indicate where the equipment is used, as appropriate, by a licensed radiographer.
- 6.3.11.2 Health Physics will determine and post the integrated Radiation Area and High Radiation
- 6.3.11.2 Area boundaries in accordance with Steps 6.3.4, 6.3.5, and 6.3.6 of this procedure.

6.3.12 Underground Radioactive Materials

6.3.12.1 The entrance to any area (normally outside areas) shall be posted to indicate the presence of underground items that contain radioactive materials such as pipelines, tanks, cribs, covered ponds, covered ditches, catch basins, inactive burial grounds and sites of known, covered, unplanned spills.

6.3.12.2 The entrances to the areas shall be clearly and conspicuously posted:

**CAUTION UNDERGROUND
RADIOACTIVE MATERIALS**

6.3.12.3 Underground Radioactive Material Areas shall also be posted "Pipes and Tanks", "Excavating, digging, drilling prohibited without Site Manager approval".

7.0 RECORDS

The records generated by the use of this procedure are documented in accordance with the provisions of Reference 3.1.4, 3.1.5, and Reference 3.1.6. No new records are created.

8.0 FORMS

8.1 ATGF-001, Radiological Survey Report

ALLIED TECHNOLOGY GROUP FIELD OPERATIONS
HEALTH PHYSICS OPERATING PROCEDURE

RELEASE OF MATERIALS FROM CONTROLLED AREAS

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ALLIED TECHNOLOGY GROUP, INC.

PROCEDURE/PLAN APPROVAL PAGE

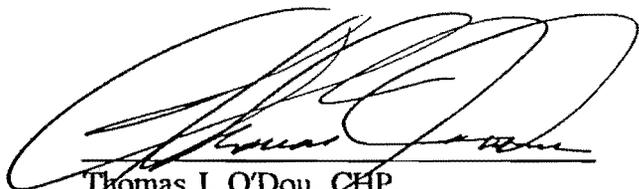
This procedure: Release of Materials From Controlled Areas has been reviewed and approved by the following:

APPROVAL SIGNATURES:



William G. Haney, Project Director

4/12/95
Date



Thomas J. O'Dou, CHP,
Project Radiation Safety Officer
HP Technical Support

4/12/95
Date

**REVISION RECORD INDICATING
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Title: Release of Materials From Controlled Areas

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RELEASE OF MATERIALS FROM CONTROLLED AREAS

1.0 SCOPE

This procedure sets forth the specific requirements for release of materials from controlled areas applicable to Allied Technology Group, Inc. (ATG) field projects.

2.0 PURPOSE

The purpose of this procedure is to specify requirements for releasing material from controlled areas and to minimize the potential for unintentionally releasing contaminated items to uncontrolled areas in accordance with the provisions of Reference 3.3.1.

3.0 REFERENCES AND DEFINITIONS

3.1 References

- 3.1.1 DOE Order 5400.5 (2-8-90), Radiation Protection of the Public and the Environment
- 3.1.2 DOE Order 5480.11 (12-21-88), Radiation Protection for Occupational Workers
- 3.1.3 10 CFR 20 (5-22-91), Standards for Protection Against Radiation
- 3.1.4 HP-OP-001, Radiation and Contamination Survey Techniques
- 3.1.5 Regulatory Guide 1.86, Termination of Operating Licenses for Nuclear Reactors
- 3.1.6 ANSI N3.1-1987, Selection, Qualification and Training of Personnel for Nuclear Power Plants
- 3.1.7 HP-IP-003, Operation and Calibration of the Ludlum Model-2929
- 3.1.8 HP-IP-001, Operation and Calibration of the Ludlum Model-3
- 3.1.9 HP-OP-002, Radiological Area Posting and Access Control
- 3.1.10 HP-OP-005, Radioactive Material and Source Control
- 3.1.11 HP-OP-004, Issue and Use of Radiation Work Permits

3.2 Definitions

- 3.2.1 Activity - The rate of disintegration (transformation) or decay of radioactive material. The units of activity for the purpose of this procedure are disintegrations per minute (dpm), Becquerel (Bq), or micro-Curies for loose contamination and disintegrations per minute or millirad/hour for fixed contamination.

- 3.2.2 Contamination - Deposition of radioactive material in any place it is not desired, particularly where its presence may be harmful. The harm may be actual exposure to individuals or release of the material to the environment or general public. Contamination may be due to the presence of alpha particle, beta particle or gamma ray emitting radionuclides.
- 3.2.3 Controlled Area - Any area to which access is controlled in order to protect individuals from exposure to radiation and radioactive materials and/or to prevent the release of radioactive materials to the uncontrolled areas.
- 3.2.4 Fixed Contamination - Radioactive contamination that is not readily removed from a surface by applying light to moderate pressure when wiping with a paper or cloth disk smear, or masslinn.
- 3.2.5 Minimum Detectable Activity (MDA) - For purposes of this procedure, MDA for removable radioactive contamination is defined as the smallest amount of sample activity that will yield a net count with a 95% confidence level based upon the background count rate of the counting instrument used.
- 3.2.6 Evaluator - An individual designated by the Radiological Field Operations Manager to evaluate materials or items in accordance with Sections 6.2, 6.3 and Step 6.5.6.
- 3.2.7 Release for Unconditional Use - A level of radioactive material that is acceptable for use of property without restrictions due to residual radioactive material without license conditions or controls. Under normal circumstances, authorized limits for residual radioactive material are set equal to, or below, the values specified in Reference 3.1.5, Table 1.
- 3.2.8 Survey Exempt Materials - The contents of sealed containers which remain unopened while in a controlled area are exempt, the outside surfaces are not exempt.

4.0 PRECAUTIONS, LIMITATIONS

4.1 Precautions

- 4.1.1 Instruments used to perform release surveys shall be operated in accordance with the respective operating procedure:
- 4.1.1.1 Ludlum Model-2929 - Reference 3.1.7
 - 4.1.1.2 Ludlum Model-3 - Reference 3.1.8
- 4.1.2 MDA for the Ludlum Model-2929 shall be in accordance with Reference 3.1.7.

- 4.1.3 Large area smears may be used to augment (but not replace) the 100 cm² smear survey. Large area wipes may be counted with the Ludlum Model-3 or equivalent. Large area smears are used to obtain immediate information concerning loose contamination for the purpose of radiological protection and to minimize time spent performing disc smears on an item easily identified as contaminated.
- 4.1.4 A release document package shall include the following forms:
 - 4.1.4.1 The Health Physics daily log.
 - 4.1.4.2 ATGF-005 - Material Release Log.
 - 4.1.4.3 ATGF-001 - Radiological Survey Report or ATGF-010, Unconditional Release of Equipment or Items Report and/or ATGF-006, Smear Counting Analysis Report.
 - 4.1.4.4 ATGF-003 - Daily Instrument Performance Test Log.
- 4.1.5 The release document shall include the following information:
 - 4.1.5.1 The date of the release survey.
 - 4.1.5.2 The number of the release survey.
 - 4.1.5.3 A description or identification of the item.
 - 4.1.5.4 The identity of the Health Physics Technician performing the release survey.
 - 4.1.5.5 The evaluator of the material for release.
 - 4.1.5.6 The release approval of the Health Physics Supervisor or designee.
- 4.1.6 All surveys performed for the release of material shall be documented on a Radiological Survey Report (ATGF-001) and/or on a Unconditional Release of Equipment or Items Report (ATGF-010).
- 4.1.7 Radiation and contamination surveys shall be performed in accordance with Reference 3.1.4.
- 4.1.8 Items identified as radioactive during the release survey shall be controlled in accordance with Reference 3.1.10.
- 4.1.9 Personnel performing release surveys shall be logged in on a Radiation Work Permit in accordance with Reference 3.1.11 (if applicable).
- 4.1.10 Audible response instruments must be used during direct scan surveys.

- 4.1.11 The instruments used for release surveys shall be within current calibration and shall have had a performance test check performed daily or prior to use in accordance with the instrument's operating procedure.
- 4.1.12 Release of materials from controlled areas shall be performed in accordance with the provisions and directives of References 3.1.1, 3.1.2, and 3.1.3.
- 4.1.13 Items presented for release shall be direct scanned in an area of low background.

4.2 Limitations

- 4.2.1 The maximum probe speed during direct scan surveys of surfaces shall be 3 cm/sec.
- 4.2.2 A response check shall be performed at the completion of the work day for instrument's used for direct scan surveys in accordance with the instruments operating procedure.
- 4.2.3 The probe face shall be held within 1/4 inch of the surface being surveyed for alpha, and within 1/2 inch of the surface being surveyed for beta-gamma.
- 4.2.4 If an instrument used to perform release surveys fails any operational check, it shall be removed from service. All data collected during the period of instrument failure must be evaluated by the Health Physics Supervisor.
- 4.2.5 Posting and access control of controlled areas shall be performed in accordance with the provisions of Reference 3.1.9.

5.0 RESPONSIBILITIES AND QUALIFICATIONS

5.1 Responsibilities

- 5.1.1 ATG Radiological Field Operations Manager
 - 5.1.1.1 Implements the requirements of this procedure.
 - 5.1.1.2 Designates qualified evaluators.
 - 5.1.1.3 Reviews the adherence of personnel to the requirements of this procedure, periodically.
 - 5.1.1.4 Ensure Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure.
- 5.1.2 Health Physics Supervisor
 - 5.1.2.1 Review the release documentation.
 - 5.1.2.2 Approve unconditional releases by signing the ATGF-005 form.

5.1.3 Health Physics Technicians

5.1.3.1 Perform the requirements of this procedure.

5.1.3.2 Adhere to other procedures (referenced in this procedure).

5.1.3.3 Document all releases.

5.2 Qualifications

5.2.1 Health Physics Technicians shall be qualified in accordance with the requirements of Reference 3.1.6 to perform release surveys of materials.

5.2.1.1 Documentation supporting qualifications shall be obtained and kept in the permanent project files.

5.2.2 Junior Health Physics/Decontamination Technicians may perform release surveys under the direct supervision of a Health Physics Technician meeting the requirements of Section 5.2.1.

5.2.3 Evaluators shall be designated by the ATG Radiological Field Operation Manager (Project Manager).

6.0 PROCEDURE

6.1 Release Limits For Gross Activity (Unknown Isotopes) - Regulatory

EMISSION	REMOVABLE (dpm/100 cm ²)	TOTAL (Fixed and Removable) (dpm/100 cm ²)
Alpha	20	100
Beta-Gamma	200	1000

NOTE: If all of the actual isotopic constituents of the contamination are known and documented on the release documents, the release limits of Table 1 of Reference 3.1.5 may be applied.

6.2 Inaccessible Surfaces

6.2.1 Items with inaccessible surfaces should be disassembled as completely as possible to facilitate release surveys. Items with inaccessible surfaces will not be unconditionally released unless evaluated by a designated evaluator who authorizes and documents the release.

6.2.2 The following guidance will be used when performing evaluations:

- A history of the item should be reviewed.
- The actual release survey shall be reviewed.
- Determination of the radiological conditions in the area the item has been used or stored shall be reviewed.
- Use of sensitive detectors such as NaI(Tl) or equivalent should be considered. (These detectors may indicate internal contamination that the Model-3 or equivalent may not detect due to its lower sensitivity to photon emissions).

6.3 Materials considered hazardous due to their physical or chemical nature and fragile items shall not be unconditionally released unless evaluated. For example, gases, pyrophoric materials, easily damaged electronic devices, or other easily damaged materials cannot be directly or indirectly surveyed. These materials will be evaluated on a case by case basis for release in a manner consistent with Section 6.2.2. Evaluation for release shall be performed by a designated evaluator only.

6.4 Survey Exempt Materials

6.4.1 Items such as briefcases, pens, papers, personal clothing, etc., are exempt from the Health Physics release survey requirements of this procedure.

6.4.2 Individuals shall survey the exempt items in the same manner as a whole body frisk when leaving a controlled area or have a Health Physics Technician perform the survey.

6.5 Survey Procedure

6.5.1 Upon receipt of an item presented for release, attempt to determine the history:

- Purpose of item.
- The current and past use of the item.
- The location(s) in which the item was used or stored.
- If the item was ever used for work with radio-active material or used in an area where radioactive material was used or stored.

This knowledge of the item history should provide the surveyor with information helpful in performing the release survey.

6.5.2 Using protective clothing such as gloves, perform large area smears of 100% of the accessible surfaces of the item using large area wipes (e.g. masslinn).

- 6.5.2.1 Determine if transferrable (loose) radioactive material is present by measuring the amount of activity on the surface of the cloth.
- 6.5.2.2 If the presence of radioactive material is indicated by a count rate above background, the item shall be treated as contaminated until the results of the disc smear survey are obtained and a determination is made concerning the actual 100 cm² loose contamination levels. The material shall be controlled in accordance with Reference 3.1.10.
- 6.5.3 Perform a direct scan of 100% of all accessible areas of the item, in accordance with the instrument's operating procedure, and Reference 3.1.4.
- NOTE:** Items presented for release shall be direct scanned in an area of low background. Preferably ≤ 100 CPM. The Health Physics Technician performing the release survey shall determine if the background is acceptable for direct scan of the item. Release surveys shall not be done in areas where background is ≥ 300 CPM.
- 6.5.3.1 If the scan indicates radioactive material on the surface of the item is less than the limits for release for total activity, proceed to 6.5.3.3.
- 6.5.3.2 If the scan indicates radioactive material on the surface of the item is greater than regulatory limits for total activity, the item cannot be released.
- 6.5.3.3 During the direct scan of the accessible surfaces of the item, a static measurement shall be taken:
- If an increase in the audible count rate is detected.
 - After each minute of scanning.
 - When the Health Physics Technician determines that an indication of fixed activity less than ten square centimeters may be present.
- 6.5.3.4 During the static measurement, the meter probe shall be held at the proper distance from the surface being surveyed for the proper response period to allow the meter reading to stabilize, in accordance with the instrument's operating procedure.
- 6.5.4 Perform disc smears of 100% of the effective surface area.
- 6.5.4.1 100% of the effective accessible surface means performing a 100 cm² disc smear on all accessible areas of the item suspected of being contaminated.

- 6.5.5 Count the smears in accordance with Reference 3.1.4.
 - 6.5.5.1 Record smear data on the Smear Counting Analysis Report (ATGF-006). If a Model-3 or equivalent was used, document the results on a Radiological Survey Report (ATGF-001).
 - 6.5.5.2 If the smear results indicate transferrable activity below the release limits, proceed to Step 6.5.6.
 - 6.5.5.3 If the smear results indicated transferrable activity above the release limits, the item cannot be released.
- 6.5.6 If the item has internal or inaccessible surfaces, have ATG personnel disassemble the item and repeat Steps 6.5.2 through 6.5.5 or have the item evaluated for release by a designated evaluator.
- 6.5.7 If the item meets the release limits or is evaluated as meeting the unconditional release criteria, complete forms ATGF-010, ATGF-005, and/or ATGF-001. Health Physics Supervision must review the release documents and approve the release prior to allowing the item to leave the controlled area.
- 6.5.8 Items identified as radioactive during the release survey shall be controlled in accordance with Reference 3.1.10.

7.0 RECORDS

The following records are generated by use of this procedure. These records will be maintained in the permanent project file.

- 7.1 ATGF-001 - Radiological Survey Report
- 7.2 ATGF-005 - Material Release Log
- 7.3 ATGF-006 - Smear Counting Analysis Report
- 7.4 HP Daily Log
- 7.5 ATGF-003 - Daily Instrument Performance Test Log
- 7.6 ATGF-010 - Unconditional Release of Equipment or Items Report

8.0 FORMS

- 8.1 ATGF-003 - Daily Instrument Performance Test Log
- 8.2 ATGF-006 - Smear Counting Analysis Report
- 8.3 ATGF-001 - Radiological Survey Report
- 8.4 ATGF-005 - Material Release Log
- 8.5 ATGF-010 - Unconditional Release of Equipment or Items Report

UNCONDITIONAL RELEASE OF EQUIPMENT OR ITEMS REPORT

JS #:	DATE:			
PROJECT/LOCATION:				
DESCRIPTION OF EQUIPMENT OR ITEMS:				
SURVEY EQUIPMENT:				
MODEL NO:	S/N:	BKRD:	EFF:	CAL DUE DATE:
MODEL NO:	S/N:	BKRD:	EFF:	CAL DUE DATE:
MODEL NO:	S/N:	BKRD:	EFF:	CAL DUE DATE:
CONTAMINATION LEVELS:				
		dpm/100 cm ² βγ	REMOVABLE	
		dpm/100 cm ² α	REMOVABLE	
		dpm/100 cm ² βγ	FIXED	
		dpm/100 cm ² α	FIXED	
<p>THIS IS TO CERTIFY THAT THE ABOVE DESCRIBED EQUIPMENT OR ITEMS HAS BEEN SURVEYED AND FOUND TO BE WITHIN ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR UNCONDITIONAL RELEASE AS REQUIRED BY NUCLEAR REGULATORY GUIDE 1.86.</p>				
HEALTH PHYSICS TECHNICIAN:				DATE/TIME:
DISPOSITION OF EQUIPMENT OR ITEMS:				
VIEWED BY:				DATE:

ALLIED TECHNOLOGY GROUP FIELD OPERATIONS
HEALTH PHYSICS OPERATING PROCEDURE

ISSUE AND USE OF RADIATION WORK PERMITS

Allied Technology Group, Inc.
47375 Fremont Blvd.
Fremont, California 94538

Prepared by

D. Spicuzza

Allied Technology Group, Inc.

PROCEDURE/PLAN APPROVAL PAGE

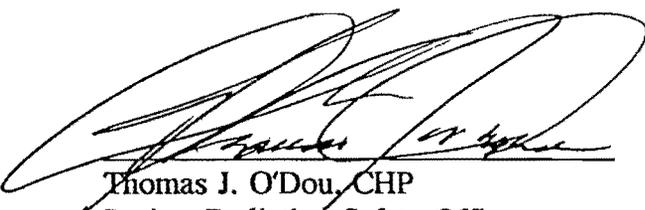
This procedure: **ISSUE AND USE OF RADIATION WORK PERMITS**, has been reviewed and approved by the following:

APPROVAL SIGNATURES:



William G. Haney, Project Director

4/12/95
Date



Thomas J. O'Dou, CHP
Project Radiation Safety Officer
HP Technical Support

4/12/95
Date

REVISION RECORD INDICATING
LATEST DOCUMENT REVISION

Procedure Number: HP-OP-004

Title: ISSUE AND USE OF RADIATION WORK PERMITS

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ISSUE AND USE OF RADIATION WORK PERMITS

1.0 SCOPE

This procedure describes the circumstances when a Radiation Work Permit (RWP) is required and addresses the requirements for planning, developing, issuing, modifying, using, and terminating RWPs. This procedure applies to all radiation workers working on A.T.G. field projects.

2.0 PURPOSE

The purpose of this procedure is:

- 2.1 To provide requirements and specifications for the preparation, use, modification, and termination of Radiation Work Permits.
- 2.2 To provide guidelines to specify appropriate protective measures within the scope of the work based upon the radiological conditions in the area.
- 2.3 To provide the documentation requirements for radiological surveys used to generate RWPs based upon sound radiological judgements for all A.T.G. field project sites.
- 2.4 To provide a complete document addressing existing radiological conditions, work scope and limitations, radiological limitations, specific protective requirements, ALARA considerations and instructions to Health Physics Technicians.

3.0 REFERENCES AND DEFINITIONS

3.1 References

- 3.1.1 DOE Order 5480.11, Radiation Protection for Occupational Workers
- 3.1.2 10 CFR 20, Standards for Protection Against Radiation
- 3.1.3 ANSI N3.1-1987, Selection, Qualification and Training of Personnel for Nuclear Power Plants
- 3.1.4 Respiratory Protection Program for A.T.G.
- 3.1.5 RP-OP-001, Selection and Use of Respiratory Protection Equipment
- 3.1.6 HP-OP-010, Air Sampling and Analysis
- 3.1.7 HP-OP-002, Radiological Area Posting and Access Control
- 3.1.8 HP-OP-001, Radiation and Contamination Survey Techniques
- 3.1.9 HP-OP-011, DAC-HR Tracking

3.2 Definitions

- 3.2.1 **Multi-Badging** - The placement of more than one dosimetric device to monitor dose received in non-uniform radiation fields.
- 3.2.2 **Non-Uniform Fields** - Radiation fields that deliver significantly different doses to body areas resulting in non-uniform whole body exposures.
- 3.2.3 **Stay Time** - The time a person is allowed to remain in a radiation field based upon exposure rate and remaining allowable dose.
- 3.2.4 **Alarming Dosimeter** - A device which continuously integrates the dose received and alarms at pre-set dose and/or exposure rate settings.
- 3.2.5 **ALARA Review** - A formal document in which ALARA requirements for a specific RWP are delineated.
- 3.2.6 **Self Reading Dosimeter** - A device which measures gamma and x-ray exposure and is usually worn adjacent the TLD or film badge.
- 3.2.7 **Health Physics Supervisor** - An individual who has the authority to approve an RWP for use.
- 3.2.8 **RWP Writer** - A individual who writes and submits an RWP for approval.
- 3.2.9 **Continuous** - A term used to describe job coverage requirements that means within line of sight or direct communication to the worker. The use of cameras and communication systems may be used.
- 3.2.10 **Modification** - Minor adjustments or alterations to an existing RWP.
- 3.2.11 **Extended RWP** - A RWP that has the end of the calendar year as an expiration date and used for ongoing routine work. An extended RWP is for work in areas with low radiological hazards.

4.0 PRECAUTIONS, LIMITATIONS, DISCUSSION

4.1 Precautions

- 4.1.1 Radiological work shall be stopped and placed in a safe condition if any unsafe condition or work practice is observed in the work area. Health Physics Technicians have Stop Work authority based upon radiological and/or safety considerations.
- 4.1.2 RWP surveys shall be performed periodically during work to determine the extent (if any) of changes in radiological conditions.

- 4.1.3 During a declared emergency situation, RWP requirements may be waived to facilitate medical actions, fire fighting, etc.
- 4.1.4 Copies of work plans/instructions should be placed with the RWP, if applicable. The detailed work instructions/plans are more in depth and should be referenced periodically during work.
- 4.1.5 Issue and use of RWPs shall be performed in accordance with the requirements and articles of References 3.1.1 and 3.2.1.

4.2 Limitations

- 4.2.1 Radiological limits and protective requirements specified in the RWP shall not be altered without specific written authorization by the Health Physics Supervisor or his/her designee.
- 4.2.2 An RWP should not be used unless a radiological survey has been performed in the work area within the last 24 hours or there is reasonable assurance that conditions have not changed as determined by the Health Physics Supervisor or his/her designee.
- 4.2.3 When an RWP requirement is altered, all personnel under the RWP must be re-authorized on ATGF-023, prior to resuming work, acknowledging the changes made.

4.3 Discussion

A requirement for continuous Health Physics coverage does not mean that a technician cannot leave the jobsite for a reasonable length of time to obtain air sampling supplies, instrumentation or other necessary equipment to perform his/her work. It is a judgement made by the technician assessing the hazard and the probability of an unsafe condition developing during the time he is absent from the jobsite. It should be noted that Health Physics techniques are not rigid in their application because of large number of variables that can be encountered during the course of work. Some degree of latitude is required to allow the technician to perform his work safely, effectively, and efficiently.

For example, a minimal hazard condition in which personnel are wearing full face filter type respirators may permit the technician to leave for several minutes to obtain equipment whereas a job in which personnel performing the work evolution are wearing full face airline respirators would preclude the technician from leaving the area for any length of time. In the second case, normally a second technician would assist the first in obtaining equipment or supplies.

5.0 RESPONSIBILITIES

5.1 **ATG Radiological Field Operations Manager (Project Manager) shall be responsible to:**

- 5.1.1 Implement this procedure.
- 5.1.2 Periodically review the adherence of personnel to the requirements of this procedure.
- 5.1.3 Ensure Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure.
- 5.1.4 Periodically review RWP practices to ensure procedural compliance.
- 5.1.5 Periodically review RWPs involving significant radiological conditions.
- 5.1.6 Approve RWPs covering High Radiation Areas and Very High Radiation Areas.

5.2 **Health Physics Supervisors shall be responsible to:**

- 5.2.1 Terminate or extend RWPs.
- 5.2.2 Review and approve RWPs for use.
- 5.2.3 Assign Health Physics Technicians performing RWP job coverage.
- 5.2.4 Perform pre-job RWP briefings with personnel using the RWP.
- 5.2.5 Ensure RWPs are written in a timely manner prior to the start of scheduled work.

5.3 **Health Physics Technicians shall be responsible to:**

- 5.3.1 Perform the requirements of this procedure:
 - 5.3.1.1 RWP job coverage and associated surveys.
 - 5.3.1.2 RWP surveys for RWP generation.
 - 5.3.1.3 RWP writing.
- 5.3.2 Ensure workers are following the requirements of the RWP.
- 5.3.3 Stop work if:
 - 5.3.3.1 Radiological conditions exceed the limits specified in the RWP.
 - 5.3.3.2 Any unsafe condition exists in the work area.
 - 5.3.3.3 Non-compliance with procedural requirements occurs.

5.3.4 Ensure dosimetry, including multiple dosimetry is properly placed on individuals prior to entering the work area (when required).

5.4 Junior Health Physics/Decontamination Technicians shall:

5.4.1 Perform the requirements of this procedure under direct supervision of a Health Physics Technician.

5.5 RWP Users shall be responsible to:

5.5.1 Read, understand, sign, and comply with all of the requirements and limitations of the RWP.

5.5.2 Meet all RAD worker qualifications required by the RWP, and maintain RAD worker qualifications current.

5.5.3 Complete the RWP sign in sheet. (ATGF-023).

5.6 Industrial Hygiene (IH)/Safety Technicians shall be responsible to:

5.6.1 Review and approve the RWP for use if there are industrial hygiene/safety considerations. (If applicable).

5.7 Health Physics Planner (Usually a Health Physics Technician or Health Physics Supervisor assigned to write the RWP) shall:

5.7.1 Write the RWP in accordance with the requirements of this procedure.

6.0 RWP ISSUE AND USE

6.1 Prerequisites

6.1.1 A RWP is required when:

6.1.1.1 Entering any posted radiological area, or

6.1.1.2 When work will occur in any controlled area where general area exposure rates exceeds 0.5 mR/hr gamma or 2.5 mrad/hr corrected beta @ 30cm or

6.1.1.3 Health Physics determines that a situation warrants radiological controls in the form of an RWP.

6.2 Initiation and Issue

6.2.1 The Health Physics Supervisor shall perform, or assign a Health Physics Technician to perform a survey of the work area in accordance with Reference 3.1.8, paying particular attention to the following:

6.2.1.1 Prior to performing a work area survey, the surveyor shall be as knowledgeable as possible about the nature of the work to be performed (disassembly, grinding, decontamination, jackhammering, welding, etc.), the specific component or equipment to be worked on, the positions the workers may take to perform the work (lying under a pump, leaning against one component to work on another, etc.), and the possibility of the presence of highly radioactive debris.

- * All surveys used to assess work conditions in preparation for a job shall clearly describe all the radiological hazards present in the work area. The following guidelines should be considered when performing a work area survey:
- * What are the contamination, radiation and airborne radioactivity levels at the position(s) where the individual is to work?
- * Where are designated radiation, high radiation, contaminated areas boundaries?
- * Are there any special radiological hazards or hot spots to avoid?
- * Is the area currently wet or greasy or will it become wet or greasy from the work?
- * If work on a specific component is required, what are the contact and 30cm dose rates for the component?
- * Is there or could there be any highly radioactive debris present?
- * What additional safety hazards may be encountered at the job site?

6.2.2 Upon completion of the radiological survey, the survey shall be reviewed/approved by the Health Physics Supervisor in accordance with Reference 3.1.8. and a copy forwarded to the Health Physics Technician/Supervisor (Planner) assigned to write the RWP.

6.2.3 The Health Physics Technician assigned to write the RWP shall complete Section I of the RWP (ATGF-002).

6.2.3.1 Above Section I

- * Indicate if the RWP is a regular RWP that will expire when the job is completed or an extended RWP that will cover ongoing work and expire at the end of the year.
- * Enter the RWP number.

6.2.3.2 Section I

- * Complete all parts of Section I.
- * A clear description of the work activity is very important. Information regarding the exact location and scope of work is essential to adequately establish the current and anticipated radiological conditions in the area.
- * Words such as "troubleshoot" or "repair" are discouraged. The full extent of the job should be described.

- 6.2.4 The Health Physics Technician shall complete Section II of the RWP entering all existing radiological conditions, source of survey information, and the number of the RWP survey.
- 6.2.5 The Health Physics Technician or ALARA designee will complete the ALARA Considerations Form (ATGF-024), if applicable, and attach to the RWP (ATGF-002).
- 6.2.6 The Health Physics Technician will complete the radiological limits in Section III of the RWP.
- 6.2.7 An Industrial Hygiene/Safety Technician will complete the industrial hygiene/safety concerns section of Section III of the RWP if applicable.
- 6.2.8 The Health Physics Technician will complete the individual sections of Section IV based upon the recommendations in Exhibit I.
- 6.2.8.1 Protective clothing requirements.
 - 6.2.8.2 Dosimetry requirements.
 - 6.2.8.3 Special Instructions.
 - 6.2.8.4 Respiratory protection requirements.
 - 6.2.8.5 Respirator filter cartridge requirements.
 - 6.2.8.6 Applicable stay times.
- 6.2.9 The Health Physics Technician shall sign ATGF-002 and give the partially completed RWP to the Health Physics Supervisor for completion.
- 6.2.10 The Health Physics Supervisor or his/her designee shall complete Section V of the RWP.

- 6.2.10.1 Job coverage requirements.
- 6.2.10.2 Survey requirements and frequencies.
- 6.2.10.3 Air sampling frequencies.
- 6.2.10.4 ALARA Considerations (if applicable).
- 6.2.11 The Health Physics Supervisor or his/her designee shall review Sections I through V for accuracy and correctness as necessary.
 - 6.2.11.1 The Health Physics Supervisor shall notify the ATG Genoa office of any special dosimetry requirements.
 - 6.2.11.2 The Health Physics Supervisor shall notify the ATG Genoa office if any special instrumentation is required.
 - 6.2.11.3 The Health Physics Supervisor shall notify the ATG Genoa office if respiratory protection equipment is to be used.
- 6.2.12 Upon completion of Step 6.2.11, the Health Physics Supervisor or his/her designee shall sign and approve the RWP for use unless:
 - 6.2.12.1 The RWP is for a High Radiation Area or Very High Radiation Area, in which case the ATG Radiological Field Operations Manager (Project Manager) shall also review and approve the RWP.
 - 6.2.12.2 In addition to the radiological conditions, there are industrial hygiene/safety aspects which could impact upon the safe completion of the work of the RWP. In this case, the Industrial Hygiene/Safety Technician shall review the RWP; ascertain that the proposed work description is acceptably safe and is accordance with the provisions of the Industrial Hygiene Safety Pre-Job Checklist (ATGF-025) and industry standards, and shall approve the RWP for use.

NOTE: If the RFO Manager, IH/Safety Group, signatures are not required, the Health Physics Supervisor shall indicate Not-Applicable (N/A) in Section H of ATGF-002. All blanks spaces on the RWP shall be filled out with the appropriate information/data. If there is no data entered in a section of the RWP, or that section is not applicable, the Health Physics Supervisor shall indicate Not-Applicable (N/A) in the section or space of concern.
- 6.2.13 Upon approval, the Health Physics Supervisor shall notify the ATG work crew that the RWP has been issued.

6.3 Use of the RWP

- 6.3.1 Prior to the initial use of any RWP, the user(s) shall read, and sign Section VI (Personnel Authorized to Perform Work & Acceptance of Responsibility) of the RWP to indicate that he/she understands the requirements of the RWP. Any questions shall be answered by the Health Physics Supervisor.
- 6.3.2 Prior to the initial use of the RWP, the Health Physics Supervisor or his/her designee shall conduct a pre-job briefing with the work crew members.
- 6.3.2.1 Pre-job briefings shall be documented on Forms ATGF-025 (Industrial Hygiene/Safety) or ATGF-026 (Health Physics) and accompanied by a ATGF-027 Attendance Record.
- 6.3.3 The RWP user shall:
- * Sign in on the RWP sign-in sheet, ATGF-023, if applicable.
 - * Adhere to all RWP requirements.
 - * Contact Health Physics if work scope or job conditions change.
 - * Sign-out of the RWP when leaving the work area, if applicable.
 - * Wear dosimetry as prescribed by the RWP.
 - * Attend pre-job briefings and post-job briefings.
 - * Follow stop work instructions when issued.
- 6.3.4 A copy of the RWP will be kept at the work area location at all times.

6.4 RWP Modification or Extension

- 6.4.1 In the event that conditions or scope of the work changes that do not justify the generation of a new RWP, two modifications or extensions of the RWP may be made by the Health Physics Supervisor.
- 6.4.2 When modifying the RWP, all copies must be modified in the same manner.
- 6.4.3 The Health Physics Supervisor shall obtain all copies of the RWP and make the necessary changes. Each change shall be made in the following manner:
- * Each change will be made with a single line cross out of the text, or area of concern.

- * The Health Physics Supervisor shall initial and date adjacent to each change made to the RWP.
 - * The Health Physics Supervisor can add any additional comments adjacent to the change, to help justify the change being made.
- 6.4.3.1 The modification of the RWP shall be annotated on all copies by placing "R-1" (first modification) or "R-2" (second modification) and the date in the upper right hand corner of the RWP.
- 6.4.3.2 A RWP may be modified or extended two times. In the event more changes are necessary, the RWP will be terminated and a new RWP generated.
- 6.4.4 Upon completion of the modification or extension of the RWP and prior to use, the approval/review signatories of the original RWP shall initial and note agreement with the modification by placing "R-1/initials" or "R-2/initials" and the date in the block for RWP approval by position.
- 6.4.5 The Health Physics Supervisor shall communicate all changes made to the RWP to the affected work crew, and work crew supervisors.

6.5 RWP Termination

- 6.5.1 The RWP shall be terminated by signing the "Termination" (Section I) block for any of the following reasons:
- * Job completion.
 - * Significant change in work scope.
 - * Significant change in radiological conditions that exceed RWP limits.
 - * For cause (RWP violations).
 - * RWP revision.
 - * End of the calendar year.
- 6.5.2 Upon termination of an RWP, the original RWP will be retained in the permanent project file. All other copies will be kept at an ATG designated office.

7.0 RECORDS

The following records will be generated and retained in the permanent project file as a result of using this procedure.

- 7.1 ATGF-001 - Radiological Survey Report**
- 7.2 ATGF-002 - Radiation Work Permit**
- 7.3 ATGF-023 - RWP Sign-In Sheet**
- 7.4 ATGF-024 - ALARA Considerations Form**
- 7.5 ATGF-025 - Pre-Job Briefing Checklist (IH/Safety)**
- 7.6 ATGF-026 - Pre-Job Briefing Checklist (Health Physics)**
- 7.7 ATGF-027 - Training Attendance Record**

8.0 FORMS AND EXHIBITS

8.1 Forms

- 8.1.1 ATGF-001 - Radiological Survey Report**
- 8.1.2 ATGF-002 - Radiation Work Permit**
- 8.1.3 ATGF-023 - RWP Sign-In Sheet**
- 8.1.4 ATGF-024 - ALARA Considerations Form**
- 8.1.5 ATGF-025 - Pre-Job Briefing Checklist (IH/Safety)**
- 8.1.6 ATGF-026 - Pre-Job Briefing Checklist (Health Physics)**
- 8.1.7 ATGF-027 - Training Attendance Record**

8.2 Exhibits

- 8.2.1 RWP Radiation Protection Recommendations for RWP Generation**

RADIATION WORK PERMIT (RWP)

WP #: _____

Regular Extended

SECTION I

Contract #	Date: / /	Time:
Location/Project:		
Exposure Category: <input type="checkbox"/> D&D <input type="checkbox"/> Demolition <input type="checkbox"/> Waste Processing <input type="checkbox"/> CHAR		
Job Description: _____ _____		
Estimated Start Date: / /		Estimated End Date: / /

SECTION II

Existing Radiological Conditions:

Radiation Survey No. _____ Airborne Survey No. _____ Contamination Survey No. _____

Existing General Area Radiation Level(s): β γ N _____ mR/hr/ γ _____ mrad/hr/corrected β _____ mrem/hr/N	Existing General Contamination Levels: _____ dpm/100cm ² $\beta\gamma$ _____ dpm/100cm ² α	Airborne DAC Level(s): α _____ % P $\beta\gamma$ _____ % P _____ % H ₃
Existing Maximum Radiation Level(s): β γ N _____ mR/hr/ γ _____ mrad/hr/corrected β _____ mrem/hr/N	Existing Maximum Contamination Level(s) _____ dpm/100cm ² $\beta\gamma$ _____ dpm/100cm ² α	Hot Particle? <input type="checkbox"/> Yes <input type="checkbox"/> No

Remarks: _____

SECTION III

Radiological Limits:

Maximum Allowed WB Exposure Rate γ N: _____ mr/hr or mrem/hr

Corrected β : _____ mrad/hr Maximum Extremity Exposure Rate: _____ mr/hr

Maximum Allowed Contamination Level $\beta\gamma$: _____ dpm/100cm² α : _____ dpm/100cm²

Maximum Allowed Airborne Concentration Level: _____ % DAC

Remarks: _____

Industrial Hygiene/Safety Concerns: _____

RADIATION WORK PERMIT (RWP)

RWP #: _____

Regular Extended

SECTION IV

WORKER REQUIREMENTS

<u>CLOTHING:</u>	<u>DOSIMETRY:</u>	<u>INSTRUCTIONS:</u>	<u>RESPIRATORY:</u>
<input type="checkbox"/> Coveralls <input type="checkbox"/> Lab Coat <input type="checkbox"/> Cloth Hood <input type="checkbox"/> Paper Coveralls <input type="checkbox"/> Plastic Suit <input type="checkbox"/> Plastic Booties <input type="checkbox"/> Rubber Shoe Covers <input type="checkbox"/> Canvas Shoe Covers <input type="checkbox"/> Cotton Gloves <input type="checkbox"/> Rubber Gloves <input type="checkbox"/> Leather Gloves <input type="checkbox"/> Beta Goggles/Face Shield <input type="checkbox"/> Extra <input type="checkbox"/> Other Clothing _____ _____ Stay Time (Heat Stress, Radiation, Exposure Limits, etc.): _____ hrs.	<input type="checkbox"/> TLD <input type="checkbox"/> Film Badge <input type="checkbox"/> SRD <input type="checkbox"/> Standard <input type="checkbox"/> Elbows <input type="checkbox"/> Gonad Pack <input type="checkbox"/> Hot Cell Entry <input type="checkbox"/> Extremity <input type="checkbox"/> Head Pack <input type="checkbox"/> Special <input type="checkbox"/> Knees <input type="checkbox"/> Varying Field <input type="checkbox"/> Upper Field <input type="checkbox"/> Ground Field <input type="checkbox"/> Alarming Dosimetry <input type="checkbox"/> None	<input type="checkbox"/> Contact HP for Line Breaks <input type="checkbox"/> Protect Cuts <input type="checkbox"/> Pre-Job Briefing <input type="checkbox"/> Post-Job Briefing <input type="checkbox"/> Contact HP Prior to Work in New Areas <input type="checkbox"/> Modesty Required <input type="checkbox"/> Site Specific Instructions <input type="checkbox"/> Equipment Monitor at Job End <input type="checkbox"/> Clean Up Work Area During and After Job <input type="checkbox"/> Eating, Drinking, Smoking, Chewing Prohibited <input type="checkbox"/> Frisk Upon Exiting Contaminated Area <input type="checkbox"/> Have Prescribed HP Coverage or Stop Work <input type="checkbox"/> Exit Area Immediately Upon Emergency or Injury. Notify HP Immediately	<input type="checkbox"/> FFNP <input type="checkbox"/> FFAL <input type="checkbox"/> SCBA <input type="checkbox"/> PAPR <input type="checkbox"/> Dusk Mask <input type="checkbox"/> Half Face <input type="checkbox"/> Bubble Hood <input type="checkbox"/> _____ <u>Cartridges:</u> <input type="checkbox"/> Particulate <input type="checkbox"/> Vapor <input type="checkbox"/> Combination <input type="checkbox"/> Other _____ _____ _____

Special Instructions: _____

SECTION V

Health Physics Requirements

1. Job Coverage: Continuous Intermittent Start End of Job
2. Air Sampling: General Area Breathing Zone Lapel AgZ
 Tritium/C-14 Particulate Charcoal LoVol HiVol
3. Exposure Rate Surveys: Start of Job Continuous Monitoring Area Monitoring
 Intermittent Monitoring End of Job
4. Contamination Surveys: Start of Job Continuous Monitoring
 Intermittent Monitoring End of Job
5. Is the ALARA Consideration Complete and Attached? Yes No Why? _____
6. Other: _____

ALARA CONSIDERATIONS

SECTION I: GENERAL INFORMATION			
PROJECT:		RWP #:	
JOB LOCATION:		START DATE:	
PROJECT MANAGER:		END DATE:	
JOB DESCRIPTION:			
SECTION II: PERSON-REM ESTIMATE (Total)			
TASK No. & TITLE	ESTIMATE PERSON-HOURS	EFF. DOSE EQUIVALENT RATE (rem/hr)	ESTIMATE PERSON-REM
SECTION II - B: POST AND PRE-JOB DOSE ESTIMATES			
Total Estimate (Pre-Job) Person-Rem:		Entered By:	Date:
Total Estimate (Post-Job) Person-Rem:		Entered By:	Date:

SECTION III: EXTERNAL RADIOLOGICAL CONTROLS				
ALARA RECOMMENDATIONS	YES	NO	N/A	REMARKS
Decontamination				
Flushing/Filling				
Temporary Shielding				
Pre-Job Meeting				
Special Training (Mock-Up)				
Stay Time				
Post Low Dose Areas				
Other (Specify)				
CONTROLS IN LIEU of RESPIRATORS				
Respiratory Protective Devices				
Full Face Particulate				
Supplied Air				
Self Contained Breathing Apparatus				
Other (Specify)				

ALARA CONSIDERATIONS - (continued)

SECTION IV: INTERNAL RADIOLOGICAL CONTROLS				
CONTROLS IN LIEU of RESPIRATORS	YES	NO	N/A	REMARKS
Ventilation				
Decontamination				
Containments				
Relocation of Work				
Stay Time (DAC-Hours)				
Total Estimate (Pre-Job) Person-Rem:	Entered By:			Date:
Total Estimate (Post-Job) Person-Rem:	Entered By:			Date:

Prepared By: _____ Date: _____

Approved By: _____ Date: _____

Additional Approvals Required: YES NO (If YES, See below)

REQUIRED APPROVALS			
RWP#:	Total Person-Rcm Estimates		
Job Description:	Individual:		mrem
	Collective:		mrem
> 500 mRem INDIVIDUAL or > 5,000 mRem COLLECTIVE			
	NAME	SIGNATURE	DATE
Health Physics Supervisor			
RFO/Project Manager			
> 1,000 mRem INDIVIDUAL or > 10,000 mRem COLLECTIVE			
Health Physics Supervisor			
RFO/Project Manager			
ATG Corp. Health Physicist			

PRE-JOB BRIEFING CHECKLIST
(Industrial Hygiene/Safety)

Briefing is required for every job. Each of the following topics must be included in the briefing.

1. SAFETY REQUIREMENTS All Industrial Safety Hazards discussed, such as:			
	Yes	No	N/A
Confined Spaces			
Adequate Lighting			
Toxic or Explosive Gases			
IDLH			
Excessive Heat			
Housekeeping			
Hearing Protection:			
Hardhats:			
O ₂ Analyzer:			
Safety Glasses:			
Gloves: Type:			
Fire Protection			
Organic Vapor Monitor:			
Foot Protection			
Explosive/Combustible Gas Monitor:			

WORK AREA HAZARDS:

- A.
- B.
- C.
- D.
- E.
- F.

3. OTHER SAFETY REQUIREMENTS and/or SAFETY EQUIPMENT:

- A.
- B.
- C.
- D.
- E.
- F.

4. JOB SPECIFIC DISCUSSION:

- A.
- B.
- C.
- D.
- E.
- F.

Briefing Conducted By (Print / Sign)

Date / Time

**PRE-JOB BRIEFING CHECKLIST
(Health Physics)**

1. Identify Stop Work Authority:			
2. HP Coverage (Intermittent, continuous):			
3. Exposure Limitation/Goal:			
4. Conditions Expected (per RWP):			
Radiation	Contamination	Airborne	Neutron
Hot Particles	Potential Changes (debris, line-ups, opening systems, etc.)		
5. Review:			
Protective Clothing?			Yes
Respiratory Protection?			No
Special Dosimetry?			N/A
Air Sampling?			
Laydown Areas Set Up?			
Keys Available?			
Control Point?			
Communications Established?			
Special Instructions (per RWP)			
7. Radiological Hold Points: Identify criterion for each point:			
8. ALARA Considerations (shielding, decon, hot spots, low dose areas, etc.):			
A.			
B.			
C.			
9. Job Specific Discussion			
10. Turnover Frequency (every shift, day, etc):			
Must cover these topics:			
ALL WORKERS MUST SIGN ATTACHED TRAINING ATTENDANCE FORM ATGF-027.			
Health Physics Supervisor Review:			
Briefing Conducted By (Print / Sign)			Date / Time

EXHIBIT 1

RWP RADIATION PROTECTION RECOMMENDATIONS FOR RWP GENERATION

PROTECTIVE CLOTHING AND EQUIPMENT

<p>>500 K dpm/100cm² loose βΓ and/or >50 K dpm/100cm² loose α</p>	<p>Cloth Coveralls Plastic Suit w/Hood 2 pr. Rubber Gloves 2 pr. Plastic Shoe Covers</p> <p>Cloth Hood Cotton Liners Rubber Overshoes</p> <p>Tape all openings Respiratory Protection</p>
<p>Wet conditions with loose contamination</p>	<p>Cloth Coveralls Plastic Suit w/Hood 2 pr. Rubber Gloves 2 pr. Plastic Shoe Covers</p> <p>Cloth Hood Cotton Liners Rubber Overshoes</p> <p>Tape all openings Respiratory Protection Respirators should be used based upon estimated re-suspension values</p>
<p>>50 K dpm/100cm² loose βΓ and/or >5 K dpm/100cm² loose α</p>	<p>Cloth Coveralls Paper Outer Coveralls 1 pr. Rubber Gloves 1 pr. Plastic Shoe Covers</p> <p>Cloth Hood Cotton Liners Rubber Overshoes</p> <p>Tape all openings Respiratory Protection based upon work scope</p>
<p>>1K dpm/100cm² loose βΓ and/or >20 dpm/100cm² loose α</p>	<p>Cloth or Paper Coveralls Cotton Liners 1 pr. Plastic Shoe Covers</p> <p>Cloth or Paper Hood 1 pr. Rubber Gloves Rubber Overshoes</p> <p>Tape all openings</p>

RECOMMENDED HEALTH PHYSICS RWP SURVEILLANCE FREQUENCIES

<p>0.2 mR/hr to 100 mR/hr</p>	<p>Pre-job briefing Worker review of radiological survey</p> <p>Intermittent coverage</p>
<p>100 mR/hr to 1000 mR/hr</p>	<p>Pre-job briefing Continuous coverage</p> <p>Worker review of radiological survey Alarming dosimeters</p>
<p>1000 mR/hr to 5000 mR/hr</p>	<p>Pre-job briefing Continuous coverage Staytime calculations Worker review of radiological survey</p> <p>ALARA briefing Alarming Dosimeters Reliable communication system</p>
<p>Hot Particle Controls</p>	<p>Pre-job briefing Continuous coverage w/particle surveys at specified frequencies</p> <p>Worker review of radiological survey</p>
<p>Radioactive System Breach</p>	<p>Pre-job briefing Continuous coverage during breach</p>

EXHIBIT 1 (continued)

RECOMMENDED DOSIMETRY FOR RWP USE	
0.2 mR/hr to 100 mR/hr Whole Body	Whole Body TLD (or film badge) 0-200 mR PIC*
100 mR/hr to > 5000 mR/hr Whole Body	Whole Body TLD (or film badge) 0-500 mR PIC* 0-5 R PIC* Alarming dosimeter Staytime calculation (@ > 1R/hr)
Non-uniform Fields Whole Body	Multiple TLDs (or film badges) arrayed to monitor body locations Additional dosimetry as described above
> 5:1 ratio of extremity exposure rate to whole body exposure rate and at least 100 mR/hr	Extremity TLDs
> 3:1 beta eye exposure rate to gamma whole body exposure rate	Shield the eyes with safety glasses of at least 700 mg/cm ² density thickness or monitor eye exposure with a forehead TLD (or film badge)

* PIC Selection should be based on dose estimate, not dose rate.

ALLIED TECHNOLOGY GROUP FIELD OPERATIONS
HEALTH PHYSICS OPERATING PROCEDURE

DECONTAMINATION OF EQUIPMENT, MATERIALS, AND TOOLS

Allied Technology Group, Inc.
47375 Fremont Blvd.
Fremont, California 94538

Prepared by

D. Spicuzza

ALLIED TECHNOLOGY GROUP, INC.

PROCEDURE/PLAN APPROVAL PAGE

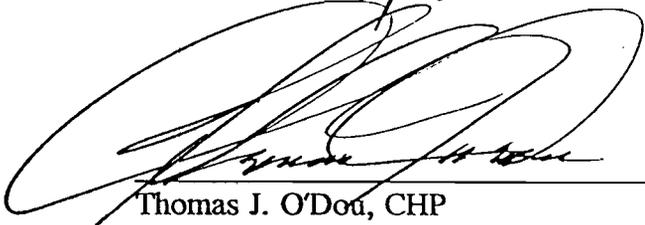
This procedure: Decontamination of Equipment, Materials and Tools has been reviewed and approved by the following:

APPROVAL SIGNATURES:



William G. Haney, Project Director

4/12/95
Date



Thomas J. O'Dou, CHP
Project Radiation Safety Officer
HP Technical Support

4/12/95
Date

**REVISION RECORD INDICATING
LATEST DOCUMENT REVISION**

Procedure Number: HP-OP-006

Title: Decontamination of Equipment, Materials and Tools

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Approval	

DECONTAMINATION OF EQUIPMENT, MATERIALS, AND TOOLS

1.0 SCOPE

This procedure establishes the procedural requirements for the decontamination of equipment, material, and tools used on ATG, Inc. field projects contaminated with radioactive material.

2.0 PURPOSE

The purpose of this procedure is to provide a instruction for the decontamination of equipment, material, and tools. Each decontamination operation is unique; thus, this procedure provides general, effective decontamination techniques and guidelines to be utilized by A.T.G. field personnel. This document applies to all A.T.G. personnel involved in the decontamination process.

3.0 REFERENCES AND DEFINITIONS

3.1 References

- 3.1.1 HP-OP-001, Radiation and Contamination Survey Techniques
- 3.1.2 Regulatory Guide 1.86, Termination of Operating Licenses For Nuclear Reactors
- 3.1.3 HP-OP-002, Radiological Area Posting and Access Control
- 3.1.4 Allied Technology Group Respiratory Protection Program
- 3.1.5 HP-OP-003, Release of Material from Radiologically Controlled Areas
- 3.1.6 HP-OP-004, Issue and Use of Radiation Work Permits
- 3.1.7 HP-OP-005, Radioactive Material and Source Control

3.2 Definitions

- 3.2.1 Decontamination - The processes whereby contamination can be safely and effectively removed from equipment, tools and materials, to levels required by Reg. Guide 1.86.
- 3.2.2 Herculite - A plastic or polyethylene floor covering used for decontamination operations. HERCULITE is a brand name.

- 3.2.3 M.S.D.S. - Material Safety Data Sheet; Manufacturer directions, safety information and limitations for use of decontamination related solvents or cleaning solutions.
- 3.2.4 Radiation Work Permit (RWP) - A document generated by Health Physics to provide:
 - 3.2.4.1 A description and scope of the work to be performed.
 - 3.2.4.2 The existing radiological conditions in the work area.
 - 3.2.4.3 The limitations placed upon the scope of work.
 - 3.2.4.4 The maximum radiological limits allowed.
 - 3.2.4.5 The protective measures to be employed during the work to protect the worker(s).
 - 3.2.4.6 The period of time the RWP is valid.
 - 3.2.4.7 Special instructions to workers and Health Physics Technicians during the course of work.
- 3.2.5 Shall - The word "shall" as used in this procedure is to be understood as denoting a mandatory requirement.
- 3.2.6 Should - The word "should" as used in this procedure is to be understood as denoting a recommendation that is a sound safety practice; it does not denote a mandatory requirement, however, is normally done unless job conditions require other actions.

4.0 PRECAUTIONS, LIMITATIONS

4.1 Precautions

- 4.1.1 All decontamination of contaminated tools or equipment shall be performed in accordance with the direction of the Health Physics Technician providing the job coverage in accordance with this Procedure, and the RWP requirements.
- 4.1.2 Decontamination activities shall be performed within a controlled area established in accordance with the provisions of Reference 3.1.3.
- 4.1.3 Controls to contain the spread of loose contamination during the decontamination activity shall be determined prior to the decontamination of equipment, material, and tools.

4.2 Limitations

- 4.2.1 Protective clothing worn by the personnel involved in decontamination activities shall be determined according to the RWP.
- 4.2.2 Decontamination cleaning solvents/solutions shall only be used in accordance with the directions and limitations listed on the manufacturer supplied MSDS. Decontamination solutions/solvents shall be approved by the Project Manager prior to use. Solvents/solutions requiring a ph adjustment shall be modified prior to use.
- 4.2.3 Respiratory protection devices required by the RWP for decontamination operations shall be selected and used in accordance with the provisions of Reference 3.1.4.
- 4.2.4 A pre-job briefing shall be held to instruct Decontamination Technicians of the conditions of the RWP. All personnel performing work in the decontamination area shall sign the RWP prior to work.
- 4.2.5 Every effort will be made by ATG personnel to avoid re-contamination of decontaminated materials. Contamination controls shall always be observed throughout a decontamination operation.
- 4.2.6 Radiation and contamination surveys shall be performed in accordance with the provisions of Reference 3.1.1.
- 4.2.7 Release of equipment, materials, and tools from the decontamination area shall be performed in accordance with the provisions of Reference 3.1.5.

5.1 Responsibilities

- 5.1.1 ATG Radiological Field Operations Manager
 - 5.1.1.1 Implementation of this procedure.
 - 5.1.1.2 Periodic reviews of the adherence of personnel to the requirements of this procedure.
 - 5.1.1.3 Ensures the health Physics Technicians are qualified by knowledge, training and experience to perform the requirements of this procedure.
- 5.1.2 Health Physics Supervisor/Evaluator
 - 5.1.2.1 The Health Physics Supervisor shall perform periodic surveillance of the decontamination operation and ensure adherence to applicable procedures.
 - 5.1.2.2 The Health physics Supervisor shall write the RWP in accordance with the provisions of Reference 3.1.6.

- 5.1.2.3 The Health Physics Supervisor shall assign job coverage assignments to Health Physics Technicians.
 - 5.1.2.4 The Health Physics Supervisor shall assure that the RWP is up-to-date prior to decontamination activities.
 - 5.1.2.5 The Health Physics Supervisor or designee shall conduct the decontamination operation pre-job briefings.
 - 5.1.2.6 The Health Physics Evaluator shall provide release evaluations of decontaminated materials in accordance with the provisions of Reference 3.1.5.
- 5.1.3 Health Physics Technician
- 5.1.3.1 The Health Physics Technician shall provide constant or intermittent job coverage as required by the RWP.
 - 5.1.3.2 Prior to the start of decontamination operations, the Health Physics Technician shall assure that the area where decontamination is to be performed is properly established in accordance with Reference 3.1.3 and all engineering controls are in place and operable.
 - 5.1.3.3 The Health Physics technician performing the job coverage shall remain cognizant of changing radiological conditions which may require different levels of personal protection equipment and/or respiratory protection equipment than the levels originally assigned for a particular decontamination operation.
 - 5.1.3.4 The Health Physics Technician performing job coverage shall be responsible for enforcing the provisions of the RWP and ALARA considerations.
- 5.1.4 Junior Health Physics/Decontamination Technician
- 5.1.4.1 The Junior Health Physics/Decontamination Technician shall decontaminate ATG equipment and tools in accordance with the provisions of this procedure.
 - 5.1.4.2 The Junior Health Physics/Decontamination Technician shall adhere to the requirements of the RWP, and ALARA considerations. The Junior Health Physics/Decontamination Technician shall comply with all directions of the Health Physics Technicians.
 - 5.1.4.3 The Junior Health Physics/Decontamination Technician shall advise Health Physics supervision if the work scope or job conditions change.

6.v **PROCEDURE**

6.1 Pre-Decontamination Preparation

- 6.1.1 The Project Manager shall initiate decontamination instructions.
- 6.1.2 A radiological survey shall be performed by a Health Physics Technician on any object which is to be removed from a controlled area.
- 6.1.3 If radiological survey results indicate that a RWP is required for decontamination, the Health Physics Supervisor shall write the RWP in accordance with the provisions of Reference 3.1.6.
- 6.1.4 If a survey indicates that decontamination is required, the item should be bagged, wrapped, or contained under the direction of Health Physics Supervision. The Health Physics Technician shall label the item in accordance with the provisions of Reference 3.1.7.
- 6.1.5 The Project Manager shall approve or disapprove the decontamination operation based on conditions of the RWP and the cost effectiveness of the operation versus disposal costs.

6.2 Establishment of the Decontamination Area

- 6.2.1 The Project Manager and the Health Physics Supervisor shall determine a location for set-up of the decontamination area.
- 6.2.2 Once a location has been established, the decontamination area shall be constructed by the Junior Health Physics/Decontamination Technicians under the direction of the Project Manager and Health Physics Supervisor.
- 6.2.3 The decontamination area should consist of:
 - 6.2.3.1 Herculited (or equivalent) floor surfaces. A double layer of Herculite (or equivalent) may be laid on the floor at the Health Physics Supervisor's direction.
 - 6.2.3.2 Herculited (or equivalent) wall surfaces, if applicable.
 - 6.2.3.3 Engineering controls (HEPA ventilation, vacuum cleaners, containment tent walls, glove bags, etc.), if applicable. Engineering controls shall be determined on the basis of the ALARA considerations section of the RWP. All possible engineering controls shall be utilized when feasible to minimize the usage of respiratory protection equipment.

- 6.2.3.4 Safe, sturdy work stations with contamination resistant surfaces. Tables that will support decontamination attempts on heavy pieces of equipment.
- 6.2.3.5 Adequate supply of overhead light, adequate electrical/compressed air supply for the operation of electrical/pneumatic driven decontamination equipment.
- NOTE:** Use caution when decontaminating with compressed air tools to minimize spread of activity in the work area. A containment with filtered inlet and exhaust is recommended.
- 6.2.3.6 Overhead lifting equipment, if applicable.
- 6.2.3.7 Adequate supply of ATG approved cleaning solutions and solvents; adequate supply of decontamination equipment such as:
- (a) Light duty decontamination equipment such as paper wipes, paper towels, masslinn towels, etc.
 - (b) Medium to Heavy duty decontamination equipment such as scrub pads, wire brushes, steel wool, files, sandpaper, etc.
 - (c) Fully stocked hand tool kit for disassembly of contaminated equipment.
 - (d) Power tools, such as drills, saws, needle guns, electric screwdrivers, etc.
 - (e) Radioactive material storage bags, stickers, etc.
 - (f) Buckets, barrels or drums for the storage of contaminated liquids, sludges or slurries, if applicable.
 - (g) Blotter paper or sorbent, if applicable.
 - (h) Approved absorbent material such as oil dry, etc., if applicable.
- 6.2.3.8 Storage drums/bags for the storage of contaminated protective clothing under direction of Health Physics supervision.
- 6.2.3.9 Proper surveillance instruments (air monitor/sampler, contamination monitor, friskers, dose rate meter, etc.) in accordance with the RWP.
- 6.2.3.10 Adequate supply of personal protective clothing, gloves, respiratory equipment, etc.

- 6.2.3.11 Step-Off Pad or Double Step-Off Pad in accordance with the provisions of the RWP.
- 6.2.3.12 A designated area within the decontamination area for the segregation of radwaste.
- 6.2.3.13 Fire extinguisher(s). If required.
- 6.2.4 Once the decontamination area has been established and stocked for operation, the bagged or wrapped contaminated or controlled equipment should be placed in the decontamination work area by Junior Health Physics/Decontamination Technicians under the direction of the Project Manager and the Health Physics Technician. Contaminated or controlled items should always be escorted by a Health Physics Technician to the decontamination area.

6.3 Decontamination

- 6.3.1 After radiological posting of the decontamination area, all requirements of the RWP shall be observed.
- 6.3.2 The preparation for decontamination of a particular tool, material, or piece of equipment shall be performed as follows:
 - 6.3.2.1 Position the wrapped item so that the written information on the wrapping is visible.
 - NOTE: Junior Health Physics/Decontamination Technicians may operate survey instrumentation for decontamination monitoring purposes. Health Physics Technicians shall oversee Junior Health Physics/Decontamination Technicians when survey instruments are in use. Survey instruments used in a known or suspected contaminated area should be protected (wrapped in plastic, poly, etc.) against possible contamination before use.**
 - 6.3.2.2 The Health Physics Technician shall direct the removal of the item from the wrapping in such a manner (rolling plastic wrapping inside out, etc.) to control the spread of contamination.
 - 6.3.2.3 An item that is highly contaminated with smearable contamination should be misted with an approved liquid. The water vapor will wet down the particulate contamination and help prevent the possibility of airborne contamination.
 - 6.3.2.4 Once the item has been removed from the wrapping and has been properly positioned, discard the wrapping as radwaste.
- 6.3.3 The following decontamination techniques should be considered for the decontamination of equipment, materials, and tools:

- 6.3.3.1 Any equipment with inaccessible areas shall be dismantled so that all surfaces are accessible for decontamination and for survey.
- 6.3.3.2 Decontamination shall be performed in a safe, effective manner.
- 6.3.3.3 The Health Physics Technician shall be notified IMMEDIATELY if the job conditions change (e.g. suspected asbestos found, presence of mercury in a switch or a light bulb, a fluid leak, or any other special circumstances).
- 6.3.3.4 A Junior Health Physics/Decontamination Technician shall be assigned as a firewatch if any spark creating decontamination techniques (grinding, etc.) are used. There shall be a dedicated fire extinguisher located within the decontamination area when these operations are done.
- 6.3.3.5 In order to secure a safe cleaning surface, the item should be positioned on the work table (if size and weight allow) and locked into a vise.
- 6.3.3.6 The decontamination area shall remain organized and free of debris. The Junior Health Physics/Decontamination Technicians shall "clean as they go."
- 6.3.3.7 A HEPA vacuum cleaner may be used during the decontamination operation for cleanup or for small volume ventilation (containments). Permanent facility ventilation shall not be used to vacuum debris.
- 6.3.3.8 Smearable Contamination Removal
- (a) When item is properly positioned for decontamination and the pre-survey has been completed, perform the following:
 - (b) Moisten the surface of the item with an approved liquid (e.g. pH adjusted SPRAY 9 or equivalent).
 - (c) Fold a paper or cloth wipe into sections, using one surface of the wipe, gently wipe contamination off in ONE direction AWAY from the body. This should reduce the possibility of personnel contamination.
 - (d) Re-fold the paper or cloth wipe so that a CLEAN surface is available (this should prevent cross-contamination) and continue until item is ready for survey.

- (e) For some materials, duct tape will effectively remove smearable contamination. Wrap the duct tape loosely around the gloved hand, ADHESIVE side OUT. Roll the tape over the contaminated area.
- (f) Re-survey.

6.3.3.9 Fixed Contamination Removal

CAUTION: High power removal techniques will make fixed activity loose and airborne. Controls to minimize contamination spread must be developed prior to the operation.

- (a) There are many techniques that can be used to remove fixed contamination. The techniques selected for a particular decontamination operation is at the discretion of the Project Manager and the Health Physics Technician. The techniques can be divided into the following categories:

- Light hand decontamination
- Abrasive hand decontamination
- Power tool decontamination
- Machine decontamination (use of abrasive bead blasters, grit blasters, high pressure water wash systems, etc.)

The specific implementation of these techniques is not included within the scope of this procedure.

- Cleaning solutions/solvents (use of ultrasonic cleaners, acid baths, electropolishing, etc.)

The specific implementation of these techniques is not included within the scope of this procedure.

- (b) Light hand decontamination consists of using many of the same techniques as described in Section 6.3.3.8 of this procedure.
- (c) Abrasive hand decontamination shall be performed in the following manner:

- Remove as much smearable contamination as possible as indicated in Section 6.3.3.8 of this procedure.
- Moisten the surface of the item(s) to contain contamination.
- Use an abrasive cleaning tool (e.g. sandpaper, steel wool, steel brush, hand grinder, etc.) to loosen fixed contamination. Clean in one direction ONLY and clean AWAY from the body to prevent personnel contamination.
- Continue to moisten the surface of the item(s) to contain contamination.
- Remove as much smearable contamination as possible per Section 6.3.3.8 of this procedure.
- Re-survey.

6.3.3.10 Power tool decontamination shall be performed in the following manner only under the direction of the Health Physics Technician.

NOTE: WHEN USING POWER TOOLS, ALWAYS CONSIDER THE POTENTIAL OF INJURY DUE TO THE HAZARDS INVOLVED. POWER TOOLS SHALL BE USED CAUTIOUSLY AND IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

- (a) Some of the electric power tools that can be used in decontamination operations are:
- drills - used to drill out contaminated areas, to disassemble contaminated components and when used with grinding wheels or disks, may be used as an abrasive tool
 - saws - used to separate contaminated pieces from clean pieces
 - grinders - used to grind fixed contamination from surfaces
 - electric screwdrivers - used in the disassembly of component parts

- (b) Some of the air-powered tools that can be used in decontamination operations are:
- Needle gun - a pneumatic tool which can remove contamination from concrete and/or steel surfaces
 - socket tools or impact hammer - used in disassembly of component parts
 - jackhammer/rotohammer - a pneumatic tool which can remove contamination from concrete and/or steel surfaces
- (c) Power tool decontamination shall be performed in the following manner:
- Remove as much smearable contamination as possible as indicated in Section 6.3.3.8 of this procedure.
 - Moisten the surface of the item lightly to contain contamination. Use a spray bottle for moistening. **DO NOT USE ELECTRIC POWER TOOLS ON A WET WORKING SURFACE. KEEP LIQUIDS AWAY FROM ELECTRIC POWER TOOLS.**
 - Whenever feasible the use of containment devices (e.g. glove box, etc.) should be used to contain the spread of contamination when using power tools for decontamination operations.
 - Use the power tool to remove fixed contamination. Clean in one direction **ONLY** and clean **AWAY** from the body to prevent personnel contamination.
 - Re-survey.

6.4 Post Decontamination

- 6.4.1 If the decontamination was successful, the Junior Health Physics/Decontamination Technician shall notify the Health Physics Technician who shall perform a free release survey in accordance with Reference 3.1.5.
- 6.4.1.1 If the item satisfies the criteria for release as in Reference 3.1.5 remove the item to a holding area for disposal and document results as in Reference 3.1.5.

- 6.4.1.2 If the item remains contaminated, attempt a second decontamination, then perform 6.4.1.1.
- 6.4.1.3 If the item remains contaminated, attempt a third decontamination ONLY by direction of the Project Manager.
- 6.4.2 If an item cannot be effectively or economically decontaminated, the Project Manager shall direct the ATG work crew to volume-reduce (reduce to component parts) the equipment, material, or tools as much as possible. The individual parts can be surveyed and released in accordance with Section 6.4.1.
- 6.4.3 If an item is volume-reduced to its component parts and decontamination is not feasible, the item parts shall be considered radwaste. Radwaste is to be segregated into similar materials for shipment purposes by the direction of the Project Manager. The Health Physics Supervisor shall direct the segregation of radwaste into the following categories:
- (a) steels, hard metals
 - (b) wood
 - (c) transite, fiber products
 - (d) paper
 - (e) rubber
 - (f) cloth (duct tape is considered a cloth)
 - (g) aluminum, soft metals (brass)
 - (h) glass
 - (i) concrete
 - (j) questionable items (e.g. light bulbs, pipe with lead solder, electronic component parts) which could be considered mixed or hazardous waste
 - (k) other categories, if applicable
- 6.4.4 After all decontamination operations have been completed a Health Physics Technician shall perform a release survey of the decontamination area and de-post the area in accordance with References 3.1.1, 3.1.2, 3.1.3, and 3.1.5.

7.0 RECORDS

The records generated by the use of this procedure are documented in accordance with the provisions of Reference 3.1.5 and Reference 3.1.6. No new records are created.

8.0 FORMS

- 8.1 ATGF-002 - Radiation Work Permit - shown in Reference 3.1.6
- 8.2 ATGF-006 - Smear Counting Analysis Report - shown in Reference 3.1.1
- 8.3 ATGF-001 - Radiological Survey Report - shown in Reference 3.1.1
- 8.4 ATGF-005 - Material Release Log - shown in Reference 3.1.5

RADIATION WORK PERMIT (RWP)

WP #: _____

Regular Extended

SECTION IV

WORKER REQUIREMENTS

<u>CLOTHING:</u>	<u>DOSIMETRY:</u>	<u>INSTRUCTIONS:</u>	<u>RESPIRATORY:</u>
<input type="checkbox"/> Coveralls <input type="checkbox"/> Lab Coat <input type="checkbox"/> Cloth Hood <input type="checkbox"/> Paper Coveralls <input type="checkbox"/> Plastic Suit <input type="checkbox"/> Plastic Booties <input type="checkbox"/> Rubber Shoe Covers <input type="checkbox"/> Canvas Shoe Covers <input type="checkbox"/> Cotton Gloves <input type="checkbox"/> Rubber Gloves <input type="checkbox"/> Leather Gloves <input type="checkbox"/> Beta Goggles/Face Shield <input type="checkbox"/> Extra <input type="checkbox"/> Other Clothing _____ _____ Stay Time (Heat Stress, Radiation, Exposure Limits, etc.): _____ hrs.	<input type="checkbox"/> TLD <input type="checkbox"/> Film Badge <input type="checkbox"/> SRD <input type="checkbox"/> Standard <input type="checkbox"/> Elbows <input type="checkbox"/> Gonad Pack <input type="checkbox"/> Hot Cell Entry <input type="checkbox"/> Extremity <input type="checkbox"/> Head Pack <input type="checkbox"/> Special <input type="checkbox"/> Knees <input type="checkbox"/> Varying Field <input type="checkbox"/> Upper Field <input type="checkbox"/> Ground Field <input type="checkbox"/> Alarming Dosimetry <input type="checkbox"/> None	<input type="checkbox"/> Contact HP for Line Breaks <input type="checkbox"/> Protect Cuts <input type="checkbox"/> Pre-Job Briefing <input type="checkbox"/> Post-Job Briefing <input type="checkbox"/> Contact HP Prior to Work in New Areas <input type="checkbox"/> Modesty Required <input type="checkbox"/> Site Specific Instructions <input type="checkbox"/> Equipment Monitor at Job End <input type="checkbox"/> Clean Up Work Area During and After Job <input type="checkbox"/> Eating, Drinking, Smoking, Chewing Prohibited <input type="checkbox"/> Frisk Upon Exiting Contaminated Area <input type="checkbox"/> Have Prescribed HP Coverage or Stop Work <input type="checkbox"/> Exit Area Immediately Upon Emergency or Injury. Notify HP Immediately	<input type="checkbox"/> FFNP <input type="checkbox"/> FFAL <input type="checkbox"/> SCBA <input type="checkbox"/> PAPR <input type="checkbox"/> Dusk Mask <input type="checkbox"/> Half Face <input type="checkbox"/> Bubble Hood <input type="checkbox"/> _____ <u>Cartridges:</u> <input type="checkbox"/> Particulate <input type="checkbox"/> Vapor <input type="checkbox"/> Combination <input type="checkbox"/> Other _____ _____ _____

Special Instructions: _____

SECTION V

Health Physics Requirements

1. Job Coverage: Continuous Intermittent Start End of Job
2. Air Sampling: General Area Breathing Zone Lapel AgZ
 Tritium/C-14 Particulate Charcoal LoVol HiVol
3. Exposure Rate Surveys: Start of Job Continuous Monitoring Area Monitoring
 Intermittent Monitoring End of Job
4. Contamination Surveys: Start of Job Continuous Monitoring
 Intermittent Monitoring End of Job
5. Is the ALARA Consideration Complete and Attached? Yes No Why? _____
6. Other: _____



HP-OP-009
Revision 0

ALLIED TECHNOLOGY GROUP FIELD OPERATIONS

HEALTH PHYSICS OPERATING PROCEDURE

PROJECT
DOSIMETRY

Prepared by:

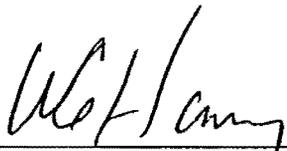
Allied Technology Group, Inc.
Technical Support Office
1515 Main Street
Genoa, Ohio 43430

Allied Technology Group, Inc.

PROCEDURE/PLAN APPROVAL PAGE

This procedure: HP-OP-009, PROJECT DOSIMETRY has been reviewed and approved by the following:

APPROVAL SIGNATURES:



William G. Haney, Project Director

4/12/95

Date



Thomas J. O'Dou, CHP, Project Radiation Safety
Officer, HP Technical Support

4/12/95

Date

REVISION RECORD INDICATING
LATEST DOCUMENT REVISION

Procedure Number: HP-OP-009

Title: Project Dosimetry

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REVISION RECORD	
Rev. No.	Date

CURRENT REVISION	
Rev. No.	0
Date	9/19/94
Approval	9/21/94

**ALLIED TECHNOLOGY GROUP, INC.
PROJECT DOSIMETRY**

1.0 POLICY

Allied Technology Group, Inc.'s (ATG) position regarding personnel monitoring is more conservative than those of the Nuclear Regulatory Commission (10 CFR 20), the International Commission on Radiological Protection (ICRP), (Publication 26), and the National Council on Radiation Protection and Measurements (NCRP), (Report 39). ATG's position is that all radiation exposures, no matter how small, should be monitored and evaluated in the spirit of ALARA, and that all radiation exposures should be as low as reasonably achievable.

All personnel who work with radioactive materials will be assigned appropriate radiation personnel dosimetry and must wear that dosimetry when working. When not in use, that dosimetry will be stored and maintained in an appropriate manner.

2.0 PURPOSE

This procedure describes the requirements for radiation personnel dosimetry and the guidelines for use and maintenance of that dosimetry. Its purpose is to provide specific guidelines for the control of project dosimetry, occupational external radiation exposure records, and maintenance of a personnel exposure history for all ATG temporary Project personnel, visitors and groups for whom monitoring is required.

Records of personnel exposure to radiation is a vitally important part of working with radioactivity and as such will require strict attention to the details of this procedure.

3.0 RESPONSIBILITY

The Allied Technical Office, Genoa is responsible for administrating the initial order of project dosimetry and the maintenance of all occupational external radiation exposure records and personnel exposure history.

The Project Manager is responsible for enforcement of the project personnel dosimetry program. The Project Manager, Health Physics Supervisor or designee is responsible for the maintenance of all personnel exposure information for the project. Prior to the start of work, the Project Manager or designee shall obtain the following from each individual assigned to the project:

3.1 Site Registration Form

All new personnel and visitors required to enter a radiologically controlled area must complete a Site Registration Form (ATG Form 109) prior to starting work at a facility.

Completed Site Registration Forms will be retained with the individual's personnel exposure file. Site Registration Forms for ATG personnel will be updated annually or earlier if existing information is known to be incorrect.

3.2 Occupational Radiation Exposure History

An NRC Form 4 or equivalent must be completed by each individual and reviewed by the Project Manager or designee prior to the individual being permitted to work in a radiologically controlled area where a dose of more than 25 mRem could be received. Exposure results shall be listed on the Form 4 on a quarterly basis.

3.3 Dosimetry Assignment

The TLD badge number, name, social security number, whether or not a worker has a completed NRC Form 4, the monitoring period (date from...to) and the individual's date of birth shall be recorded on ATG Form 111a, for each individual monitored on a project. The original form will be maintained as a permanent record of the project monitoring. A copy will be maintained in the Genoa project office.

OCCUPATIONAL EXPOSURE LIMITS/ADMINISTRATIVE CONTROL LEVELS

4.1 Occupational Exposure Limits

4.1.1 Nuclear Regulatory Commission (NRC) limits per calendar year:

Whole Body (TEDE)	5 Rem
Eye Dose Equivalent	15 Rem
Skin Dose Equivalent	50 Rem
Organ Dose (CEDE)	50 Rem

4.2 Administrative Control Levels

4.2.1 ATG Radiation Administrative Control Levels per calendar year:

Whole Body	1.00 Rem
Eye Dose Equivalent	3.00 Rem
Skin Dose Equivalent	5.0 Rem
Organ Dose (CEDE)	5.0 Rem

The Radiation Safety Officer (RSO) shall approve exposure above the Annual Administrative Control Levels.

5.0 RADIOLOGICAL CONTROLLED AREAS

5.1 A radiologically controlled area (RCA) is considered to be any portion of a facility, plant, vehicle or project for which restrictions apply for purposes of occupational radiation exposure control. Radiation exposures received within the boundary of a restricted area are occupational exposures. As described in the applicable Project Detail Work Procedure, radiologically controlled areas will be established to provide the specific radiological controls necessary for the completion of the work scope and the protection of all project personnel. The following guidelines apply:

5.1.1 RCA Location

An RCA is always located within a restricted area as defined by 10 CFR20.3.

5.1.2 RCA Areas

Each radiation area, high radiation area, airborne radioactivity area, and contaminated area shall be contained within a radiologically controlled area.

5.1.3 RCA Personnel Monitoring

All personnel and casual visitors within an RCA will be provided with appropriate dosimetry and monitored for radiation exposure.

6.0 GENERAL REQUIREMENTS

All personnel who could potentially receive 25% or more of the permissible legal limit for external radiation exposure are required by 10 CFR 20 to be furnished with personnel monitors. In the interests of ALARA, all ATG personnel who work with radioactive material are required to wear appropriate radiation exposure monitors. Personnel working within an RCA will receive, at a minimum, a TLD and for work in areas with dose rates above 5 mrem/hour, a TLD and a low range Pocket Ion Chamber (PIC).

6.1 Pocket Ion Chamber

All personnel working in a radiologically controlled area may be issued/monitored by a Pocket Ion Chamber (PIC). PIC's may either be issued for an individual or group depending on the type and duration of work to be performed. The Project Manager or designee will determine if it will be necessary to issue individual or group PIC's. The PICs used for general radiation work will have a range of response of 0 to 200 millirem. PICs will be set to zero (0) at the start of each work shift.

6.2 TLD

Thermoluminescent Dosimeters (TLDs) are the permanent record of an individual's occupational radiation exposure. Upon receipt of Project dosimetry, TLDs and TLD finger

rings shall be stored in a low background area inside the project main office or in other designated storage locations when not in use. A (TLD) control badge shall be kept where the assigned badges are stored when they are not in use. All ATG personnel entering a Radiologically Controlled Area (RCA) where anticipated dose of 25 mRem could be received will be issued a TLD.

The individual's name, social security number, issue date, and date of return will be recorded on the Monthly Badge Issue Log, (ATG Form 111a).

6.3 Visitors/Group Monitoring

A casual visitor is any person touring or visiting the RCA on an infrequent basis, escorted while in the restricted area and not performing or supervising hands-on work.

Visitors will be issued a TLD on a case by case basis depending on the type and duration of the job. The Project Manager or designee shall determine if a TLD is to be issued to a visitor. TLDs will always be issued to occupational workers expected to exceed 25 mrem. A visitor expected to receive in excess of 25 mrem shall be trained as, and considered an occupational worker.

6.3.1 Visitor RCA Conditions

A visitor may be escorted into an RCA provided that:

- there are not entries into high radiation areas or airborne contamination areas,
- the external radiation exposure is limited to 50 mRem per year, or 10 mrem per entry.
- the visitor is furnished with a personnel radiation dosimeter.

6.3.2 Visitor Dosimetry

Visitors within an RCA shall receive, as a minimum, a low range, 0-200 mR Pocket Ionization Chamber (PIC).

Visitor TLD results are recorded on the Site Registration Form which is maintained at the facility. When a visitor is issued a TLD, the individual's name, social security number, issue date, and date of return will also be recorded on the Monthly Badge Issue Log.

6.4 Lost Badges

In the event of a lost TLD or PIC, the Project Manager or designee shall be notified immediately. A Lost Badge Report, (ATG Form 111) will be completed and filed in the

individual's exposure file. The dose estimated from all exposure received while the individual was in an exposure situation must be determined and recorded in the individuals' dose record.

In the event of multiple loss occurrences, the RSO shall be notified immediately.

7.0 PROJECT DOSIMETRY ISSUANCE/CONTROL

7.1 Prior to project commencement, the Project Manager and RSO will determine the appropriate radiation monitoring dosimetry required in accordance with the ATG Health and Safety Manual. The Project Manager or designee will contact the ATG Technical Support Office and provide them with the following information:

- ATG Project Name and Account Number
- Project start date and projected duration
- Appropriate dosimetry required for project
- Number of dosimetry requested
- Name, address, social security, birth date of project personnel to be monitored.
- Address dosimetry is to be shipped to.

7.1.1 Personnel assigned to projects will wear the appropriate badge dosimetry for no more than one month or the duration of the project, whichever is shortest.

It will be arranged at the time of initial project TLD order by the Technical Support Office as to how many month's supply of dosimetry will be required for the project. It will be the responsibility of the Project Manager or designee to return dosimetry to the vendor for processing at the end of each monthly monitoring period.

If the original projected project duration is extended, the Project Manager or designee shall inform the Technical Support Office so that the proper arrangements can be made to supply additional dosimetry from the vendor.

7.1.2 Dosimetry Processor (Vendor)

The dosimetry vendor must meet the criteria and be in accordance with ATG's Health and Safety Manual.

7.2 Upon receiving project dosimetry, the Project Manager or designee shall verify that the dosimetry received meets the requirements of the project. Any problems should be reported to the Technical Support Office, Genoa for immediate attention and resolution. All documentation received with dosimetry will be filled out completely. When all required

preliminary training and documentation has been completed as described in the project Detail Work Procedure, dosimetry will be issued to project personnel.

It is the responsibility of the Project Manager or designee to ensure that ATGF-111a, Badge Issue Log is completed at the time of dosimetry issuance and a copy is sent to the Technical Support Office, Genoa.

8.0 DOCUMENTATION

8.1 Radiation Work Permits

All personnel working in a radiologically controlled area must be assigned to a specific Radiation Work Permit (RWP), (ATG Form 113) applicable to the job being performed. A Radiation Work Permit Access Log, (ATG Form 114) will be attached to each RWP.

All personnel assigned to a job requiring an RWP shall sign the Access Log prior to starting work, indicating time in and starting PIC dose. Upon completion of the work or at the end of the shift, personnel shall sign out on the Access Log, indicating time out and the current PIC dose.

8.2 Weekly Available Exposure Report

A weekly accumulated estimated exposure report will be maintained and posted for employee review at the start of each work week. This report will reflect a running total of exposure available for the current calendar quarter. The beginning annual available exposure will be 1000 mRem for those individuals with a completed and signed Occupational Exposure History Form.

8.3 Occupational Radiation Exposure History Letter

An Occupational Radiation Exposure History Letter, (ATG Form 115) will be completed for all personnel for whom permanent exposure results have been obtained. Copies of this letter will be sent to the individual, and maintained in the individual's personnel exposure file by the ATG Technical Support Office, Genoa. For current employees, this letter will be completed annually. For former employees, this letter will be completed and mailed within thirty working days after results have been obtained.

Any time ATG is required to report an individual's exposure to the Department of Health or other Regulatory Agency a copy of the report will be sent to the individual.

8.4 Project Records/Documentation

Upon completion of the project, it will be the responsibility of the Project Manager or designee to forward all project records, logs, and communications regarding personnel exposure, exposure records, dosimetry records, and all other pertinent information about

personnel dosimetry and individual radiation protection for RSO review, and filing in anticipation of NRC review.

9.0 RECORDS

9.1 The following records are completed by this procedure and shall be maintained as specified in procedure ATG-R-01, Document Control.

- 9.1.1 ATGF-109, Site Registration Form
- 9.1.2 NRC Form 4
- 9.1.3 ATGF-111, Lost Badge Report
- 9.1.4 ATGF-111a, Badge Issue Log
- 9.1.5 ATGF-112, Radiation Exposure Record
- 9.1.6 ATGF-002, Radiation Work Permit
- 9.1.7 ATGF-023, Radiation Work Permit Access Log
- 9.1.8 ATGF-047, Occupational Radiation Exposure History

**SITE REGISTRATION FORM
ALLIED TECHNOLOGY GROUP, INC.**

PERSONAL INFORMATION			
Name:			Date:
Social Security:	Date of Birth:	Project Name:	
Permanent Address:			
City:		State:	Zip:
EMPLOYER INFORMATION			
Employer's Name:			
Employer's Address:			
Name of Emergency Contact:			
Address of Emergency Contact:			
Emergency Contact Phone:			
Signature:			
MEDICAL HISTORY			
List any condition or ailment that may affect your ability to perform your job:			
Indicate if you are epileptic or diabetic:			
List any allergies you have:			
List any medications you are now taking:			
Last Tetanus Shot date:		Date of Last Physical:	
Signature:			Date:
FINAL PAYCHECK ADDRESS			
Address:			
City:			
Phone:			
FedEx: <input type="checkbox"/>	Check box at left if you want your check Federal Expressed to you. \$10.00 fee is deducted from your final pay for this service. If not checked, paycheck will be sent regular mail.		

LIFETIME OCCUPATIONAL EXPOSURE HISTORY

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: _____ MINUTES. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0005), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

1. NAME (LAST, FIRST, MIDDLE INITIAL)		2. IDENTIFICATION NUMBER		3. ID TYPE		4. SEX MALE <input type="checkbox"/> FEMALE <input type="checkbox"/>		5. DATE OF BIRTH	
6. MONITORING PERIOD		7. LICENSEE NAME		8. LICENSE NUMBER		9. RECORD ESTIMATE NO RECORD <input type="checkbox"/>		10. ROUTINE PSE <input type="checkbox"/>	
11. DDE	12. LDE	13. SDE, WB	14. SDE, ME	15. CEDE	16. CDE	17. TEDE		18. TODE	
6. MONITORING PERIOD		7. LICENSEE NAME		8. LICENSE NUMBER		9. RECORD ESTIMATE NO RECORD <input type="checkbox"/>		10. ROUTINE PSE <input type="checkbox"/>	
11. DDE	12. LDE	13. SDE, WB	14. SDE, ME	15. CEDE	16. CDE	17. TEDE		18. TODE	
6. MONITORING PERIOD		7. LICENSEE NAME		8. LICENSE NUMBER		9. RECORD ESTIMATE NO RECORD <input type="checkbox"/>		10. ROUTINE PSE <input type="checkbox"/>	
11. DDE	12. LDE	13. SDE, WB	14. SDE, ME	15. CEDE	16. CDE	17. TEDE		18. TODE	
6. MONITORING PERIOD		7. LICENSEE NAME		8. LICENSE NUMBER		9. RECORD ESTIMATE NO RECORD <input type="checkbox"/>		10. ROUTINE PSE <input type="checkbox"/>	
11. DDE	12. LDE	13. SDE, WB	14. SDE, ME	15. CEDE	16. CDE	17. TEDE		18. TODE	
6. MONITORING PERIOD		7. LICENSEE NAME		8. LICENSE NUMBER		9. RECORD ESTIMATE NO RECORD <input type="checkbox"/>		10. ROUTINE PSE <input type="checkbox"/>	
11. DDE	12. LDE	13. SDE, WB	14. SDE, ME	15. CEDE	16. CDE	17. TEDE		18. TODE	
6. MONITORING PERIOD		7. LICENSEE NAME		8. LICENSE NUMBER		9. RECORD ESTIMATE NO RECORD <input type="checkbox"/>		10. ROUTINE PSE <input type="checkbox"/>	
11. DDE	12. LDE	13. SDE, WB	14. SDE, ME	15. CEDE	16. CDE	17. TEDE		18. TODE	
19. SIGNATURE OF MONITORED INDIVIDUAL		20. DATE SIGNED		21. CERTIFYING ORGANIZATION		22. SIGNATURE OF DESIGNEE		23. DATE SIGNED	

LOST BADGE REPORT

REPORT DATE:	REPORT TIME:
INDIVIDUAL'S NAME:	BADGE NUMBER:
DATE BADGE LOST:	TIME BADGE LOST:
LOCATION IF KNOWN:	
APPLICABLE RWP NUMBER:	

EXPOSURE CALCULATION		
1.	Exposure from dosimeter readings: (Total from date issued) through _____ (Date)	= _____ mrem
2.	Current dosimeter reading: (If more than one dosimeter, use highest reading)	= _____ mrem
3.	If individual was not wearing a dosimeter, or lost his dosimeter, assign highest exposure received by workers in the same area. If none, use dose rate x time in area for the same period.	= _____ mrem
4.	Total estimated exposure to be assigned:	= _____ mrem

THE METHOD USED TO ESTIMATE MY EXPOSURE AND THE ESTIMATED EXPOSURE ASSIGNED TO ME ARE ACCEPTABLE.	
Employee's Signature	Date:
Calculated By:	Date:
R.S.O. Approval:	Date:
Form 5 Updated: <input type="checkbox"/> YES <input type="checkbox"/> NO	Report Voided (Not Necessary) <input type="checkbox"/>
Reason:	

1995 RADIATION EXPOSURE RECORD

NAME:	
SOCIAL SECURITY NO:	BIRTH DATE:
EXTREMITY BADGE NO:	LM BADGE NO:
LIFETIME WHOLE BODY EXPOSURE:	

	WHOLE	SKIN	EXTREMITIES		LIFETIME HIGHEST WHOLE BODY
			LEFT	RIGHT	
JANUARY					
FEBRUARY					
MARCH					
QUARTER TOTALS					
APRIL					
MAY					
JUNE					
QUARTER TOTALS					
JULY					
AUGUST					
SEPTEMBER					
QUARTER TOTALS					
OCTOBER					
NOVEMBER					
DECEMBER					
QUARTER TOTALS					
ANNUAL TOTALS					

RADIATION WORK PERMIT (RWP)

WP #: _____

Regular Extended

SECTION I

Contract #	Date: / /	Time:
Location/Project:		
Exposure Category: <input type="checkbox"/> D&D <input type="checkbox"/> Demolition <input type="checkbox"/> Waste Processing <input type="checkbox"/> CHAR		
Job Description: _____ _____		
Estimated Start Date: / / Estimated End Date: / /		

SECTION II

Existing Radiological Conditions:

Radiation Survey No. _____ Airborne Survey No. _____ Contamination Survey No. _____

Existing General Area Radiation Level(s): β γ N _____ mR/hr/ γ _____ mrad/hr/corrected β _____ mrem/hr/N	Existing General Contamination Levels: _____ dpm/100cm ² $\beta\gamma$ _____ dpm/100cm ² α	Airborne DAC Level(s): α _____ % P $\beta\gamma$ _____ % P _____ % H ₃
Existing Maximum Radiation Level(s): β γ N _____ mR/hr/ γ _____ mrad/hr/corrected β _____ mrem/hr/N	Existing Maximum Contamination Level(s) _____ dpm/100cm ² $\beta\gamma$ _____ dpm/100cm ² α	Hot Particle? <input type="checkbox"/> Yes <input type="checkbox"/> No

Remarks: _____

SECTION III

Radiological Limits:

Maximum Allowed WB Exposure Rate γ N: _____ mr/hr or mrem/hr

Corrected β : _____ mrad/hr Maximum Extremity Exposure Rate: _____ mr/hr

Maximum Allowed Contamination Level $\beta\gamma$: _____ dpm/100cm² α : _____ dpm/100cm²

Maximum Allowed Airborne Concentration Level: _____ % DAC

Remarks: _____

Industrial Hygiene/Safety Concerns: _____

RADIATION WORK PERMIT (RWP)

WP #: _____

Regular Extended

SECTION IV

WORKER REQUIREMENTS

<u>CLOTHING:</u>	<u>DOSIMETRY:</u>	<u>INSTRUCTIONS:</u>	<u>RESPIRATORY:</u>
<input type="checkbox"/> Coveralls <input type="checkbox"/> Lab Coat <input type="checkbox"/> Cloth Hood <input type="checkbox"/> Paper Coveralls <input type="checkbox"/> Plastic Suit <input type="checkbox"/> Plastic Booties <input type="checkbox"/> Rubber Shoe Covers <input type="checkbox"/> Canvas Shoe Covers <input type="checkbox"/> Cotton Gloves <input type="checkbox"/> Rubber Gloves <input type="checkbox"/> Leather Gloves <input type="checkbox"/> Beta Goggles/Face Shield <input type="checkbox"/> Extra <input type="checkbox"/> Other Clothing _____ _____ Stay Time (Heat Stress, Radiation, Exposure Limits, etc.): _____ hrs.	<input type="checkbox"/> TLD <input type="checkbox"/> Film Badge <input type="checkbox"/> SRD <input type="checkbox"/> Standard <input type="checkbox"/> Elbows <input type="checkbox"/> Gonad Pack <input type="checkbox"/> Hot Cell Entry <input type="checkbox"/> Extremity <input type="checkbox"/> Head Pack <input type="checkbox"/> Special <input type="checkbox"/> Knees <input type="checkbox"/> Varying Field <input type="checkbox"/> Upper Field <input type="checkbox"/> Ground Field <input type="checkbox"/> Alarming Dosimetry <input type="checkbox"/> None	<input type="checkbox"/> Contact HP for Line Breaks <input type="checkbox"/> Protect Cuts <input type="checkbox"/> Pre-Job Briefing <input type="checkbox"/> Post-Job Briefing <input type="checkbox"/> Contact HP Prior to Work in New Areas <input type="checkbox"/> Modesty Required <input type="checkbox"/> Site Specific Instructions <input type="checkbox"/> Equipment Monitor at Job End <input type="checkbox"/> Clean Up Work Area During and After Job <input type="checkbox"/> Eating, Drinking, Smoking, Chewing Prohibited <input type="checkbox"/> Frisk Upon Exiting Contaminated Area <input type="checkbox"/> Have Prescribed HP Coverage or Stop Work <input type="checkbox"/> Exit Area Immediately Upon Emergency or Injury. Notify HP Immediately	<input type="checkbox"/> FFNP <input type="checkbox"/> FFAL <input type="checkbox"/> SCBA <input type="checkbox"/> PAPR <input type="checkbox"/> Dusk Mask <input type="checkbox"/> Half Face <input type="checkbox"/> Bubble Hood <input type="checkbox"/> _____ <u>Cartridges:</u> <input type="checkbox"/> Particulate <input type="checkbox"/> Vapor <input type="checkbox"/> Combination <input type="checkbox"/> Other _____ _____ _____

Special Instructions: _____

SECTION V

Health Physics Requirements

1. Job Coverage: Continuous Intermittent Start End of Job
2. Air Sampling: General Area Breathing Zone Lapel AgZ
 Tritium/C-14 Particulate Charcoal LoVol HiVol
3. Exposure Rate Surveys: Start of Job Continuous Monitoring Area Monitoring
 Intermittent Monitoring End of Job
4. Contamination Surveys: Start of Job Continuous Monitoring
 Intermittent Monitoring End of Job
5. Is the ALARA Consideration Complete and Attached? Yes No Why? _____
6. Other: _____

RWP SIGN- SHEET

- NOTE:**
1. All personnel signing in on this RWP Sign-in sheet must have signed Section VI of the RWP.
 2. All persons entering the RWP areas must log in and out.

RWP#:		Location / Project				Date				
Job Description:										
Date	Name (Print)	Signature	Social Security Number	Time		SRD Reading (mR)		Respirator Worn?		HP Comments
				In	Out	In	Out	Yes	No	

Allied Technology Group, Inc.
 47375 Fremont Blvd.
 Fremont, California 94538
 (800) 227-2840

OCCUPATIONAL RADIATION EXPOSURE HISTORY
 Exposure Year 1994

Name: _____ Social Security Number: _____

Address: _____ Date of Birth: _____

City: _____ State: _____ Zip: _____

The Occupational Radiation Exposure listed below was received by the above individual while assigned by Allied Technology Group, Inc.

Project/Location Monitored	Monitoring Method TLD/Film Badge	Record/Estimate	NRC License Number(s):

Abbreviations: NC - Not Calculated ND - None Detected NM - Not Monitored SA - See attached

Monitoring Period		Deep-Dose Equivalent			Shallow-Dose Equivalent		LDE	CEDE	CDE	TEDE	TODE
From	To	X or γ	Neutron	Total DDE	Skin SDE, WB	Extremity SDE, ME	Lens	H _{E,50}	H _{T,50}	DDE + CEDE	DDE + CDE

THIS REPORT IS FURNISHED TO YOU UNDER THE PROVISIONS OF THE NUCLEAR REGULATORY COMMISSION REGULATION 10 CFR PART 20 TITLED "STANDARDS FOR PROTECTION AGAINST RADIATION". YOU SHOULD PRESERVE THIS REPORT FOR FURTHER REFERENCE. ALL DOSE EQUIVALENT VALUES ARE REPORTED IN MILLIREM.

Radiation Safety Officer: _____

Date: _____



HP-OP-010
Revision 0

ALLIED TECHNOLOGY GROUP FIELD OPERATIONS
HEALTH PHYSICS OPERATING PROCEDURE

AIR SAMPLING AND ANALYSIS

Allied Technology Group, Inc.
1515 Main Street
Genoa, Ohio 43430

Prepared by:

D. Spicuzza

Allied Technology Group, Inc.

PROCEDURE/PLAN APPROVAL PAGE

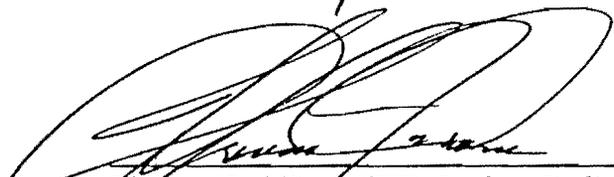
This procedure: AIR SAMPLING AND ANALYSIS, has been reviewed and approved by the following:

APPROVAL SIGNATURES:



William G. Haney, Project Director

4/12/95
Date



Thomas J. O'Dod, CHP, Project Radiation Safety
Officer, HP Technical Support

4/12/95
Date

REVISION RECORD INDICATING
LATEST DOCUMENT REVISION

Procedure Number: HP-OP-010

Title: AIR SAMPLING AND ANALYSIS

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AIR SAMPLING AND ANALYSIS

1.0 SCOPE

This document provides guidelines for the selection, operation, and documentation of the results of air samples performed on A.T.G. field projects. The same basic method is used for both occupational samples (such as high-volume job-related samples and personal air samples), and for fence-line ambient air samples.

2.0 PURPOSE

The purpose of this procedure is to provide procedural guidance to ensure a) optimum and adequate protection of workers; b) conformance with sound health physics and radiological safety practices; and c) compliance with 10 CFR 20 and DOE Order 5480.11.

3.0 REFERENCES AND DEFINITIONS

3.1 References

- 3.1.1 DOE Order 5480.11, Radiation Protection for Occupational Workers
- 3.1.2 10 CFR 20, Standards for Protection Against Radiation
- 3.1.3 HP-OP-002, Radiological Area Posting and Access Control
- 3.1.4 Respiratory Protection Program for A.T.G.
- 3.1.5 NUREG 0041, Manual of Respiratory Protection Against Airborne Radioactive Materials
- 3.1.6 ANSI N13.1-1969, Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities
- 3.1.7 Regulatory Guide 8.25, Air Sampling in the Workplace
- 3.1.8 HP-IP-007, Operation and Calibration of the Model LV-1 Low Volume Air Sampler
- 3.1.9 HP-IP-008, Operation and Calibration of the Model H-9400 High Volume Air Sampler
- 3.1.10 HP-IP-003, Operation and Calibrations of the Ludlum Model-2929 Dual Channel Scaler

3.2 Definitions

- 3.2.1 **ALI (Annual Limit of Intake)** - Value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent H_{E50} of 5 rems (0.05Sv) or a committed dose equivalent H_{T50} of 50 rems (0.5Sv) to any individual organ or tissue. (ALI values for intake by ingestion and by inhalation of selected radionuclides are given in References 3.1.1 and 3.1.2.)
- 3.2.2 **Breathing Zone** - That region adjacent to the worker's mouth and nostrils from which air is drawn into the lungs while he/she performs his/her assigned work. Air taken from this region will represent the air the worker is breathing while he/she works. The samples collected to assess breathing zone concentrations normally are within 12" of the nostrils.
- 3.2.3 **Grab Sample** - A random, single sample taken over a short period of time (dependent upon flow rate) are based upon the minimum volume required.
- 3.2.4 **Lapel Sampler** - A battery operated portable air sampler with a sample collector fastened near the breathing zone.
- 3.2.5 **Marinelli Beaker** - A plastic or glass container used to sample for liquids or gases. These containers normally contain 500 ml.
- 3.2.6 **DAC (Derived Air Concentration)** - The concentration of a given radionuclide in air which, if breathed by the reference man for a working year of 2,000 hours under conditions of light work (inhalation rate 1.2m³ of air per hour), results in an intake of one ALI. DAC values can be found in References 3.1.1 and 3.1.2.
- 3.2.7 **DAC-Hour** - The product of the concentration of radioactive material in air (expressed as a fraction or multiple of the derived air concentration for each radionuclide) and the time of exposure to that nuclide, in hours. A facility may take 2,000 DAC-hours to represent one ALI.
- 3.2.8 **Monitor** -
- 3.2.8.1 To measure an airborne radioactive constituent or gross content of radioactive material continuously or at a frequency which permits an evaluation of the concentration over an interval of time.
- 3.2.8.2 An instrument or device used to take measurements.
- 3.2.9 **Particle** - An aggregate of molecules forming a solid or liquid ranging in size from a few molecular diameters to some tenths of millimeters (several hundred microns).
- 3.2.10 **Representative** - Indicates the quality and characteristics of the entire volume from which a sample is drawn.

- 3.2.11 **Sample** - A representative portion of an atmosphere of interest, or one or more separated constituents from a representative portion of an atmosphere.
- 3.2.12 **Vapor** - The gaseous form of materials that are liquids or solids at room temperature. Distinguished from non-condensable gases.

4.0 **PRECAUTIONS, LIMITATIONS**

- 4.1 Avoid unnecessary contamination of survey instruments through the use of plastic coverings and care in handling. Do not cover the air intakes or exhausts on air samplers.
- 4.2 Avoid unnecessary exposure when conducting air monitoring surveys by utilizing good ALARA practices.
- 4.3 Air samplers shall be operated in accordance with their operation and calibration procedure.
- 4.4 Air samplers used in confined spaces may ignite explosive gases. Extreme care shall be exercised including prior sampling of the atmosphere for explosive gas and O₂ content.
- 4.5 Samples should not be taken in such a manner as to contaminate the sample filter with materials which are not airborne or by sucking up loose contamination from surfaces near the sampling head. Caution should be used to minimize producing airborne material by the exhaust of the sampler.
- 4.6 The instrument (Ludlum Model 2929 or equivalent) used to screen air samples shall be designated by Health Physics Supervision.

5.0 **RESPONSIBILITIES AND QUALIFICATIONS**

5.1 **Responsibilities**

- 5.1.1 ATG Radiological Field Operations Manager(Project Manager) shall be responsible for:
- 5.1.1.1 Implementation of this procedure.
 - 5.1.1.2 Periodic reviews of adherence to the requirements of this procedure.
 - 5.1.1.3 Ensure Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure.
 - 5.1.1.4 Periodic review of air sample data to verify effectiveness of engineering controls and the ATG respirator program.

5.1.2 Health Physics Supervisors shall be responsible for:

- 5.1.2.1 Assignment of Health Physics Technicians performing this procedure.
- 5.1.2.2 Reviewing and approving documentation generated by the use of this procedure.

5.1.3 Health Physics Technicians shall be responsible for:

- 5.1.3.1 Performance of the requirements of this procedure.
- 5.1.3.2 Adherence to other procedures referenced.
- 5.1.3.3 Documentation of all work performed under this procedure.

5.1.4 Employees shall be responsible for:

- 5.1.4.1 Notifying Health Physics prior to the start of any work under an RWP requiring respiratory protection.
- 5.1.4.2 Notifying Health Physics prior to entering any areas posted: "Airborne Radioactivity Area."

5.2 Qualifications

- 5.2.1 Health Physics Technicians shall be qualified in accordance with the requirements of ANSI 3.1-1987 to perform air monitoring and subsequent calculations.
- 5.2.2 Health Physics Technicians shall be qualified in accordance with procedures in the operation of equipment required to perform air monitoring.
- 5.2.3 Junior Health Physics/Decontamination Technicians shall perform air sampling and counting only under direct supervision of a Health Physics Technician meeting the requirements of Sections 5.2.1 and 5.2.2 of this procedure.

6.0 PROCEDURE

6.1 Prerequisites

- 6.1.1 ATG shall use, to the extent practicable, process or other engineering controls (e.g., containment or ventilation) to control the concentration of radioactive material in air.
- 6.1.2 Air Monitoring

Ambient air monitoring shall be performed in areas with the potential to exceed 10 percent of any derived air concentration (DAC) [see References 3.1.1 and 3.1.2].

Ambient air monitoring may be performed using portable air samplers or air monitoring systems. Ambient air monitoring shall be placed in strategic locations to detect and evaluate airborne contamination at work locations. Data obtained from air monitoring shall be used for assessing the control of airborne radioactivity in the workplace and may be used to evaluate the dose equivalent to radiation workers from internal sources.

- 6.1.3 Air monitoring systems shall be routinely calibrated and maintained, and should be capable of measuring one DAC when averaged over 8 hours.
- 6.1.4 Background Air Samples

Background air sampling should be performed in areas where work activities are not being performed. Consideration should also be made in sampling the work area prior to work starting in the area. The data obtained from these samples should be used as a baseline for work area ambient and breathing zone air samples.

6.2 Discussion

A comprehensive air-sampling program is essential to evaluate the hazards associated with work situations involving radioactive materials. In many instances, air sampling data can also provide the basis for development and evaluation of control procedures and can indicate whether or not operational changes are necessary to provide adequate protection for the worker. In conjunction with a respiratory protection program, air sampling data is necessary to define the air concentration levels so that the proper respiratory protective equipment can be selected. Since respiratory protection factors vary over several orders of magnitude, it is very important that an initial estimate be made of the air concentration levels, relative to specified regulatory limits. Thus, adequate protection can be provided while unnecessary inconvenience to the worker wearing a respirator is minimized. Air sampling programs may also be designed to estimate the release of contaminants to the general work area and to the outside environment.

6.2.1 An air sampling program directly related to respiratory protection should:

- 6.2.1.1 Provide an estimate of the potential intake of airborne radioactive materials and resulting exposure of the individual worker.
- 6.2.1.2 Provide data to assist in the selection of respiratory protective equipment that would provide adequate protection under exposure conditions.
- 6.2.1.3 Provide data for control of long-term exposure to workers.
- 6.2.1.4 Provide documentation of personnel exposures for legal or regulatory purposes.

- 6.2.1.5 Identify and characterize the contaminants and their sources.
- 6.2.1.6 Provide data for determining the requirements for engineering or administrative controls.
- 6.2.1.7 Indicate the continuing effectiveness of existing controls, and warn of deterioration of control equipment or operating procedures.
- 6.2.1.8 Provide a record of long-term trends showing variations in contaminant levels.
- 6.2.1.9 Continuously measure the level of airborne contaminants in and above work areas and warn of release of airborne contaminants to the outside environment.

6.2.2 Consideration in Air Sampling

An air sampling program must be designed and operated so that the data obtained are directly and meaningfully related to the problem of concern. As part of a respiratory protection program, the air-sampling procedures must take into account:

- 6.2.2.1 The physical and chemical state of the contaminant.
- 6.2.2.2 Aerodynamic size characteristics of airborne particulates.
- 6.2.2.3 Range of contaminant concentration.
- 6.2.2.4 Environmental conditions such as temperature.
- 6.2.2.5 Sampler location relative to the worker and the source of contamination.
- 6.2.2.6 Instrument operating and response characteristics.
- 6.2.2.7 Instrument portability.
- 6.2.2.8 Sensitivity of the associated analytical procedures relative to the specified concentration limits and quantity of material sampled.

6.3 General

6.3.1 Preparation and General Requirements for Airborne Radioactivity Surveys

- 6.3.1.1 Air may be sampled for various types of radioactive material (particulates, radioiodines, radiogases, or tritium.)

- 6.3.1.1.1 Particulates are normally collected on paper filter material.
- 6.3.1.1.2 Radioiodines are normally collected by charcoal cartridges.
- 6.3.1.1.3 Radiogases are normally collected as a fixed trapped volume of air.
- 6.3.1.1.4 Tritium is normally collected by bubbling air through water.

6.3.1.2 Air sampler and equipment.

- (a) Select calibrated instrumentation appropriate for the survey to be performed.
- (b) Performance check instrument(s) (as applicable) in accordance with the operation and calibration procedures.
- (c) Obtain other items needed, such as filters, bubblers or radiogas chambers.

6.3.1.3 Punch-Outs

- (a) Analyzing punched-out portions of filters too large to count in available instruments will not pose difficulties for accuracy or precision.
- (b) A filter ratio (FR) factor of 3.0 should be used for 4" diameter filters cut out to fit into the sampling tray of a Ludlum Model-2929 or equivalent for counting purposes.

6.3.1.4 Survey Documentation

- (a) Obtain necessary air sample filter(s) and any other material required to provide the necessary sample data.
- (b) The following data is normally required for each air sample and is recorded on Form ATGF-030.

NOTE: N/A should be recorded for items which are not applicable to the particular sample.

- * Type of sample; general area (GA), or breathing zone
- * (BZ).

- * Purpose of sample; that is, routine or non-routine, and special if non-routine.
- * A brief description of the task being performed.
- * RWP number the sample was obtained for, if available.
- * Sample location.
- * Sampler model and serial or ID number.
- * Sample start date and time.
- * Sample start flow rate.
- * Sample stop flow rate and vacuum, if applicable.
- * Sample average flow rate, as CFM or LPM.
- * Total sampling time; as days, hours, or minutes as appropriate.
- * Any specific sample analysis required (e.g., gamma or alpha isotopic).
- * If samples are collected in a sub-atmospheric area, the pressure in psia.
- * The name(s) of the individual(s) starting and stopping the sample.

6.3.1.5 Air Sample packaging considerations.

- (a) Particulate filters of different air samples should be placed in a separate envelope, poly bag, or other suitable container to ensure no possibility of cross contamination.
- (b) Charcoal cartridges and the upstream particulate filter should be placed in a clear poly bag or equivalent.
- (c) Tritium bubblers should be placed in a clear poly bag or equivalent, and other tritium sampling items placed in another bag.
- (d) Radiogas sample chambers should be placed in a clear poly bag or equivalent.

- 6.3.1.6 During collection and handling of air samples, caution must be used to prevent the samples from being contaminated by other sources of radioactive material.
- 6.3.1.7 Notify the Health Physics Supervisor of any unusual airborne radiological conditions identified, such as dust, smoke or chemicals.

6.4 Types of Air Samples

6.4.1 Low Volume and High Volume Air Samples

- 6.4.1.1 Low volume air samples are at a flow rate of 1 CFM (28.32 LPM) to 5 CFM (141.6 LPM).
- 6.4.1.2 High volume air samples are at a flow rate of 10 CFM (283.2 LPM) to 30 CFM (849.6 LPM).

6.4.2 General Area (GA) airborne surveys provide data representative of the air in an area, building, or room. GA surveys normally provide the data used for determining if an area is an Airborne Radioactivity Area for implementing posting and access controls. Using a low volume air sampler, the minimum volume for GA air samples is 100ft³ (2,832 liters).

- (a) GA samples are normally taken on a routine basis, including predetermined times and locations.
- (b) GA samples should be taken at between 3 to 6 feet above floor level.
- (c) Samples may be taken in a short period of time over a period of time varying from an hour up to one or more days, generally known as a "continuous sample".
- (d) Samples are normally obtained and analyzed as a minimum for particulates by gross alpha, beta-gamma counting.

6.4.3 Breathing Zone (BZ) airborne surveys provide data representative of the air that worker would be breathing during a particular task. The minimum volume for BZ air samples is 50 ft³ (1,416 liters).

- (a) BZ samples are normally taken as a minimum during the time when the highest concentrations of radioactive material are expected to be present.
- (b) BZ samples may be taken at any time to document low, high, and average concentrations of airborne radioactive material.

- (c) Samples are normally taken in a position which would be representative of the air which would be breathed by a worker, regardless if a respirator is being worn or not. The samples should be taken within a circumference of 12 inches of the worker's head, if possible.
- (d) Samples are normally analyzed for particulates.

6.4.4 Grab and Continuous Samples and Samplers.

- (a) Grab samples are taken with a high volume sampler. The minimum volume required for grab samples using a high volume sampler is 150ft³ (4,248 liters).
 - * Grab samples represent the concentrations during the relatively short period of sampling time and may be useful to estimate peak concentrations if this type of data is required.
 - * Continuous samples are normally taken with low volume air samplers due to the long run times involved. The minimum volume for continuous air samples is 100ft³ (2,832 liters).
 - * Continuous samples represent the concentrations during the relatively long period of sampling time and are used to estimate average concentrations.
 - * Continuous samples are not normally used where airborne concentrations are expected to vary significantly during the time period of interest.
- (b) Either grab or continuous samples may be representative of areas where airborne concentrations are not expected to vary significantly over a time period of interest.

6.5 Sampling and Analysis for Radioactive Noble Gases

6.5.1 Obtain a 500 ml marinelli beaker.

- 6.5.1.1 Ensure the beaker is free of contamination or that a background count of the beaker has been performed.
- 6.5.1.2 Ensure petcocks are free to be opened/closed.
- 6.5.1.3 Fill the beaker with de-ionized water, if available, or tap water, if not and replace the top.

6.5.2 At the sample location:

6.5.2.1 Remove the marinelli beaker top and pour the water from the beaker.

6.5.2.2 Replace top securely.

6.5.2.3 Ensure petcocks are closed.

6.5.3 The chamber is to be analyzed for gamma isotopic as soon as possible after sampling to minimize error due to noble gas loss by diffusion or decay.

6.5.4 Perform Step 6.7.4.8 (a)(b) of this procedure when noble gas isotopic results exceed 10% of the DAC value.

6.6 Sampling and Analysis for Radioiodines

6.6.1 Obtain a low volume air sampler with a particulate filter and charcoal cartridge arrangement.

6.6.2 At the sampling location(s):

6.6.2.1 Start the air sampler.

6.6.2.2 Sample time should be such that a minimum volume of 100ft³ (2,832 liters).

6.6.2.3 At the end of the sampling period, stop the sampler.

6.6.2.4 Send the filter/and charcoal cartridge for gamma isotopic analysis.

6.6.2.5 Request results of the analysis are expressed in $\mu\text{Ci/ml}$ and percent DAC.

6.6.3 Perform Step 6.7.4.8 (a)(b) of this procedure when radioiodine results exceed 10% of the DAC value.

6.7 Sampling and Analysis for Tritium or Carbon 14

6.7.1 Obtain sample pump and tritium bubbler sampling system.

6.7.1.1 Sampling pump.

6.7.1.2 Midget bubbler, with 25 mls of demineralized water.

6.7.1.3 Filter to remove particulate material from air sample.

- 6.7.1.4 Assemble sampling system with filter upstream of bubbler and bubbler upstream of pump.
- 6.7.2 At sampling location:
 - 6.7.2.1 Start the pump; and if flow rate is adjustable, adjust flow rate as indicated on the sampling pump or for a gentle bubbling action in bubbler.
 - 6.7.2.1 bubbler.
 - 6.7.2.2 Sample time should be such that a minimum air volume of 10 liters (0.35 ft³) is sampled.
 - 6.7.2.3 Send the sample to an approved laboratory for analysis.
 - 6.7.2.4 Request a liquid scintillation analysis for Tritium and/or C-14.
 - 6.7.2.5 The results of the analysis are expressed in $\mu\text{Ci/ml}$ and percent DAC.
- 6.7.3 Perform Step 6.7.4.8 (a)(b) of this procedure when Tritium or Carbon-14 results exceed 10% of the DAC value.

6.8 Sampling and Analysis for Radioactive Particulate Material

- 6.8.1 Obtain the air sampler and filter(s) to be used.
 - 6.8.1.1 The filter is to be a F&J FP-47 (Low Volume) and F&J FP-4.0 (High Volume) particulate filter, or filter of equivalent efficiency and characteristics.
 - NOTE: If the sampling head is designed for both a particulate filter and a charcoal cartridge and the sample is for particulate only, a dummy or spacer charcoal cartridge may be required to be inserted into the sampling head to ensure proper fit of the particulate filter and to duplicate calibration conditions. Refer to the samplers calibration documentation for applicability. High volume air samplers shall not be used with the spacer cartridge.
 - 6.8.1.2 Install the filter in the sampling head with the "fuzzy side" facing outward.
- 6.8.2 At the sampling location:
 - 6.8.2.1 Select flow rate and determine time required for the needed volume of air.
 - (a) High volume 150ft³.

(b) Low volume 100ft³.

6.8.2.2 Start the air sampler.

6.8.2.3 At the end of the sampling period, stop the sampler.

NOTE: In the event the required volume of the air sample cannot be taken, the sample, regardless of volume, is still valid.

6.8.2.4 Remove the filter at a designated location, and identify and package the sample.

6.8.3 Particulate Sampling Techniques

6.8.3.1 Grab samples are taken with a high volume sampler. The minimum volume required for grab samples using a high volume sampler is 150ft³ (4,248 liters).

- (a) Grab samples represent the concentrations during the relatively short period of sampling time and may be useful to estimate peak concentrations if this type of data is required.
- (b) Continuous samples are normally taken with low volume air samplers due to the long run times involved. The minimum volume for continuous air samples is 100ft³ (2,832 liters).
- (c) Continuous samples represent the concentrations during the relatively long period of sampling time and are used to estimate average concentrations.
- (d) Continuous samples are not normally used where airborne concentrations are expected to vary significantly during the time period of interest.

6.8.3.2 Lapel Sampling

- (a) Attach the sampling apparatus to the user's hip or waist with a belt.
- (b) The sample head is secured in the "lapel" area.
- (c) Secure the tubing and sample head with tape and/or clips.
- (d) At the sampling location turn the sampling pump on.

- (e) Complete Form ATGF-035 with the following information:
 - * Name of Wearer and SS#
 - * Sampler ID#
 - * Date/Time On
 - * Flow Rate CFM/LPM
- (f) At the end of the sampling period turn the sampling pump off.
- (g) Complete Form ATGF-035 with the following information:
 - * Date/Time Off
 - * Total Volume Ft³/Liters
- (h) The Health Physics Technician shall ensure that the worker being issued the sampler is instructed as to follow the requirements below:
 - * Refrain from tampering with the pump or the sample head.
 - * Leave the work area if the sampler fails, and note stop time.
 - * Contact an HP representative for assistance at completion of work.

NOTE: Due to the low volume of lapel breathing zone air samples, the Minimum Detectable Activity on gross counting equipment is usually insufficient to determine 10 % DAC for unknown isotopes for screening purposes. In the event it is desired to screen these breathing zone samples, a high volume air sample may be placed within 2 feet of the most restrictive breathing zone (highest expected concentration). This sample may be used to screen the lapel samples.

6.8.3.3 Air particulate samples are to be analyzed as a minimum for gross alpha and beta-gamma counting using a Ludlum Model-2929 Dual Channel Scaler or equivalent.

6.8.3.4 Air particulate samples should be initially counted within fifteen (15) minutes of the end of the sampling period.

6.8.3.5 Air particulate samples shall be counted for a period of five minutes.

6.8.4 Air Sample Analysis of Particulate Filters

6.8.4.1 Upon completion of sampling, use Form ATGF-030 and perform the sample analysis in the order of steps on the ATGF-030.

6.8.4.2 Place the air sample filter inside the sampling tray with the "fuzzy" side facing up towards the detector.

NOTE: If a high volume air sample filter is to be counted, using a hole punch, cut out the center portion of the filter and place the cut out portion of the filter in the sampling tray with the "fuzzy" side facing up towards the detector.

6.8.4.3 Count the sample for a five minute period.

6.8.4.4 Upon completion of the counting period calculate and record the alpha activity (unless no alpha counts are present) then calculate the beta activity using the instructions on Form ATGF-030.

NOTE: The following Criteria may be used when evaluating air sample results.

- (a) Contamination levels and physical characteristics.
- (b) Work activities in the area/resuspension probability.
- (c) Historical data/isotopic information.
- (d) Background air sample data.

6.8.4.5 If the calculated air activity does not exceed 10% of the DAC value of the radionuclide(s) of concern, no further analysis is required and the sample may be discarded at the discretion of Health Physics Supervision.

6.8.4.6 If the calculated air activity exceeds 10% of the DAC value of the radionuclide(s) of concern.

- (a) Report this information to Health Physics supervision immediately.

- (b) Allow the sample to decay for a 3 hour period (if feasible) and recount the sample in accordance with the instructions on Form ATGF-030 and Steps 6.7.4.2 thru 6.7.4.4 of this procedure.
- 6.8.4.7 Following the 3 hour decay period, if the calculated air activity does not exceed 10% of the DAC value of the radionuclide(s) of concern, no further analysis is required and the sample may be discarded at the discretion of Health Physics Supervision.
- 6.8.4.8 If the calculated air activity exceeds 10% of the DAC value of the radionuclide(s) of concern.
- (a) Report this information to Health Physics supervision immediately.
 - (b) Consideration should be given to isotopic analysis and area access restriction/posting in accordance with Reference 3.1.3.
 - (c) Allow the sample to decay for a 20 hour period (if feasible) and recount the sample in accordance with the instructions on Form ATGF-030 and Steps 6.7.4.2 thru 6.7.4.4 of this procedure.
- 6.8.4.9 Following the 20 hour decay period, if the calculated air activity does not exceed 10% of the DAC value of the radionuclide(s) of concern, no further analysis is required and the sample may be discarded at the discretion of Health Physics Supervision.
- 6.8.4.10 If the calculated air activity exceeds 10% of the DAC value of the radionuclide(s) of concern.
- (a) Report this information to Health Physics supervision immediately.
 - (b) Consideration should be given to isotopic analysis and area access restriction/posting in accordance with Reference 3.1.3.

6.9 Documentation

- 6.9.1 Air samples shall be documented using a Air Sample Data and Analysis Report (ATGF-030) with the appropriate supporting documentation attached.
- 6.9.1.1 An isotopic printout from the laboratory performing the analysis of the sample(s).
 - 6.9.1.2 Air Sample Identification Record. (ATGF-048).

- 6.9.2 At the Health Physics Supervisors discretion, air sample filters may be preserved and archived after analysis if the results are to be used for the calculation of DAC-hrs and lead to the assignment of dose.

7.0 RECORDS

The following records will be generated and retained in the permanent project file as a result of using this procedure.

- 7.1 Form ATGF-048, Air Sample Identification Record
- 7.2 Form ATGF-030, Air Sample Data and Analysis
- 7.3 Form ATGF-035, Personal Air Monitoring Log
- 7.4 Isotopic Printouts

8 FORMS

- 8.1 Form ATGF-048, Air Sample Identification Record
- 8.2 Form ATGF-030, Air Sample Data and Analysis
- 8.3 Form ATGF-035, Personal Air Monitoring Log

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA } \mu\text{Ci/ml} = \frac{2.71 + 3.29 \sqrt{R_B t_{S+B} (1 + t_{S+B} / t_B)}}{2.22E6 \cdot E \cdot V \cdot t_{S+B}}$$

where: V = Sample Volume in ml
 E = Counter Efficiency
 R_B = Background Count Rate (cpm)
 t_{S+B} = Sample Counting Time (min)
 t_B = Background Counting Time (min)

Alpha MDA = _____ Beta-Gamma MDA = _____

Technician Performing Calculation: _____ Date: _____

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 minutes:

Time Counted	Gross Counts	Count Period	Gross CR	Bkgrnd CR	Net CR	CF	EFF. cpm / dpm	dpm / μCi	Activity
	cts	min	cpm	cpm	cpm	.67		2.22E+ 6	μCi
	cts	min	cpm	cpm	cpm	.95		2.22E+ 6	μCi

Technician Performing Initial Count: _____ Date: _____

INSTRUCTION 5: Calculate the Total Sample Volume:

$$\text{Total Sample Run Time (minutes)} \times \left(\text{Sample Average Flow Rate (cfm)} \times 2.83E+4 + \text{Sample Average Flow Rate (lpm)} \times 1.0E+3 \right) = \text{Total Volume (ml)}$$

Technician Performing Calculation: _____ Date: _____

INSTRUCTION 6: Determine the Initial Airborne Concentration:

$$\alpha \text{ } \mu\text{Ci} \times \text{FR} \div \text{Volume (ml)} = \text{Initial Activity } \mu\text{Ci/ml } \alpha$$

$$\beta\gamma \text{ } \mu\text{Ci} \times \text{FR} \div \text{Volume (ml)} = \text{Initial Activity } \mu\text{Ci/ml } \beta\gamma$$

= Filter Ratio (4" Filters = 3.0) (2" Filters = 1.0)

Technician Performing Calculation: _____ Date: _____

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 3 hour decay period to allow the short lived Radon daughters to decay.

Time Counted	Gross Counts	Count Period ÷	Gross CR =	Bkgrnd CR -	Net CR =	CF ÷	EFF. cpm dpm ÷	dpm μCi ÷	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+ 6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+ 6	μCi

Technician Performing 3 Hour Count: _____ Date: _____

INSTRUCTION 8: Determine the airborne concentration following 3 Hr. decay and utilizing volume data in Instruction 5:

3 Hr. Decayed Activity	Volume	3 Hr. Decayed Activity
α _____ μCi X FR	÷ _____ ml	= _____ μCi/ml α
βγ _____ μCi X FR	÷ _____ ml	= _____ μCi/ml βγ

Technician Performing Calculation: _____ Date: _____

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T_{1/2} \text{ (min)} = \frac{- .693 (t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t = elapsed time between counts in minutes

t^{1/2} α = _____

t^{1/2} βγ = _____

Technician Performing Calculation: _____ Date: _____

INSTRUCTION 10: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 3 hour decay, then a 20 hour decay count of the sample is required to remove the Thoron component of the sample.

INSTRUCTION 11: Decay sample for 20 hours and then recount the sample:

Time Counted	Gross Counts	Count Period	Gross CR	Bkgrnd CR	Net CR	CF	EFF. $\frac{\text{cpm}}{\text{dpm}}$	$\frac{\text{dpm}}{\mu\text{Ci}}$	Activity
α	αs	min	cpm	cpm	cpm	.67		2.22E+6	μCi
$\beta\gamma$	αs	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 20 Hour Count: _____ Date: _____

INSTRUCTION 12: Using the 3 hour and the 20 hour activity, determine the long-lived activity due to alpha:

$$A_{LL}^{\alpha} = \frac{A_{20}^{\alpha} - A_3^{\alpha} (e^{-0.0655(\Delta T)})}{1 - e^{-0.0655(\Delta T)}}$$

where:

- A_{LL}^{α} = long-lived activity which emits alpha
- A_{20}^{α} = 20 hour decayed activity due to alpha
- A_3^{α} = 3 hour decayed activity due to alpha
- 0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
- ΔT = elapsed time between the 3 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$\begin{aligned} \alpha A_{LL} \mu\text{Ci} &= \frac{A_{20} \mu\text{Ci} - A_3 \mu\text{Ci} (e^{-0.0655 \text{ (hrs)}})}{1 - e^{-0.0655 \text{ (hrs)}}} \\ &= \frac{\mu\text{Ci} - \mu\text{Ci} (e^{-0.0655 (- \text{hrs})})}{1 - e^{-0.0655 (- \text{hrs})}} \\ &= \underline{\hspace{2cm}} \mu\text{Ci} \end{aligned}$$

Technician Performing Calculation: _____ Date: _____

INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:

$$\beta A_{LL} \mu\text{Ci} = (\alpha A_{LL} \mu\text{Ci}) (0.67)$$

where 0.67 is:

Nuclide	T _{1/2}	Ci	Emission	Yield	Energy
Th-232	1.4E+ 10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

$$\begin{aligned} \text{Total long-lived alpha activity} &= 1 + .917 + .917 = 2.83 && \frac{1.89}{2.83} = 0.67 \\ \text{Total long-lived beta activity} &= .945 + .945 = 1.89 && \end{aligned}$$

Technician Performing Calculation: _____ Date: _____

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$$\frac{A_{LL}^{\alpha} \mu\text{Ci}}{\text{volume}} = \text{_____} \mu\text{Ci/ml } [A_{LL}^{\alpha}]$$

$$\frac{A_{LL}^{\beta} \mu\text{Ci}}{\text{volume}} = \text{_____} \mu\text{Ci/ml } [A_{LL}^{\beta}]$$

If: $[A_{LL}^{\alpha}] > 1\text{E-}13 \mu\text{Ci/ml}$

$[A_{LL}^{\beta}] > 2\text{E-}10 \mu\text{Ci/ml}$

- Then:
- o Report this to the HP Supervisor Immediately
 - o Post the area as Airborne Radioactivity Area
 - o Calculate and record DAC Hours for the affected individuals
 - o Send the sample out for an isotopic analysis

Technician Performing Calculation: _____ Date: _____

HP Supervisor Review: _____ Date: _____



HP-OP-011
Revision 0

ALLIED TECHNOLOGY GROUP FIELD OPERATIONS
HEALTH PHYSICS OPERATING PROCEDURE

DAC HOUR TRACKING

Allied Technology Group, Inc.
47375 Fremont Blvd.
Fremont, California 94538

Prepared by:

Daniel Spicuzza

Allied Technology Group, Inc.

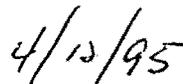
PROCEDURE/PLAN APPROVAL PAGE

This procedure: HP-OP-011, DAC HOUR TRACKING, has been reviewed and approved by the following:

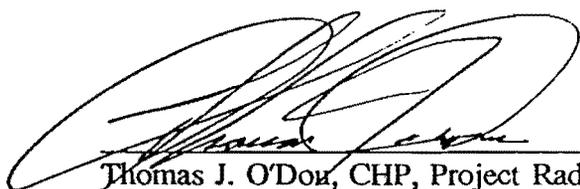
APPROVAL SIGNATURES:



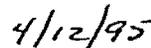
William G. Haney, Project Director



Date



Thomas J. O'Don, CHP, Project Radiation Safety
Officer, HP Technical Support



Date

**REVISION RECORD INDICATING
LATEST DOCUMENT REVISION**

Procedure Number: HP-OP-011

Title: DAC HOUR TRACKING

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Date	6/02/94
Approval	6/02/94

DAC-HOUR TRACKING

1.0 SCOPE

This procedure applies to all individual accounting of DAC-HRs accrued by Allied Technology Group, Inc. (ATG) personnel on field projects.

2.0 PURPOSE

The purpose of this procedure is to provide standardization of the documentation and management of data from the assessment of airborne radioactivity concentrations used for personnel protection.

3.0 REFERENCES AND DEFINITIONS

3.1 References

- 3.1.1 Respiratory Protection Program for A.T.G.
- 3.1.2 DOE Order 5480.11, Radiation Protection for Occupational Workers
- 3.1.3 10 CFR 20, Standards for Protection Against Radiation
- 3.1.4 HP-OP-010, Air Sampling and Analysis
- 3.1.5 RP-OP-001, Selection and Use of Respiratory Protection Equipment

3.2 Definitions

- 3.2.1 **ALI (Annual Limit of Intake)** - Value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent H_{E50} of 5 rems (0.05Sv) or a committed dose equivalent H_{T50} of 50 rems (0.5Sv) to any individual organ or tissue. (ALI values for intake by ingestion and by inhalation of selected radionuclides are given in References 3.1.2 and 3.1.3.)
- 3.2.2 **DAC (Derived Air Concentration)** - The concentration of a given radionuclide in air which, if breathed by the reference man for a working year of 2,000 hours under conditions of light work (inhalation rate 1.2m³ of air per hour), results in an intake of one ALI. DAC values can be found in References 3.1.2 and 3.1.3.
- 3.2.3 **DAC-Hour** - The product of the concentration of radioactive material in air (expressed as a fraction or multiple of the derived air concentration for each radionuclide) and the time of exposure to that nuclide, in hours. A facility may take 2,000 DAC-hours to represent one ALI.

4.0 PRECAUTIONS, LIMITATIONS

4.1 Precautions

- 4.1.1 Health Physics shall determine if an individual has received DAC-HRs at another facility prior to receiving any internal exposure at A.T.G. project sites. An effective dose equivalent or committed dose equivalent, recorded as legal dose on NRC Form-4 (or equivalent) accounting for internal exposure is acceptable. If the effective or committed dose equivalent has not been determined due to the other facility using Maximum Permissible Concentration values, the prior MPC-HR total for the year from the other facility shall be obtained and used to determine the annual effective dose and committed 50 year dose equivalent. If this data is not available, the ATG Corporate Health Physicist or his/her designee should prepare an estimate based upon bioassay data and the ATG baseline bioassay.
- 4.1.2 Use the DAC values listed in References 3.1.2 and 3.1.3 unless otherwise directed by Health Physics Supervision.

4.2 Limitations

- 4.2.1 The most restrictive (lower numeric quantity) value for DAC shall be used, unless the specific form of the material is known, in which case the actual DAC for that form shall be used.

5.0 RESPONSIBILITIES AND QUALIFICATIONS

5.1 Responsibilities

- 5.1.1 ATG Radiological Field Operations Manager(Project Manager) shall be responsible for:
 - 5.1.1.1 Implementation of this procedure.
 - 5.1.1.2 Periodic reviews of adherence to the requirements of this procedure.
 - 5.1.1.3 Ensure Health Physics Technicians are qualified by training and experience to perform the requirements of this procedure.
- 5.1.2 Health Physics Supervisors shall be responsible for:
 - 5.1.2.1 Assignment of Health Physics Technicians performing this procedure.
 - 5.1.2.2 Reviewing and approving documentation generated by the use of this procedure.

- 5.1.2.3 The transfer of reviewed form ATGF-032, Individual DAC-HR Accounting, to the permanent project files on a DAILY basis.
 - 5.1.2.4 Ensuring all DAC-HR records are sent to the designated ATG office for exposure record updates.
 - 5.1.2.5 Notifying the ATG Corporate Health Physicist or his/her designee if an individual exceeds 10 DAC-HRs in any one week.
- 5.1.3 Health Physics Technicians shall be responsible for:
- 5.1.3.1 Performance of the requirements of this procedure.
 - 5.1.3.2 Adherence to other procedures referenced.
 - 5.1.3.3 Completing all required records and submitting them to the Health Physics Supervisor for review and approval.
 - 5.1.3.4 Immediately notifying the Health Physics Supervisor of any worker who exceeds the limit of 10 DAC-HRs in any one week.
- 5.1.4 Employees shall be responsible for:
- 5.1.4.1 Notifying Health Physics prior to the start of any work under an RWP requiring respiratory protection.
 - 5.1.4.2 Notifying Health Physics prior to entering any areas posted: "Airborne Radioactivity Area."

5.2 Qualifications

- 5.2.1 Health Physics Technicians shall be qualified in accordance with the requirements of ANSI 3.1-1987 to perform air monitoring and subsequent calculations.
- 5.2.2 Health Physics Technicians shall be qualified in accordance with procedures in the operation of equipment required to perform air monitoring.
- 5.2.3 Junior Health Physics/Decontamination Technicians shall perform air sampling and counting only under direct supervision of a Health Physics Technician meeting the requirements of Sections 5.2.1 and 5.2.2 of this procedure.

6.0 PROCEDURE

6.1 Prerequisites

6.1.1 DAC-HRs will be documented and maintained if:

- 6.1.1.1 The individual is exposed to airborne radioactivity greater than the amount equal to 10% of the DAC value for specified isotopes.
- 6.1.1.2 There is a possibility that the individual could receive during the year 10% of the ALI.
- 6.1.1.3 the individual has received internal exposure at another location, such as a power reactor during the current year, and that exposure is recorded as part of the annual effective dose equivalent or 50 year committed dose equivalent.

6.1.2 Once assessment of an individual's DAC-HRs has been commenced, all assessments to exposure to airborne radioactive material will be included, as follows:

- 6.1.2.1 Upon receipt of the isotopic printout, determine the Lung Retention Class (LRC) for the identified isotopes (DAILY, WEEKLY, or YEARLY) if the specific form is known (oxide, etc.) from Table 2 of Reference 3.1.2 or Appendix B of Reference 3.1.3. In the event a radionuclide has two LRCs, use the one with the most restrictive DAC value unless the chemical form of the isotope is known, in which case, the actual LRC is used.
- 6.1.2.2 For mixtures in which there are isotopes at values less than 10% of the DAC value, the isotope may be disregarded if the total of the disregarded isotopes is less than 30% of the total for the mixture. If the total of the disregarded isotopes is greater than 30% of the total for the mixture, the radionuclide with the largest percent DAC should be included first. If the remaining disregarded radionuclides are less than 30% of the new total for the mixture, no further action is required. If the remaining total of disregarded radionuclides is still greater than 30% of the new total for the mixture, include the next highest disregarded isotope in the mixture, and so on, until the <30% value is met.
- 6.1.2.3 Use ATGF-033 to determine and record the DAC value for each isotope from the sample.
- 6.1.2.4 In the event DAC's are determined using alpha-beta counting systems (Model 2929 or equivalent), the most restrictive DAC value shall be used for the job site's radionuclide(s) of concern to calculate the number of DAC's:

- (a) Calculate and record the DAC-HRs in accordance with Section 6.3 of this procedure.
- (b) Note in the "Comments" section of the ATGF-032
 - * The chemical symbol (Th, Pu, etc.) of the site's radionuclide(s) of concern.to indicate that the DAC-HRs were calculated from gross counting system analysis.
- (c) When isotopic results are obtained, correct the entry to reflect the actual DAC-HRs.
- (d) Line through all the information of the chemical symbol entry and note in the "Comments" section "Up" to indicate the DAC-HRs were updated by isotopic analysis and corrected.

- 6.1.3 The gamma spectroscopy system may calculate the DAC value and report results on the printout in DACs or %DAC. If so, use this value to calculate DAC-HRs.
- 6.1.4 DAC-HR data will be recorded on the Individual DAC-HR Accounting Form (ATGF-032), and a running total shall be retained for the duration of the project and/or year.
- 6.1.5 The Health Physics Supervisor shall review ATGF-032 and forward to the permanent project file on a DAILY basis.
- 6.1.6 The designated ATG office shall update the individual's exposure record at the end of the project and/or year.

6.2 General

- 6.2.1 The designated Health Physics Technician at each job site will complete an Individual DAC-HR Accounting Form, ATGF-032, for any worker required to have DAC-HRs recorded. These forms will be maintained by the site's Health Physics Supervisor and turned into the designated ATG office at the completion of the project and/or year to update the individual's exposure record.

6.3 DAC-HR Calculation

- 6.3.1 Obtain data from Form ATGF-030, Air Sample Data and Analysis, and ATGF-001, Radiological Survey Report. Air sample data is obtained in accordance with Reference 3.1.4.

- * Percent DAC (see Step 6.1.2)
- * Time of Exposure (expressed in hours)

6.3.2 Calculate DAC-HRs using the following equation:

$$\frac{\% \text{ DAC} \times \text{Time of Exposure}}{100 \%} = \text{DAC-HRs}$$

For Example:

$$\% \text{ DAC} = 200$$

$$\text{Time of Exposure} = 8 \text{ hours}$$

$$\frac{200 \% \text{ DAC} \times 8 \text{ HRs}}{100 \%} = 16 \text{ DAC-HRs}$$

Calculate for each isotope requiring documentation.

6.3.3 If respiratory protection is worn, the respirator's protection factor (PF) shall be used to calculate the DAC-HRs.

$$\frac{\% \text{ DAC}}{100 \% \text{ PF}} \times \text{Time of Exposure} = \text{DAC-HRs}$$

6.3.4 Document DAC-HRs on Form ATGF-032 with the following information:

- * RWP #
- * ATGS #
- * Project/Location
- * Calculate Running Total

7.0 RECORDS

The following records will be generated and retained in the permanent project file as a result of using this procedure.

7.1 Form ATGF-032, Individual DAC-HR Accounting

7.2 Form ATGF-033, DAC Determination

8.0 FORMS

8.1 Form ATGF-032, Individual DAC-HR Accounting

8.2 Form ATGF-033, DAC Determination

8.3 Form ATGF-001, Radiological Survey Report (see Reference 3.1.4)

8.4 Form ATGF-030, Air Sample Data and Analysis (see Reference 3.1.4)

INSTRUCTION 3: Calculate the alpha and beta-gamma MDA values:

$$\text{MDA } \frac{\mu\text{Ci}}{\text{ml}} = \frac{2.71 + 3.29 \sqrt{R_B t_{s+b} (1 + t_{s+b} / t_B)}}{2.22E6 \cdot E \cdot V \cdot t_{s+b}}$$

where: V = Sample Volume in ml
 E = Counter Efficiency
 R_B = Background Count Rate (cpm)
 t_{s+b} = Sample Counting Time (min)
 t_B = Background Counting Time (min)

Alpha MDA = _____ Beta-Gamma MDA = _____

Technician Performing Calculation: _____ Date: _____

INSTRUCTION 4: Upon completion of the end of sampling period, perform the initial count of the sample within 15 minutes:

Time Counted	Gross Counts	Count Period	Gross CR	Bkgrnd CR	Net CR	CF	EFF. cpm / dpm	dpm μCi	Activity
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	.67	_____	2.22E+6	μCi
_____	_____	_____	_____	_____	_____	.95	_____	2.22E+6	μCi

Technician Performing Initial Count: _____ Date: _____

INSTRUCTION 5: Calculate the Total Sample Volume:

$$\frac{\text{Total Sample Run Time}}{\text{minutes}} \times \left(\frac{\text{Sample Average Flow Rate}}{\text{cfm}} \times 2.83E+4 + \frac{\text{Sample Average Flow Rate}}{\text{lpm}} \times 1.0E+3 \right) = \text{Total Volume (ml)}$$

Technician Performing Calculation: _____ Date: _____

INSTRUCTION 6: Determine the Initial Airborne Concentration:

$$\begin{aligned} \alpha \text{ } \frac{\mu\text{Ci}}{\text{ml}} \times \text{FR} \div \text{Volume (ml)} &= \text{Initial Activity } \frac{\mu\text{Ci}}{\text{ml}} \alpha \\ \beta\gamma \text{ } \frac{\mu\text{Ci}}{\text{ml}} \times \text{FR} \div \text{Volume (ml)} &= \text{Initial Activity } \frac{\mu\text{Ci}}{\text{ml}} \beta\gamma \end{aligned}$$

FR = Filter Ratio (4" Filters = 3.0) (2" Filters = 1.0)

Technician Performing Calculation: _____ Date: _____

INSTRUCTION 7: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then a recount of the sample is required after a 3 hour decay period to allow the short lived Radon daughters to decay.

Time Counted	Gross Counts	Count Period +	Gross CR =	Bkgrnd CR -	Net CR =	CF +	EFF. $\frac{\text{cpm}}{\text{dpm}}$ +	$\frac{\text{dpm}}{\mu\text{Ci}}$ +	Activity =
α	cts	min	cpm	cpm	cpm	.67		2.22E+ 6	μCi
$\beta\gamma$	cts	min	cpm	cpm	cpm	.95		2.22E+ 6	μCi

Technician Performing 3 Hour Count: _____ Date: _____

INSTRUCTION 8: Determine the airborne concentration following 3 Hr. decay and utilizing volume data in Instruction 5:

3 Hr. Decayed Activity	Volume	3 Hr. Decayed Activity
α _____ μCi X FR	÷ _____ ml	= _____ $\mu\text{Ci/ml}$ α
$\beta\gamma$ _____ μCi X FR	+ _____ ml	= _____ $\mu\text{Ci/ml}$ $\beta\gamma$

Technician Performing Calculation: _____ Date: _____

INSTRUCTION 9: Determine the half-life of the radionuclide(s) using the following formula:

$$T_{1/2} \text{ (min)} = \frac{- .693 (t)}{\ln \frac{\text{Final Activity}}{\text{Initial Activity}}}$$

t = elapsed time between counts in minutes

$t_{1/2} \alpha$ = _____

$t_{1/2} \beta\gamma$ = _____

Technician Performing Calculation: _____ Date: _____

INSTRUCTION 10: If either the Alpha/Beta-Gamma activity exceeds 10% of the DAC value of the known radionuclide(s) of concern following the 3 hour decay, then a 20 hour decay count of the sample is required to remove the Thoron component of the sample.

INSTRUCTION 11: Decay sample for 20 hours and then recount the sample:

Time Counted	Gross Counts	Count Period	Gross CR	Bkgrnd CR	Net CR	CF	EFF. $\frac{\text{cpm}}{\text{dpm}}$	$\frac{\text{dpm}}{\mu\text{Ci}}$	Activity
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
$\beta\gamma$	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing 20 Hour Count: _____ Date: _____

INSTRUCTION 12: Using the 3 hour and the 20 hour activity, determine the long-lived activity due to alpha:

$$A_{LL}^{\alpha} = \frac{A_{20}^{\alpha} - A_3^{\alpha} (e^{-0.0655(\Delta T)})}{1 - e^{-0.0655(\Delta T)}}$$

where:

- A_{LL}^{α} = long-lived activity which emits alpha
- A_{20}^{α} = 20 hour decayed activity due to alpha
- A_3^{α} = 3 hour decayed activity due to alpha
- 0.0655 = Pb-212 decay constant; since Bi-212 is in transient equilibrium with the Pb-212 and Po-212 is in secular equilibrium with the Bi-212, it is also Po-212's decay constant.
- ΔT = elapsed time between the 3 hour decay period midpoint and the 20 hour decay period midpoint in hours

$$\begin{aligned} \alpha A_{LL} \mu\text{Ci} &= \frac{A_{20} \mu\text{Ci} - A_3 \mu\text{Ci} (e^{-0.0655 (\text{hrs})})}{1 - e^{-0.0655 (\text{hrs})}} \\ &= \frac{\mu\text{Ci} - \mu\text{Ci} (e^{-0.0655 (-\text{hrs})})}{1 - e^{-0.0655 (\text{hrs})}} \\ &= \underline{\hspace{2cm}} \mu\text{Ci} \end{aligned}$$

Technician Performing Calculation: _____ Date: _____

INSTRUCTION 13: Using the value of alpha long-lived activity from Instruction 12, calculate the beta long-lived activity:

$$\beta A_{LL} \mu\text{Ci} = (\alpha A_{LL} \mu\text{Ci}) (0.67)$$

where 0.67 is:

Nuclide	T _{1/2}	Ci	Emission	Yield	Energy
Th-232	1.4E+ 10 yr.	1.	Alpha	100%	4.01 Mev
Ra-228	5.75 yr.	.9446	Beta	100%	0.05 Mev
Ac-228	6.13 hr.	.9446	Beta	100%	2.11 Mev
Th-228	1.91 yr.	.9171	Alpha	100%	5.4 Mev
Ra-224	3.62 day	.9169	Alpha	100%	5.5 Mev
Rn-220	55 sec.	.9169	Alpha	100%	6.3 Mev
Po-216	0.15 sec.	.9169	Alpha	100%	6.8 Mev
Pb-212	10.6 hr.	.9169	Beta	100%	0.6 Mev
Bi-212	60.6 min	.9169	Beta	100%	2.25 Mev

$$\begin{aligned} \text{Total long-lived alpha activity} &= 1 + .917 + .917 = 2.83 && \frac{1.89}{2.83} = 0.67 \\ \text{Total long-lived beta activity} &= .945 + .945 = 1.89 && \end{aligned}$$

Technician Performing Calculation: _____ Date: _____

INSTRUCTION 14: Calculated the long-lived activity concentrations from the values determined in Instructions 12 and 13:

$$\frac{A_{LL}^{\alpha} \mu\text{Ci}}{\text{volume}} = \text{_____} \mu\text{Ci/ml} [A_{LL}^{\alpha}]$$

$$\frac{A_{LL}^{\beta} \mu\text{Ci}}{\text{volume}} = \text{_____} \mu\text{Ci/ml} [A_{LL}^{\beta}]$$

If: $[A_{LL}^{\alpha}] > 1\text{E-}13 \mu\text{Ci/ml}$

$[A_{LL}^{\beta}] > 2\text{E-}10 \mu\text{Ci/ml}$

- Then:
- Report this to the HP Supervisor Immediately
 - Post the area as Airborne Radioactivity Area
 - Calculate and record DAC Hours for the affected individuals
 - Send the sample out for an isotopic analysis

Technician Performing Calculation: _____ Date: _____

HP Supervisor Review: _____ Date: _____

AIR SAMPLE DATA WORK SHEET

Project/Location: _____ Date: _____

A/S ID Number: _____ RWP Number: _____ Survey Number: _____

Date Start: _____ Date Stop: _____

Time Start: _____ Time Stop: _____ Total Time: _____ minutes

Flow Start: _____ Flow Stop: _____

Sample Location: _____

Sample Type: Breathing Zone General Area Other: _____
 High Volume Low Volume Lapel/Personal

<u>Total Sample Run Time</u>	<u>Sample Average Flow Rate</u>	<u>Total Volume</u>
_____ minutes	_____ cfm X 2.83E+4 _____ 1pm X 1.0E+3	_____ ml

Time Counted	Gross Counts	Count Period	Gross CR	Bkgrnd CR	Net CR	CF	EFF. cpm / dpm	dpm / μCi	Activity
		÷	=		=	÷	÷	÷	=
α	cts	min	cpm	cpm	cpm	.67		2.22E+6	μCi
βγ	cts	min	cpm	cpm	cpm	.95		2.22E+6	μCi

Technician Performing Initial Count: _____ Date: _____

Initial Activity	Volume	Initial Activity
α _____ μCi X FR	÷ _____ ml	= _____ μCi/ml α
βγ _____ μCi X FR	÷ _____ ml	= _____ μCi/ml βγ

FR = Filter Ratio (4" Filters = 4.0) (2" Filters = 1.0)

Note: If either the Alpha / Beta-Gamma initial activity exceeds 10% of the DAC value of the known radionuclide(s) of concern, then initiate Instruction #7 in ATG Form 030.

Technician Performing Calculation: _____ Date: _____

ATG Supervisor: _____ Date: _____

ALLIED TECHNOLOGY GROUP FIELD OPERATIONS
HEALTH PHYSICS OPERATING PROCEDURE

ATG ALARA PROGRAM

Allied Technology Group, Inc.
47375 Fremont Blvd.
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D. Spicuzza

PROCEDURE/PLAN APPROVAL PAGE

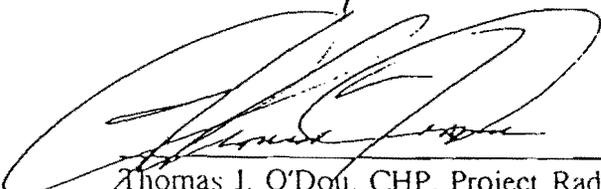
This procedure, HP-OP-012 has been reviewed and approved by the following.

APPROVAL SIGNATURES:



William G. Haney, Project Director

4/12/95
Date



Thomas J. O'Dou, CHP, Project Radiation Safety
Officer, HP Technical Support

4/12/95
Date

**REVISION RECORD INDICATING
LATEST DOCUMENT REVISION**

Procedure Number: HP-OP-012

Title: ATG ALARA PROGRAM

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ATG ALARA PROGRAM

1.0 SCOPE

Maintaining radiation exposures As Low As Reasonably Achievable (ALARA) based upon cost vs. benefit analysis in relation to strict compliance with the requirements of DOE Order 5480.11 and the U.S. NRC Regulatory Guide 8.8. The ALARA program applies to all Allied Technology Group, Inc. (ATG) personnel on field operations.

2.0 PURPOSE

The purpose of this procedure is to implement ALARA commitments. This procedure and subordinate operating procedures satisfy the requirements of DOE Order 5480.11 and are consistent with the ALARA principles and requirements in applicable NRC Regulations, including 10 CFR 20.

3.0 REFERENCES AND DEFINITIONS

3.1 References

- 3.1.1 DOE Order 5480.11, Radiation Protection for Occupational Workers
- 3.1.2 10 CFR 20, Standards for Protection Against Radiation
- 3.1.3 Respiratory Protection Program for ATG.
- 3.1.4 USNRC Regulatory Guide 8.8, Information Relevant to Ensuring that Occupational Radiation Exposures Will Be As Low As Reasonably Achievable
- 3.1.5 HP-OP-004, Issue and Use of Radiation Work Permits
- 3.1.6 HP-OP-001, Radiation and Contamination Survey Techniques
- 3.1.7 HP-OP-005, Control of Radioactive Material

3.2 Definitions

- 3.2.1 **AS LOW AS REASONABLY ACHIEVABLE (ALARA)** - An approach to radiation protection to control or manage exposure (both individual and collective to the workforce and general public) as low as social, technical, economic, practical, and policy considerations permit. ALARA is not a dose limit, but a process, which has the objective to ensure dose to all exposed people is as far below applicable limits as reasonably achievable.
- 3.2.2 **ALARA GOAL** - Any radiation dose poses some risk, therefore goals are set to maintain individual and thereby, collective dose As Low As Reasonably Achievable to minimize that risk.

- 3.2.3 **BENEFIT** - The total exposure savings of implementing an ALARA engineering objective. A comparative monetary value is \$5,000 per man-rem.
- 3.2.4 **CHRONIC EXPOSURE** - Small repeated doses received over a long period of time.
- 3.2.5 **ACUTE EXPOSURE** - A large dose received in a short period of time, i.e., less than one day.
- 3.2.6 **COLLECTIVE DOSE** - The total cumulative dose for all personnel involved in a specific project recorded in man-Rem.
- 3.2.7 **COST** - The total monetary value of resources such as "labor and materials" to accomplish an ALARA engineering objective.
- 3.2.8 **DOSE EQUIVALENT (H)**- The product of absorbed dose (D) in rads in tissue, a quality factor (Q), and other modifying factors (N). Dose equivalent (H) is expressed in units of Rem (or Sievert). $DQN=H$
- 3.2.9 **EFFECTIVE DOSE EQUIVALENT (H_E)**- The sum over specified tissues of the products of the dose equivalent in a tissue (H_t) and the weighing factor (W_t) for that tissue, i.e., $H_E = \sum H_t W_t$. The effective dose equivalent is expressed in units of Rem (or Sievert).
- 3.2.10 **RADIATION WORK PERMIT (RWP)** - A document which provides guidelines to specify protective radiological measures within the scope of the work. The RWP also documents existing radiological conditions, work scope and radiological limitations.

4.0 **PRECAUTIONS, LIMITATIONS**

The ALARA program is measured with the benefit of reductions in individual and/or collective exposures to workers and/or the general public. While ALARA has no limitation other than the derived benefit vs. actual cost, the application of ALARA techniques need individual consideration for the safety and comfort of the worker.

4.1 **Shielding**

- 4.1.1 Shielding composed of high density materials should be handled carefully. Injury may result from improper handling of heavy shielding material.
- 4.1.2 Shielding should be inspected frequently to ensure its original configuration is maintained and should be surveyed periodically.
- 4.1.3 Shielding should not impede work evolutions. The exposure saved by shielding may be spent by longer work periods.
- 4.1.4 Shielding should be installed based upon seismic considerations.

- 4.1.5 Lead is classified as a hazardous material due to its toxicity. Precautions for handling lead should be exercised during use.
- 4.1.6 Shielding should be evaluated for weight considerations. Shielding may damage or destroy equipment if load limits of supports are exceeded.
- 4.1.7 Shielding should be protected by plastic wrapping when used in loose contamination areas.
- 4.1.8 Radioactive sources should be stored in shielded containers and kept shielded at all other times practical during use.
- 4.1.9 Shielding should be evaluated for compatibility with the area in which it is to be used. For example, lead shot should not be used in areas where loose materials may cause damage to equipment.
- 4.1.10 Temporary shielding is particularly effective against small, localized hot spots and should be used when possible.
- 4.1.11 Consider the installation of permanent shielding. The estimated exposure for installing the shielding must be weighed against the expected exposure reduction.
- 4.1.12 Many different types of shielding are available for use. Consider the following:
 - 4.1.12.1 Lead blankets, bricks, sheets, matting, lead glass.
 - 4.1.12.2 Water.
 - 4.1.12.3 Plastic and wood materials.
 - 4.1.12.4 Aluminum.
 - 4.1.12.5 Cement concrete blocks.

4.2 Remote Handling Devices

- 4.2.1 Remote handling devices should be used by personnel familiar with their operation. Loss of control of highly radioactive material may occur if handling devices are used improperly.
- 4.2.2 Remote handling devices should be inspected prior to use and periodically to ensure they are in good condition.
- 4.2.3 Care should be exercised to prevent cross contaminating handling devices.

- 4.2.4 Cranes used to remotely handle radioactive material shall be operated ONLY by qualified operators.

4.3 Temporary Confinements/Containments

- 4.3.1 Temporary confinements/containments used to limit the spread of contamination should be constructed of fire proof or fire retardant materials.
- 4.3.2 If the possibility of system leakage exists inside temporary confinements/containments, an appropriate drainage path to radioactive drain collecting systems should be installed; use berms in areas where no drains are available.
- 4.3.3 Air quality in temporary confinements/containments should be evaluated frequently for habitability and levels of contaminants.
- 4.3.4 When ventilation systems are used with temporary confinements/containments, it is important to balance the supply and exhaust air flows to prevent damage to the confinement/containment.
- 4.3.5 Temporary confinements/containments used outside should be constructed to withstand adverse environmental conditions. It is particularly important to provide roof drainage in the event of rain.
- 4.3.6 Temporary confinements/containments should be constructed with clear plastic windows to allow outside personnel to view activities inside the confinement / containment. This is important in the event of an incapacitating injury to personnel inside the confinement/containment.

4.4 Worker Comfort

- 4.4.1 The comfort of the worker is extremely important to the ALARA philosophy. Job performance is directly proportional to the degree of comfort a worker feels.
- 4.4.2 Bubble hoods should be used instead of airline full face respirators when possible.
- 4.4.3 The minimum amount of protective clothing required should be determined and only this amount should be used.
- 4.4.4 The time a worker wears a full face respirator shall be limited according to the provisions of Reference 3.1.3. Frequent breaks and maximum total work periods should be observed.
- 4.4.5 Heat stress should be considered and monitored during work. Counter measures should be used to reduce this possibility (e.g., fluid intake, staytimes, or ice vest, etc.).
- 4.4.6 Awkward working positions should be avoided when possible.

- 4.4.7 Unsafe conditions are a distraction to workers. Unsafe conditions should be removed/corrected from a work area.
- 4.4.8 Good lighting is essential to worker comfort. A brightly lighted work area is important to the psychological well being of a worker. A brightly lighted work area should be considered whenever possible.
- 4.4.9 Low dose areas should be designated in work areas where personnel may take rest breaks without removing protective clothing/equipment.
- 4.4.10 Methods to adjust humidity and temperature in the work area should be considered.
- 4.4.11 It is comforting to workers to know they are being watched and help is immediately available in the event of an emergency. An outside person(s) shall ALWAYS be available to assist workers inside radiologically significant (high radiation, high contamination, airborne, confined spaces, etc.) areas.

4.5 Communications

- 4.5.1 Headphones and microphone systems should be considered.
- 4.5.2 Hand signals should be understood by all personnel before starting work.
- 4.5.3 A preplanned reliable communication system shall be employed. Poor communication results in more exposure.
- 4.5.4 A reliable two-way communication system shall be required when personnel are working in areas where:
 - 4.5.4.1 Time keeping is in effect.
 - 4.5.4.2 General area exposure rates require constant communication.
 - 4.5.4.3 Line of sight cannot be maintained in confined spaces.
 - 4.5.4.4 Frequent monitoring is required.
 - 4.5.4.5 Communication is required to meet an ALARA commitment.

4.6 Decontamination

- 4.6.1 Consider decontaminating the work area, or equipment prior to the commencement of work. In addition to exposure reduction due to the removal of the contamination, decontamination may allow work crews to forego protective clothing and/or respirators thereby increasing their productivity and reducing their exposure.

4.6.2 The estimated exposure for decontamination tasks shall be weighed against the expected exposure savings.

4.7 Removal of Sources or Relocation of Work

4.7.1 Consider flushing systems, piping, tanks, valves, etc prior to commencement of work. Consider removing unused equipment in the work area, if equipment is a radiation source. Consider storage of radiological sources in another area.

4.7.2 Consider moving the equipment that is to be worked on to an area with lower radiation levels.

4.8 Improve Access

4.8.1 Consider the improvement of access to work areas by the installation of scaffolding, removal of interferences, establishing different access control points.

4.8.2 Care should be exercised in the location of control points. Personnel should not be required to remain in a radiation area while awaiting their turn at the step-off-pad.

4.9 Special Tools and Fixtures

4.9.1 Consider obtaining or fabricating and using special tools or fixtures:

4.9.1.1 Tools, such as a long handled retriever can significantly reduce dose.

4.9.1.2 Fixtures, such as a temporary confinement/containment with forced ventilation through HEPA filters should be considered for contamination control when applicable.

4.10 Mock-Up Exercises

4.10.1 Consider mock-ups or dry runs to make certain each individual is familiar with their roll in the operation. Mock-up exercises can also help identify problems and solutions with little or no exposure.

5.0 RESPONSIBILITIES

5.1 The ATG Radiological Field Operations Manager (Project Manager) shall be responsible for:

5.1.1 Implementation of this procedure.

5.1.2 Periodic reviews of adherence to the requirements of this procedure.

5.1.3 Promoting the ALARA philosophy.

- 5.1.4 While maintaining ALARA principles, shall ensure the use of respiratory protection will be reduced to the minimum practicable by implementing engineering controls and work practices to contain radioactivity at the source.
- 5.1.5 Implementing ALARA through Radiation Work Permits in full compliance with the ATG ALARA Program including all goals and procedures.

5.2 The Health Physics Supervisor shall be responsible for:

- 5.2.1 Reviewing work environments, procedures, and equipment to maintain work crew exposure consistent with the ATG ALARA Program goals, procedures, and with applicable RWPS.
- 5.2.2 Actively promoting the ALARA philosophy by establishing high standards for the performance of radiological controls. These standards and management expectations should be frequently communicated to the work force.
- 5.2.3 While maintaining ALARA principles, ensure the use of respiratory protection is reduced to the minimum practicable by implementing engineering controls and work practices to contain radioactivity at the source.
- 5.2.4 Monitoring subordinate's year-to-date radiation exposures.
- 5.2.5 Establishing working conditions that encourage improved radiological controls. This includes temperature, humidity, and lighting as well as the more difficult consideration of accessibility. Work conditions should be considered in planning work.

5.3 ATG Personnel shall be responsible to:

- 5.3.1 Review work environments, procedures, and equipment to maintain work crew exposure consistent with the ATG ALARA Program goals, procedures, and with applicable RWPS.
- 5.3.2 Maintain their own exposures ALARA consistent with the ATG ALARA program, goals, procedures, and with the applicable RWPs.
- 5.3.3 Make suggestions to improve the ALARA program.
- 5.3.4 Follow all procedures and work instructions.
- 5.3.5 Attend and participate in ALARA briefings.
- 5.3.6 Obey promptly "stop work" and "evacuate" instructions of Health Physics.
- 5.3.7 Keep track of his/her individual radiation dose and avoid exceeding dose control levels and limits.

- 5.3.8 Wear dosimetry as required by procedures, RWP's, or Health Physics instructions.
- 5.3.9 Remain in as low a dose rate area as practical to accomplish work.
- 5.3.10 Leave radiation areas or airborne radioactivity areas when not working, and use "low dose waiting areas" when designated.
- 5.3.11 NO SMOKING, EATING, DRINKING OR CHEWING in controlled areas, or bring open containers of smoking, eating, drinking, or chewing materials into controlled areas.
- 5.3.12 Wear protective clothing and respirators whenever required by signs, RWP's, Health Physics personnel, procedures. and instructions.
- 5.3.13 Remove protective clothing and respirators properly to minimize the spread of contamination.
- 5.3.14 Minimize the spread of a known or possible radioactive/hazardous material spill and notify Health Physics promptly.
- 5.3.15 Avoid unnecessary contact with contaminated surfaces.
- 5.3.16 Limit the amount of material requiring decontamination or disposal as radioactive waste.
- 5.3.17 Place contaminated tools, equipment, and solid waste on disposable surfaces (for example, sheet plastic) when not in use, and inside plastic bags when work is finished.
- 5.3.18 Control the amount of materials brought into radiologically controlled areas to minimize radioactive waste.
- 5.3.19 Report unsafe or non compliance situations promptly.
- 5.3.20 Report the presence of treated or open wounds to Health Physics before work in areas where radioactive/hazardous contamination exists, and exit immediately if a wound occurs while in such an area.
- 5.3.21 Report prior or concurrent occupational radiation exposure.
- 5.3.22 Report known or suspected pregnancy to Health Physics promptly.

6.0 ALARA PROCEDURE

Considerations provided in Section 6.1 insure that when dealing with possible radiation exposure to personnel the review of these considerations play a major roll in preparing all individuals in the practices of ALARA. ALARA considerations, once approved, become requirements of the RWP.

6.1 ALARA Considerations

6.1.1 An ALARA Considerations Form (ATGF-024) shall be completed by the Health Physics Planner/Supervisor or ALARA designee for every job specific RWP where the following conditions are anticipated:

- 6.1.1.1 High Radiation/Very High Radiation Area entry.
- 6.1.1.2 A potential radiation exposure > 50 mRem individual whole body or > 500 mRem collective whole body exposure.
- 6.1.1.3 High Contamination or Hot Particle controls.
- 6.1.1.4 Use of temporary shielding.
- 6.1.1.5 When required by another procedure.
- 6.1.1.6 Respiratory protection usage or when measures are taken in lieu of respiratory protection, e.g. DAC hour tracking, glove bag, etc.

6.1.2 Extended RWPs shall have ATGF-024 forms completed for specific tasks which qualify under Section 6.1.1.

6.1.3 The ATGF-024, shall be reviewed and approved in accordance with the following:

ESTIMATED WHOLE BODY EXPOSURE*		REQUIRED APPROVAL
INDIVIDUAL	COLLECTIVE	
> 50 mRem but < 500 mRem	> 500 mRem but < 5000 mRem	Health Physics Supervisor
> 500 mRem but < 1000 mRem	> 5,000 mRem but < 10,000 mRem	Health Physics Supervisor RFO Manager (Project Manager)
> 1,000 mRem	> 10,000 mRem	Health Physics Supervisor RFO Manager (Project Manager) ATG Corporate Health Physicist

* Internal and/or External Exposure

6.1.4 The ATGF-024 Form shall be attached to the RWP and become part of the RWP package.

6.1.5 The ATGF-024 form shall be closed out by the Health Physics Supervisor/Planner or ALARA designee in conjunction with its corresponding RWP or at the completion of a specific task for extended RWPs.

6.1.5.1 Enter the total post-job dose estimate in Section IIB of the ATGF-024 form. Designate where dose information is from; i.e., RWP Sign-in Sheet, TLD, etc.

6.1.5.2 If the post-job estimate exceeds the pre-job estimate the ALARA designee or Health Physics Supervisor shall be notified.

6.1.5.3 The ATGF-024 shall be submitted with the RWP package and retained in the permanent project file.

6.2 ALARA Training

6.2.1 All ATG personnel involved in radiological related activities shall receive training in the ALARA principle and ATG's ALARA policies. This training shall be implemented on a job by job basis and documented on Form ATGF-027 Training Attendance Record.

6.3 ALARA Pre-Job Planning

6.3.1 ALARA pre-job planning should be included in the initiation of the work plan and RWPs where the possibility of meeting Section 6.1.1 specifications are anticipated. The intent of ALARA Pre-Job planning is to provide an objective view of the proposed activity that may not be readily apparent to the author. ALARA Pre-Job planning should consider the following:

6.3.1.1 A specific description of the job (including location).

6.3.1.2 The original dose equivalent estimate for completing the job.

6.3.1.3 Resources required (equipment, supplies and personnel).

6.3.1.4 Radiological conditions.

6.3.1.5 Identify persons performing work.

6.3.1.6 Job assignments.

6.3.1.7 Training requirements, mock-up, dry run.

6.3.1.8 Time required to complete the job.

6.3.1.9 Consideration of exposure reduction techniques.

6.3.1.10 Consideration of the RWP requirements.

6.3.1.11 Any special or unusual hazards.

6.3.1.12 Current radiation effective dose equivalent (available status).

6.3.1.13 Other qualifications (Example-current respirator use, medical, etc.).

6.4 Pre-Job Briefing

6.4.1 The Pre-job briefing shall attempt to insure that all individuals involved in a specific task are working toward a common goal and are aware of radiological conditions and methods of minimizing exposure.

6.5 Post Job Review

6.5.1 The ALARA Coordinator/Health Physics Supervisor or designee should conduct a debriefing meeting upon conclusion of jobs involving collective dose equivalent of greater than 100 person mRem. Debriefings should include the following:

- 6.5.1.1 Identification of any problems encountered and the resolution of the problem.
- 6.5.1.2 Suggestions for improving the future performance of similar tasks, including techniques for further reducing exposures.
- 6.5.1.3 Comparison of the actual dose equivalent to the estimated dose equivalent.

6.6 ALARA Reports

6.6.1 The ALARA reports and associated forms should be completed in accordance with the provisions of this procedure.

7.0 RECORDS

The following records will be generated and retained in the permanent project file as a result of using this procedure.

- 7.1 ATGF-024, ALARA Considerations Form
- 7.2 ATGF-025, Pre-Job Briefing Checklist (IH/Safety)
- 7.3 ATGF-026, Pre-Job Briefing Checklist (Health Physics)
- 7.4 ATGF-027, Training Attendance Record

8.0 FORMS

- 8.1 ATGF-024, ALARA Considerations Form
- 8.2 ATGF-025, Pre-Job Briefing Checklist (IH/Safety)
- 8.3 ATGF-026, Pre-Job Briefing Checklist (Health Physics)
- 8.4 ATGF-027, Training Attendance Record

ALARA CONSIDERATIONS

SECTION I: GENERAL INFORMATION

PROJECT:	RWP #:
JOB LOCATION:	START DATE:
PROJECT MANAGER:	END DATE:
JOB DESCRIPTION:	

SECTION II: PERSON-REM ESTIMATE (Total)
--

TASK No. & TITLE	ESTIMATE PERSON-HOURS	EFF. DOSE EQUIVALENT RATE (rem/hr)	ESTIMATE PERSON-REM

SECTION II - B: POST AND PRE-JOB DOSE ESTIMATES
--

Total Estimate (Pre-Job) Person-Rem:	Entered By:	Date:
Total Estimate (Post-Job) Person-Rem:	Entered By:	Date:

SECTION III: EXTERNAL RADIOLOGICAL CONTROLS
--

ALARA RECOMMENDATIONS	YES	NO	N/A	REMARKS
Decontamination				
Flushing/Filling				
Temporary Shielding				
Pre-Job Meeting				
Special Training (Mock-Up)				
Stay Time				
Post Low Dose Areas				
Other (Specify)				
CONTROLS IN LIEU of RESPIRATORS				
Respiratory Protective Devices				
Full Face Particulate				
Supplied Air				
Self Contained Breathing Apparatus				
Other (Specify)				

ALARA CONSIDERATIONS - (continued)

SECTION IV: INTERNAL RADIOLOGICAL CONTROLS				
CONTROLS IN LIEU of RESPIRATORS	YES	NO	N/A	REMARKS
Ventilation				
Decontamination				
Containments				
Relocation of Work				
Stay Time (DAC-Hours)				
Total Estimate (Pre-Job) Person-Rem:	Entered By:			Date:
Total Estimate (Post-Job) Person-Rem:	Entered By:			Date:

Prepared By: _____ Date: _____

Approved By: _____ Date: _____

Additional Approvals Required: YES NO (If YES, See below)

REQUIRED APPROVALS			
RWP#:	Total Person-Rem Estimates		
Job Description:	Individual:		mrem
	Collective:		mrem
> 500 mRem INDIVIDUAL or > 5,000 mRem COLLECTIVE			
	NAME	SIGNATURE	DATE
Health Physics Supervisor			
RFO/Project Manager			
> 1,000 mRem INDIVIDUAL or > 10,000 mRem COLLECTIVE			
Health Physics Supervisor			
RFO/Project Manager			
ATG Corp. Health Physicist			

**PRE-JOB BRIEFING CHECKLIST
(Industrial Hygiene/Safety)**

A briefing is required for every job. Each of the following topics must be included in the briefing.

1. SAFETY REQUIREMENTS			
All Industrial Safety Hazards discussed, such as:			
	Yes	No	N/A
Confined Spaces			
Adequate Lighting			
Toxic or Explosive Gases			
IDLH			
Excessive Heat			
Housekeeping			
Hearing Protection:			
Hardhats:			
O ₂ Analyzer:			
Safety Glasses:			
Gloves: Type:			
Fire Protection			
Organic Vapor Monitor:			
Foot Protection			
Explosive/Combustible Gas Monitor:			
2. WORK AREA HAZARDS:			
A.			
B.			
C.			
D.			
E.			
F.			
3. OTHER SAFETY REQUIREMENTS and/or SAFETY EQUIPMENT:			
A.			
B.			
C.			
D.			
E.			
F.			
4. JOB SPECIFIC DISCUSSION:			
A.			
B.			
C.			
D.			
E.			
F.			
Briefing Conducted By (Print / Sign)			Date / Time

**PRE-JOB BRIEFING CHECKLIST
(Health Physics)**

1. Identify Stop Work Authority:			
2. HP Coverage (Intermittent, continuous):			
3. Exposure Limitation/Goal:			
4. Conditions Expected (per RWP):			
Radiation	Contamination	Airborne	Neutron
Hot Particles	Potential Changes (debris, line-ups, opening systems, etc.)		
5. Review:			
Protective Clothing?		Yes	No
Respiratory Protection?			
Special Dosimetry?			
Air Sampling?			
Laydown Areas Set Up?			
Keys Available?			
Control Point?			
Communications Established?			
6. Special Instructions (per RWP)			
7. Radiological Hold Points: Identify criterion for each point:			
8. ALARA Considerations (shielding, decon, hot spots, low dose areas, etc.):			
A.			
B.			
C.			
9. Job Specific Discussion			
10. Turnover Frequency (every shift, day, etc):			
Must cover these topics:			
ALL WORKERS MUST SIGN ATTACHED TRAINING ATTENDANCE FORM ATGF-027.			
Health Physics Supervisor Review:			
Briefing Conducted By (Print / Sign)			Date / Time



RP-OP-002
Revision 0

ALLIED TECHNOLOGY GROUP FIELD OPERATIONS
HEALTH PHYSICS OPERATING PROCEDURE

USE OF FILTER TYPE RESPIRATORS

Allied Technology Group, Inc.
47375 Fremont Blvd.
Fremont, California 94538

Prepared by

D. Spicuzza

Allied Technology Group, Inc.

PROCEDURE/PLAN APPROVAL PAGE

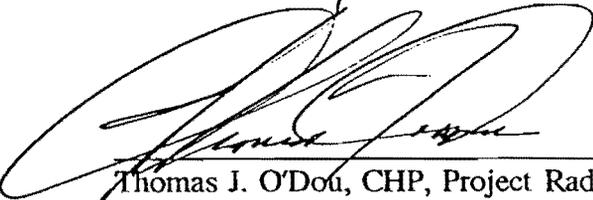
This procedure: RP-OP-002 - USE OF FILTER TYPE RESPIRATORS has been reviewed and approved by the following:

APPROVAL SIGNATURES:



William G. Haney, Project Director

4/12/95
Date



Thomas J. O'Dou, CHP, Project Radiation Safety
Officer, HP Technical Support

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Date

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USE OF FILTER TYPE RESPIRATORS

1.0 SCOPE

This document establishes procedural requirements for the operation of the air-purifying, filter-type respiratory protection devices approved for use by A.T.G. personnel based upon the provisions of the Respiratory Protection Program for Allied Technology Group, Inc. (ATG). This document applies to any qualified respirator user who may be required to use this type of device for a specific task and/or to the personnel assigned to respiratory protection duties.

2.0 PURPOSE

This document describes the proper fitting and operation of the filter-type respirator and provides specific maintenance instructions for the makes of filter-type respirators available to ATG personnel on field projects.

3.0 REFERENCES AND DEFINITIONS

3.1 References

- 3.1.1 Respiratory Protection Program for A.T.G.
- 3.1.2 HP-OP-004, Issue and Use of Radiation Work Permits (RWPs)
- 3.1.3 RP-OP-001, Selection and Use of Respiratory Protection Equipment
- 3.1.4 Mine Safety Appliances (MSA) - Ultra-Twin Respirator Instruction and Approval Manual
- 3.1.5 North - 7600 series, Air Purifying Respirator Using 7600-8a Full Facepiece Operating and Maintenance Manual
- 3.1.6 3M - 7800/Easi-Air Full Facepiece Instruction Manual
- 3.1.7 HP-OP-003, Release of Materials from Controlled Areas

3.2 Definitions

- 3.2.1 **Air-Purifying Respirator** - A respiratory protection system that removes particulate or gaseous contaminants from the ambient air. The purification of the air is accomplished by mechanically filtering out particulate contaminants with fibrous media or by removing contaminating gases and vapors by activated media. The motive force for passage of contaminated air through the air-purifying media is

provided by the wearer's breathing. During inhalation, the facepiece is under negative pressure.

- 3.2.2 **"Bag Out"** - A reference to the process whereby a contaminated item is slowly and carefully placed into a transport container to remove the item from a contaminated area. "Bag Out" requires the worker in a work area to place the contaminated item into a clean plastic bag held by a worker outside the contaminated area. The worker outside the contaminated area holds the clean bag so that the outside of the bag does not touch any contaminated surface. The bag containing the contaminated item is then sealed to prevent contamination from escaping the bag. The contaminated item can now be transported without spread of activity.
- 3.2.3 **Negative Pressure Respirator** - A respiratory protection system where a negative pressure is created in the facepiece during inhalation.

4.0 PRECAUTIONS, LIMITATIONS

4.1 Precautions

- 4.1.1 Any user of a filter type respirator shall be a qualified respirator user. This requires medical approval and training to use specific respirators.
- 4.1.2 A respirator shall NOT be used unless equipped with the appropriate cartridge for the work environment as specified by the RWP.
- 4.1.3 A filter type respirator does NOT supply respirable air; A filter type respirator shall NOT be used in an environment which may be immediately dangerous to life and health (IDLH) or in atmospheres containing less than 19.5% oxygen.
- 4.1.4 This procedure shall be implemented in accordance with the requirements of Reference 3.1.1 and Reference 3.1.3.

4.2 Limitations

- 4.2.1 The respirator shall always be donned in a non-contaminated or non airborne area.
- 4.2.2 The respirator shall always be removed in a non-airborne area, unless it is restricting the flow of breathing air to the user, then the user shall immediately exit the area.
- 4.2.3 Only NIOSH certified respiratory protection equipment shall be used.
- 4.2.4 While using the respirator in a contaminated or airborne area, the user shall not loosen the headstraps, pull the respirator from the face or in any way breach the facepiece to face seal.

- 4.2.5 All O-rings and gaskets used in air-purifying filter type respirators shall be replaced at least once a year.
- 4.2.6 Individuals approved to use specific respiratory protection devices shall use ONLY those devices; An individual with a medical limitation regarding the use of a filter type respirator shall strictly observe such limitations.
- 4.2.7 No air-purifying respirator shall be used for protection against gas or contaminants with poor warning properties (odor, taste or irritation).

5.0 RESPONSIBILITIES

- 5.1 ATG Radiological Field Operations Manager or Project Manager shall be responsible for:
 - 5.1.1 Implementation of this procedure.
 - 5.1.2 Periodic reviews of the adherence of personnel to the requirements of this procedure.
 - 5.1.3 Ensuring by training and experience Health Physics Technicians are qualified to perform the requirements of this procedure.
 - 5.1.4 Reviewing and recommending procedures for operation and maintenance of respiratory protection devices.
- 5.2 Health Physics Supervisor shall be responsible to:
 - 5.2.1 Performs periodic surveillance of the use and maintenance of the respiratory protection equipment.
 - 5.2.2 Maintain inventory of respiratory protection equipment locations and users.
 - 5.2.3 Ensure the Health Physics Technician providing job coverage and personnel using respiratory protection equipment are qualified respirator users.
- 5.3 Health Physics Technician shall be responsible for:
 - 5.3.1 Performing periodic surveillance of the use and maintenance of the respiratory protection equipment.
 - 5.3.2 Ensuring the personnel using respiratory protection equipment are qualified respirator users.
 - 5.3.3 Reporting incidents of respirator use non-compliance and incidents of respirator failure to Health Physics Supervision.

- 5.4 Qualified Respirator Users shall be responsible to:
 - 5.4.1 Prevent damage to respiratory protection equipment.
 - 5.4.2 ALWAYS inspect their respirator BEFORE AND AFTER each use in accordance with the provisions of this procedure.
 - 5.4.3 IMMEDIATELY exit the work area and report any malfunction of a respiratory protection device to the Health Physics Technician or the IH/Safety Technician providing job coverage.
 - 5.4.4 IMMEDIATELY exit the work area and report any undue physical or psychological distress to the Health Physics Technician providing the job coverage.
- 5.5 Respiratory Protection Technician (A Collateral Health Physics function) shall:
 - 5.5.1 Perform scheduled and as-needed maintenance on the air-purifying, filter type respirator systems.
 - 5.5.2 Maintain a back-up inventory of spare parts for repair or replacement purposes.
 - 5.5.3 Maintain records of all repairs/replacement of parts for filter type respirator systems.
- 5.6 IH (Industrial Hygiene)/Safety Technicians shall:
 - 5.6.1 Sample for hazardous materials and/or decontaminate all respiratory protection equipment as necessary BEFORE the equipment is returned to RESPIRATORY PROTECTION for re-certification for use.
 - 5.6.2 Be a qualified respirator user if he/she provides job coverage.
 - 5.6.3 Report incidents of respirator use non-compliance and incidents of respirator failure to Health Physics Supervision.

6.0 PROCEDURE

6.1 Proper Donning of Air-Purifying Filter Type Respirators

- 6.1.1 An inspection to include the following shall be performed before donning the respirator:
 - 6.1.1.1 Inspect the headstraps to see that they still have their elasticity. Inspect for cracks and tears and make sure all buckles are in place and working properly.

- 6.1.1.2 Inspect the facepiece for foreign matter, cracks, tears or holes. Inspect the shape of the face-piece for possible distortion that may occur from improper storage and make sure that the mask material is flexible, not stiff.
- 6.1.1.3 Inspect inhalation, exhalation valves seating surfaces for scratches and other damage that may interfere with the sealing surfaces.
- 6.1.1.4 Inspect cartridges for dents, scratches or other damage particularly the sealing surfaces.
- 6.1.1.5 Inspect o-rings, gaskets etc. Ensure all are in proper place and not damaged.

WARNING: DO NOT USE A RESPIRATOR THAT HAS NOT BEEN INSPECTED BEFORE USE. IT IS THE RESPONSIBILITY OF EVERY RESPIRATOR USER TO INSPECT HIS/HER RESPIRATOR BEFORE AND AFTER EACH USE.

6.1.2 The respirator shall be donned by the following steps:

WARNING: ALL RESPIRATOR USERS MUST BE MEDICALLY QUALIFIED TO WEAR A RESPIRATOR, A QUALIFIED USER, FIT TEST WITHIN THE LAST SIX MONTHS, AND CLEAN SHAVEN PRIOR TO DONNING A RESPIRATOR.

- 6.1.2.1 Prepare the respirator for donning by adjusting the headstraps to their full outward position and placing over the facepiece.
- 6.1.2.2 Put on the facepiece by placing the facepiece snug against the face and pulling the headstrap harness up and over the head until the harness is centered at the rear of the head, and the chin is fitted into the chin cup.
- 6.1.2.3 Make certain the facepiece is centered on the face, and no hair is interfering with the face seal area. Pull both lower headstraps at the same time towards the rear.
- 6.1.2.4 Tighten the two upper headstraps.
- 6.1.2.5 Tighten the top forehead headstrap.

6.1.3 A satisfactory fit shall be determined by the following fitting tests:

- 6.1.3.1 Negative Pressure Fit Check
 - (a) Place the palms of the hands over the openings in the filter

cartridges and inhale. If the facepiece collapses slightly and no air leaks between the facepiece and the face are detected, a good fit has been obtained.

- (b) If air leaks are detected, reposition the facepiece on the face and/or re-adjust the tension of the head harness bands and repeat the negative pressure check until a tight seal is obtained.

6.1.3.2 Positive Pressure Fit Check

- (a) Use the palm of your hand to close the openings in the exhalation valve port and simultaneously exhale. If the facepiece bulges slightly and no air leaks between the facepiece and face are detected, a good fit has been obtained.
- (b) If air is detected to be leaking out between the facepiece and the face, reposition the facepiece on the face and/or re-adjust the tension of the head harness bands to eliminate the leakage. This check must be repeated until a tight seal of the facepiece is obtained.

6.1.4 If both tests indicated a tight seal of the facepiece to the face, the user shall be ready to enter the environment for which the respirator is intended. **THE RESPIRATOR SHALL PASS BOTH FIT CHECKS BEFORE THE RESPIRATOR IS USED.** The respirator will not furnish protection unless ALL inhaled air is drawn through suitable cartridges or filters.

6.2 Operation of Air Purifying Type Respirators

6.2.1 The operation of the air purifying type respirators shall be implemented under the provisions of Reference 3.1.1 and Reference 3.1.3.

WARNING: RESPIRATOR USERS SHALL LEAVE AREAS WHERE RESPIRATOR USE IS REQUIRED IMMEDIATELY IN CASE OF EQUIPMENT MALFUNCTION, UNDUE PHYSICAL OR PSYCHO-LOGICAL DISTRESS, PROCEDURAL OR COMMUNICATION FAILURE, SIGNIFICANT DETERIORATION OF OPERATIONAL CONDITIONS OR ANY OTHER CONDITION THAT MIGHT REQUIRE SUCH RELIEF.

6.3 Removal and Disposal of the Air Purifying Filter Type Respirator

6.3.1 Exit the work area to a non-airborne area. Do not exit the contaminated area prior to removing the respirator and protective clothing.

- 6.3.2 The respirator shall be removed according to the following steps:
- 6.3.2.1 The user shall grasp the base of the respirator with both hands. Do NOT hold the cartridge receptacles.
 - 6.3.2.2 Leaning forward, and holding the respirator with both hands, the user shall lift the respirator slowly out and away from the face.
 - 6.3.2.3 As the headstraps come loose over the head, the arms shall be extended out and away from the body. This is to lessen the risk of spreading loose contamination which may be present on the respirator external surfaces.
 - 6.3.2.4 Inspect the respirator after removal to ascertain that respirator was in proper working condition during the entire duration of the job. If the respirator is satisfactory, proceed to 6.3.2.5. If not, IMMEDIATELY notify the Health Physics or IH/Safety Technician providing job coverage.
 - 6.3.2.5 Respiratory protection equipment used to perform RWP-governed work shall be "bagged out" of the work area into a small "RAD" bag and sealed. The Health Physics Technician providing job coverage shall survey the respirator in accordance with the provisions of Reference 3.1.7.

CAUTION: Respiratory Protection equipment used to perform RWP-governed work shall be sampled for hazardous/radioactive materials and/or decontaminated as necessary BEFORE the return of the equipment to ATG Respiratory Protection.

6.4 Maintenance of the Air Purifying, Filter Type Respirator

- 6.4.1 Only trained technicians assigned to Respiratory Protection shall perform periodic maintenance on ATG respiratory protection systems.
- 6.4.2 All repairs/replacement of parts for ATG respiratory systems shall be documented on form ATGF-019.
- 6.4.3 The NORTH 7600-8A is an air purifying, negative pressure, filter type respiratory system which includes a full facepiece assembly and a pair of air-purifying filter elements to provide respiratory protection against hazardous vapors, gases and/or particulate matter, depending upon the filter elements used.
 - 6.4.3.1 The maintenance of the NORTH 7600-8A air-purifying, filter type respirator shall be implemented in accordance with Reference 3.1.5.

- 6.4.3.2 The NIOSH/MSHA approval and all NORTH warranties for this respirator shall be nullified if other than NORTH replacement parts are used.
- 6.4.3.3 Periodic Maintenance for the NORTH 7600-8A respirator system shall be performed as follows:
- (a) Inspect headstraps and clips for abuse. Check all elastomer and rubber parts for pliability and signs of deterioration.
 - (b) Unscrew and remove exhalation valve guard, valve and seat.
 - (c) Remove the threaded plastic flange which held the exhalation valve seat from the inside of the oral/nasal cup.
 - (d) Remove oral/nasal cup assembly by pulling it from mask.
 - (e) Unscrew the nut retaining the speaker diaphragm and remove the diaphragm and O-ring. Inspect the O-ring for damage, replace if necessary.
 - (f) Remove the speaker adapter and gasket from the facepiece by unscrewing the nut on the outside. Inspect the gasket for damage, replace if necessary.
 - (g) Remove the cartridge connectors and their grommets from the facepiece. Inspect grommets for damage, replace if necessary.
 - (h) Visually inspect the exhalation valve for damage, if necessary, replace.
 - (i) Check oral/nasal cup and inhalation valves for distortion and completeness; if necessary, replace.
 - (j) Inspect the lens for scratches and defects. Replace, if necessary.
 - (k) Reassemble the facepiece. Make certain all O-rings and gaskets are in place.
 - (l) Visually inspect the respirator; ascertain correct reassembly.
 - (m) Document all repairs or replacement of parts on form ATGF-019.

- 6.4.4 The MSA ULTRA-TWIN is an air-purifying, negative pressure, filter type respiratory system which consists of a full facepiece assembly and a pair of air-purifying filter cartridges to provide respiratory protection against hazardous vapors, gases and/or particulate matter, depending on the cartridge used.
- 6.4.4.1 The maintenance of the MSA ULTRA-TWIN air-purifying, filter type respirator shall be implemented in accordance with Reference 3.1.4.
- 6.4.4.2 The NIOSH/MSHA approval and all MSA warranties for this respirator shall be nullified if other than MSA replacement parts are used.
- 6.4.4.3 Periodic Maintenance for the MSA ULTRA-TWIN respiratory system shall be performed as follows:
- (a) Inspect headstraps, buckles and harness for abuse. Check all silicone and rubber parts for pliability and signs of deterioration.
 - (b) Pop off the exhalation valve cover, pull the exhalation flapper valve out. Inspect the exhalation valve body. Replace, if necessary.
 - (c) Loosen the clamp holding the speaker diaphragm housing in place. Pull the speaking diaphragm housing loose from the mask assembly. Inspect the O-ring, retainer ring and the speaking diaphragm. Replace, if necessary.
 - (d) Inspect cartridge receptacles and cartridge receptacle gaskets. Unscrew cartridge receptacles from the inhalation valve seat. Replace cartridge receptacle gaskets, if necessary.
 - (e) Press inhalation valve seat out through the front of the facepiece. Inspect the inhalation valves and the inhalation valve seat. Replace, if necessary.
 - (f) Inspect the lens for scratches and defects. Remove by loosening the two screws holding the lens ring and replace, if necessary.
 - (g) Reassemble the facepiece. Make certain O-rings and gaskets are in place.
 - (h) Visually inspect the respirator; ascertain correct assembly.
 - (i) Document all repairs/replacement of parts on form ATGF-019.

- 6.4.5 The 3M 7800 Easi-Air is an air-purifying, negative pressure, filter type respiratory protection system which consists of a full facepiece assembly and a pair of air-purifying cartridges to provide respiratory protection against hazardous vapors, gases and/or particulate matter, depending on the filter cartridges used.
- 6.4.5.1 The maintenance of the 3M 7800 Easi-Air respirator shall be implemented in accordance with Reference 3.1.6.
- 6.4.5.2 The NIOSH/MSHA approval and all 3M warranties for this respirator shall be nullified if other than 3M replacement parts are used.
- 6.4.5.3 Periodic maintenance of the 3M 7800 Easi-Air respirator shall be performed as follows:
- (a) Inspect the headstraps and retainers for abuse. Check all elastomer parts for pliability and signs of deterioration.
 - (b) Loosen and remove the metal restraining strap on the exhalation valve/speaker diaphragm assembly; unscrew the assembly restraint and remove.
 - (c) Remove the oral/nasal cup assembly by pulling it from the mask.
 - (d) Inspect the O-ring and exhalation valve; replace, if necessary.
 - (e) Unscrew the cartridge holders from the facepiece. Inspect the cartridge gaskets and the interior gaskets. Replace, if necessary.
 - (f) Check the oral/nasal cup and inhalation valves for distortion and completeness. Replace, if necessary.
 - (g) Inspect the lens for scratches and defects. Replace, if necessary.
 - (h) Reassemble the facepiece. Make certain all O-rings and gaskets are in place.
 - (i) Visually inspect the respirator. Ascertain correct assembly.
 - (j) Document all repairs or replacement of parts on form ATGF-019.
- 6.4.6 If it is necessary to remove a respirator from service, the technician assigned to Respiratory Protection shall complete form ATGF-019, Section I and Section IV.

7.0 **RECORDS**

The following records will be generated and retained in the permanent project file as a result of using this procedure.

7.1 ATGF-019, Respirator Evaluation/Repair Report

8.0 **FORMS**

8.1 ATGF-019, Respirator Evaluation/Repair Report

RESPIRATOR EVALUATION/REPAIR REPORT

Section I			
1. Device/Type:	2. Specified Evaluation	Sat	Unsat
A. Date	A. Straps, Suspension		
B. Evaluator(s)	B. Facepiece Material		
C. Manufacturer	C. Facepiece Integrity		
D. Model	D. Cartridge Gaskets		
E. Cartridge No.	E. Integrity -Inhale-Exhale (valves/seals)		
F. NIOSH approval	F. Speaking Diaphragm		
G. I.D. Number	G. Lens		
	H. Clamps/Connectors		
All mechanical parts (regulators, warning devices, etc.) evaluated in Section II.			
Section II - Testing (For mechanical parts: complete Section I, Part 1)			
1. Evaluation performed in accordance with procedure/documents:			
2. Test Parameters:			
3. Testing Results:			
Section III - Repair			
1. Item Repaired or replaced:			
2. Technician		3. Date	
Section IV - Comments			
Comments:			
Respirator Suitable for Issue:		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Respirator Removed from Service:		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Technician:			Date
Reviewed by:			Date