

## SECTION 4.5

### SAMPLE HANDLING

#### 1.0 Purpose

To describe the approach for the maintenance of sample accountability, field control of cross contamination, and sample screening for laboratory contamination control.

#### 2.0 Responsibilities

- The site coordinator is responsible for assuring that this procedure is implemented.
- Survey team personnel are responsible for following this procedure.
- Other specific responsibilities are described under the appropriate subsection.

#### 3.0 Procedure

##### 3.1 Sample Chain-of Custody

Sample accountability and integrity is maintained by use of the chain-of-custody procedures in Section 8.16.

Sample custody documentation is initiated upon collection or receipt of the samples by the program and continues until the samples are consumed in analysis, transferred to another organization, or disposed of properly.

An acceptable chain-of-custody is maintained when the sample is under direct surveillance, kept in a tamper-free container, or is within a controlled access facility.

Samples collected by other organizations that are provided to field personnel will have chain-of-custody initiated for them by the individual receiving the samples. When the organization has an established chain-of-custody in place, a copy of the form will be attached to the ESSAP form.

##### 3.2 Field Control of Cross Contamination

Equipment and supplies used for collection and storage of samples must be handled in such a manner as to prevent accidental contamination. The degree of concern and precautions followed will be determined by the specific site conditions and activity levels involved. Equipment used for sample collection should be surveyed, and cleaned as necessary, following each use.

### 3.2.1 Equipment

- ✓ tap water
- ✓ deionized water
- ✓ non-phosphate detergent
- ✓ alcohol (isopropyl)
- ✓ spray bottles
- ✓ stiff bristle brush
- ✓ paper towels

### 3.2.2 Cleaning Procedure for Contaminated Sampling Equipment

3.2.2.1 Wipe equipment surfaces free of loose material using paper towels

3.2.2.2 Rinse with tap water

3.2.2.3 Wash with detergent solution and brush

3.2.2.4 Rinse with deionized water

3.2.2.5 Rinse thoroughly with isopropyl alcohol

3.2.2.6 Allow to air dry

3.2.3 Monitoring routinely performed at the sampling location will provide an indication as to the need for special attention following sampling. Any necessary decontamination should be performed such that potentially contaminated waste, generated in the process, can be collected and assessed to determine the appropriate disposal method. All samples known or suspected of containing levels of radioactivity which could present a contamination or exposure problem in the field or laboratory are to be placed in clean outer containers and identified with a radiation warning label or other explanatory information, as appropriate in accordance with the ESSAP sample screening requirements.

### 3.3 Screening Samples For Laboratory Contamination Control

Requirements/procedures for screening samples are provided to enable implementation of appropriate laboratory contamination control actions.

### 3.3.1 Responsibilities

#### 3.3.1.1 Site Coordinators/Laboratory Manager

- 3.3.1.1.1 Evaluate projects to identify those with potential for samples containing activity levels that may require special laboratory handling.
- 3.3.1.1.2 Document in the project file (e.g., memo, logbook, safety plan, etc.) the need for screening and the screening method and action levels, if appropriate, to be used.
- 3.3.1.1.3 Provide direction to sample collectors and those performing log-in as to screening and records requirements.
- 3.3.1.1.4 Develop a listing of samples from each project which exceed the activity levels requiring special handling and submit with the laboratory work request.

#### 3.3.1.2 Field Survey Personnel (sample collectors)

- 3.3.1.2.1 Determine at collection time, those samples in categories requiring special handling and note on sample container and collection record form.
- 3.3.1.2.2 During log-in, record screening information in the sample database and confirm proper container labeling.

#### 3.3.1.3 Laboratory Personnel/Field Survey Personnel

- 3.3.1.3.1 During log-in of samples not previously screened by ESSAP personnel, such as samples received from outside organizations, perform sample screening, label containers requiring special handling, and record findings in the sample database.

### 3.3.2 Sample Screening Process

3.3.2.1 The following three categories of samples have been established for the purpose of controlling contamination in the laboratory during sample analysis:

- Low Activity (LA)—Samples containing less than 1000 pCi/g (soil/sediment) or 1000 pCi/l (liquid). Samples of small size, e.g., smears, are limited to 1000 pCi total activity, when the

activity is dispersable (i.e., in other than a solid matrix) or the analysis entails other than strictly physical operations (weighing or direct counting).

- Moderate Activity (MA)—Samples with activity levels between 1 and 100 times the upper limits for the Low Activity category.
- High Activity (HA)—Samples containing greater than the Moderate Activity category limits.

On the basis of empirical data, responses of typical field survey instruments to samples, containing Moderate Activity and High Activity levels of some commonly encountered contaminants, have been determined; these response data are summarized in Table 1 of this Section. When potential sample contaminants would be expected to provide instrument responses comparable to those in this Table, action levels from this Table may be used. Action levels for other contaminants or mixtures of contaminants, for which a comparable material is not provided in this Table, may be chosen on the basis of conservative assumptions and expected instrument response characteristics. Certain contaminants (for example, very low energy pure beta emitters, and pure alpha emitters in soil and water) will not be detectable at the Moderate Activity and/or High Activity levels using direct monitoring methods. Site history and other analytical data (if available) may be used as a basis for initially identifying samples as potentially containing levels requiring special laboratory handling. The conservatively estimated activity level should be assumed. Any such samples would, in addition to the activity category, be further identified as "Suspect."

Prior to collection of samples (or receipt of samples that are submitted directly to the laboratory by other organizations), the cognizant project supervisor will evaluate the potential that samples may contain activity levels in excess of the Low Activity category limits. If it is determined that such a potential does not exist, that evaluation is documented by a note to the project file, a notation in the project logbook, a statement in the project Safety Plan, or other documentation in the permanent record.

If it is determined that there is a potential for receiving samples containing Moderate Activity and/or High Activity levels, a plan for screening will be developed by the project supervisor. The plan will identify:

- potential radionuclide contaminants which may exceed Low Activity levels
- areas of the survey site from which samples may contain such levels
- screening techniques (instruments, site history) to be used

- instrument response action levels (if appropriate) to be used for designating categories

This information becomes part of the project file; project personnel will receive instruction in its implementation.

- 3.3.2.2 At the time of collection by ESSAP personnel, those samples containing other than Low Activity levels (by virtue of field measurements, site history, or sample characteristics) will be identified. Identification tape will be affixed to the containers and a notation will be added to the sampling record form. HA samples will be labeled with red tape, MA samples with yellow tape. Samples for which screening by direct monitoring is not applicable, which are suspect for other reasons, will also include the wording "Suspect."
- 3.3.2.3 When samples are to be received from another collecting organization, the ESSAP project supervisor will request the providing organization to include information as to the anticipated activity levels and to identify those specific samples suspected of containing Moderate Activity and High Activity.
- 3.3.2.4 During log-in, samples received from other organizations will be monitored by direct measurement to confirm (where possible) the activity category. Again, the information in Table 1 will provide guidance as to the category levels. Those samples not previously identified as requiring special handling, will be labeled. Categories and screening level data will be noted on the containers and in the sample database.

### 3.3.3 Guidance for performing sample screening

- 3.3.3.1 Select the instrument which will provide the greatest sensitivity for the potential contaminant.
- 3.3.3.2 Scan the sample to locate the point of maximum direct radiation. Determine the maximum direct contact radiation level and compare with the appropriate action levels for sample category. Note the screening category on the sample label and in the sampling record form or sample database, as appropriate. The scan and measurement should be performed in a manner that provides an optimum condition for identifying activity, but prevents the possibility of contaminating instruments, personnel, and other samples. For example, soil samples may be monitored through the plastic collection bag and smears may be monitored directly, while avoiding contact between the detector face and the smear.

- 3.3.3.3 Where direct screening methods are not sufficiently sensitive to identify activity levels of the Moderate and High categories, but the sample is suspected for other reasons of containing such levels, enter the notation "Suspect" on the sample label and in the sample database.
- 3.3.3.4 In certain cases, other routine measurements may be sufficient to categorize a sample, without additional screening. Examples are: (1) where surface activity measurements indicate a total activity level below the upper limit for Low Activity Samples, screening of smears will not be necessary, and (2) when in-situ soil contact gamma measurement indicates that a sampling location does not potentially contain elevated concentrations of gamma emitters, gamma screening of the sample will not be required.
- 3.3.4 The cognizant supervisor will prepare or direct preparation of the Lab Work Request, such that analyses of samples of Low, Moderate, and High activity are requested separately and that Lab Work Requests include notation as to the sample activity category.

**TABLE 1**  
**EXAMPLES OF TYPICAL**  
**INSTRUMENT RESPONSE FOR SAMPLE SCREENING PURPOSES**

Sample Media	Contaminant	Contact Radiation Level (c/m)											
		Low Activity (<1000 pCi)				Moderate Activity (1000 to 10,000 pCi)				High Activity (>100,000 pCi)			
		$\alpha$ scintillation <sup>a</sup>	GM <sup>b</sup>	$\gamma$ scintillation <sup>c</sup>	$\alpha$ scintillation	GM	$\gamma$ scintillation	$\alpha$ scintillation	GM	$\gamma$ scintillation	$\alpha$ scintillation	GM	$\gamma$ scintillation
Smear	alpha	<400	--- <sup>d</sup>	---	400-40,000	---	---	>40,000	---	---	---	---	---
	beta E-max >200 keV	---	<450	---	---	450-40,000	---	---	---	---	40,000	---	---
	E-max 100-200 keV (C-14)	---	<250	---	---	250-20,000	---	---	---	---	>20,000	---	---
	E-max 50-100 keV (Ni-63)	---	<150	---	---	150-10,000	---	---	---	---	>10,000	---	---
	E-max <50 keV (H-3)	---	---	---	---	---	---	---	---	---	---	---	---

TABLE 1 (Continued)

EXAMPLES OF TYPICAL INSTRUMENT RESPONSE FOR SAMPLE SCREENING PURPOSES

Sample Media	Contaminant	Contact Radiation Level (c/m)												
		Low Activity (<1000 pCi/g)				Moderate Activity (1000 to 10,000 pCi/g)				High Activity (>100,000 pCi/g)				
		$\alpha$ scintillation <sup>a</sup>	GM <sup>b</sup>	$\gamma$ scintillation	$\alpha$ scintillation	GM	$\gamma$ scintillation	$\alpha$ scintillation	GM	$\gamma$ scintillation	$\alpha$ scintillation	GM	$\gamma$ scintillation	
soil/sediment other residues	Sr-90	---	<4300	---	---	4300-430,000	---	---	---	---	---	---	>430,000	
	Cs-137	---	<1100	<14,000	---	1100-110,000	---	---	---	14,000-500,000	---	---	>110,000	
	Co-60	---	<10,000	<150,000	---	10,000-1,000,000	---	---	---	150,000-500,000	---	---	>1,000,000	
	Thorium (natural)	---	<2300	<45,000	---	2300-230,000	---	---	---	45,000-500,000	---	---	>230,000	
	Uranium (processed-natural)	---	<1700	<4000	---	1700-170,000	---	---	---	4000-400,000	---	---	>170,000	
	Ra-226	---	<3500	<50,000	---	3500-350,000	---	---	---	50,000-500,000	---	---	>350,000	
	pure alpha emitters	---	---	---	---	---	---	---	---	---	---	---	---	
	pure beta emitters E-max <150 keV	---	---	---	---	---	---	---	---	---	---	---	---	

TABLE 1 (Continued)

EXAMPLES OF TYPICAL  
INSTRUMENT RESPONSE FOR SAMPLE SCREENING PURPOSES

Sample Media	Contaminant	Contact Radiation Level (c/m)													
		Low Activity (<1000 pCi/l)				Moderate Activity (1000 to 10,000 pCi/l)				High Activity (>100,000 pCi/l)					
		α scintillation <sup>a</sup>	GM <sup>b</sup>	γ scintillation	α scintillation	GM	γ scintillation	α scintillation	GM	γ scintillation	α scintillation				
Liquid	Sr-90	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Cs-137	---	---	---	---	---	---	---	---	---	---	---	---	---	>5000
	Co-60	---	---	---	---	---	---	---	---	---	---	---	---	---	>20,000
	Thorium (natural)	---	---	---	---	---	---	---	---	---	---	---	---	---	>8000
	Uranium (processed-natural)	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Ra-226	---	---	---	---	---	---	---	---	---	---	---	---	---	>170
	pure alpha emitters	---	---	---	---	---	---	---	---	---	---	---	---	---	>350
	pure beta emitters E-max <150 keV	---	---	---	---	---	---	---	---	---	---	---	---	---	---

<sup>a</sup>Eberline AC3-7 or equivalent.

<sup>b</sup>Pancake detector-Eberline HP-260 or equivalent.

<sup>c</sup>NaI-Victoreen 489-55 or equivalent.

<sup>d</sup>Dash indicates instrument not adequately sensitive to radiation.